Research Article

Impact Of Macroeconomic Variables On The Indian Stock Market: An Empirical Study

Saravanan.R[1*], Dr.E. Muthukumar[2], R.Meena[3], S.Mahalakshmi[4], Nisha.K.G[5]

[1*]Research Scholar, Nehru College of Management, Coimbatore, Tamilnadu, India
[2]Professor, Nehru College of Management, Coimbatore, Tamilnadu, India
[3]Assistant Professor, Nehru Arts & Science College, Coimbatore, Coimbatore, Tamilnadu, India
[4]Assistant Professor, Sri Krishna Arts and Science College, Coimbatore, Tamilnadu, India
[5]Assistant Professor, V V College of Science and Technology, Palakkad, Kerala, India

ARTICLE INFO	ABSTRACT
	This study explores the impact of macroeconomic variables on the Indian stock market, specifically the National Stock Exchange (NSE) Nifty 50 index. Five macroeconomic variables - exchange rate, gold price, inflation, interest rate, and Nifty 50 - are analyzed for five years (2018-2022). The research employs various statistical techniques including descriptive statistics, the Augmented Dickey-Fuller (ADF) test for stationarity, correlation analysis, and the Granger causality test to investigate the relationships and causalities among the variables. Findings indicate that while some variables exhibit normal distributions and stationarity, others show skewness and non-stationarity. Correlation analysis reveals significant relationships between Nifty 50 and certain macroeconomic factors. Overall, the study contributes to understanding the dynamics between macroeconomic indicators and stock market performance in India.The study reveals a significant relationship between selected macroeconomic variables and the Indian stock market, specifically the Nifty 50. Gold price, interest rate, and Nifty 50 show normal distributions, suggesting a stable pattern. The Granger Causality test shows bidirectional causality between Nifty 50 and the inflation rate, but no causality between the exchange rate, gold price, and interest rate. **Keywords**: Indian stock market, Nifty 50, macroeconomic variables, exchange rate, Granger causality test.

Introduction

A stock market is a platform where one can invest in various financial instruments, including shares, bonds, futures and derivatives. Irrespective of investment choices, the stock market is equipped to offer an ideal instrument and immense opportunities to make profits. However, before entering the stock market, it is wise to understand the functioning of the market to make better selections. There are two major stock exchanges in India:
● Bombay Stock Exchange(BSE)
● National Stock Exchange(NSE)
The Securities and Exchange Board of India (SEBI) regulates the stock market, the stock exchanges and the depository's participants in India. It was constituted in 1992 under the SEBI Act. Along with the overall administrative control of stock markets, SEBI is also entrusted with the role of conducting inspections and formulating rules for the transparent functioning of the stock markets**.**
NationalStockExchangewasincorporatedintheyear1992tobringabouttransparencyin the Indian equity markets.NSE commenced operations on 30 June 1994 starting with the Wholesale Debt Market (WDM) segment and equities segment on 03 November 1994. It was the first exchange in India to introduce an electronic trading facility.
Macroeconomics is the study of the overall behaviour of a country or regional economy. It is focused on comprehending macroeconomic events such as the total amount of products and services produced, the level of unemployment, and price behaviour in general. As a result, in addition to using microeconomic tools such as supply-and-demand analysis, macroeconomists use aggregate measures such as GDP, unemployment rates, and the consumer price index (CPI) to study the large-scale consequences of micro-level decisions. Five macroeconomic variables are considered in this research. They are:

- **Exchange Rate:** The exchange rate between two currencies is commonly determined by the economic activity, market interest rates, gross domestic product, and unemployment rate in each of the countries. Commonly called market exchange rates, they are set in the global financial marketplace, where banks and other financial institutions trade currencies around the clock based on these factors. Changes in rates can occur hourly or daily with small changes or in large incremental shifts.
- **Inflation:** It measures the overall impact of price changes for a diversified set of products and services. It allows for a single value representation of the increase in the price level of goods and services in an economy over a period.
- **Interest Rate:** Interest is essentially a charge to the borrower for the use of an asset. Assets borrowed can include cash, consumer goods, vehicles, and property. Because of this, an interest rate can be thought of as the "cost of money" - higher interest rates make borrowing the same amount of money more expensive.
- **Gold Price:** The price of gold is determined by a combination of supply and demand, interest rates (and interest rate expectations) and investor behaviour. For instance, many investors think of gold as an inflation hedge. However, the relationship between gold and inflation is weak at best. Interest rates and overall market volatility are far better predictors of gold's performance in the short run.
- **NIFTY 50:** It is a benchmark Indian stock market index that represents the weighted average of 50 of the largest Indian companies listed on the NSE. The NIFTY 50 index has shaped up to be the largest single financial product in India, with an ecosystem consisting of exchange-traded funds (onshore and offshore), and futures and options at NSE and SGX.

Stock markets play a vital role in the financial sector of every economy. An efficient capital market drives economic growth by stabilizing the financial sector. The research work aims to investigate the impact of selected five macroeconomic variables namely exchange rate, inflation rate, interest rate, and gold price on the stock market. Analyze how the selected variables affect the performance of the stock in the market and study the direction and degree of relationship between selected macroeconomic factors and stock returns.

The following section of the paper discusses the literature study, research objective, methodology and result analysis.

Literature Survey

Sarika Keswani and Bharti Wadhwa (2019) conducted a study to evaluate the impact of macroeconomic variables on the Indian stock market. There search examined the impact of macroeconomic factors such as disposable revenues, interest rates, government policies, inflation and exchange rates on the results of securities market performance in the NSE and BSE. The examination utilized the ADF, correlation, multiple regression andGrangercausalitytestforanalysingtheassociationbetweentheselectedfactors. Megaravalli (2018) examines the long and short-run association between macroeconomic variables and stock markets in three major Asian Countries namely India, China and Japan. The study considers two macroeconomic variables exchange rate and inflation. The study applies the Unit root test, Co-integration test, Granger Causality test and pooled mean group estimator for the investigation.

Chandrashekar (2018) examined the linkage between macroeconomic variables and stock markets across the panel of India and Brazil. Macroeconomic variables selected for the study were the Index of Industrial Production (IIP), consumer price index proxy for the rate of inflation (INF), Lending Rate (LR) proxy for interest rate, and Real Effective Exchange Rate (REER) proxy for the exchange rate. Amith Vikram Megaravalli and Gabriele Sampagnaro, G. (2018), has conducted a study on macroeconomic indicators and their impact on stock markets in ASIAN 3: A Pooled Mean Group Approach. The unit root test, the co-integration test. Granger causality test and pooled mean group estimator have been applied to derive the long-run and short-run statistical dynamics. AniruddhaDas (2017), has conducted a study on the association of macroeconomic variables and stock in India. Four macroeconomic variables, namely exchange rate, foreign institutional investment, call money rate and consumer price index had been taken into consideration to find out the effect of the macroeconomic indicators on the Indian Stock Exchange.

Ms.Aanchal (2017), examined the impact of macroeconomic variables in the growth of the stock market in India. The study considers variables such as GDP, Inflation, Exports, Imports, and market indices of CNX Nifty 50. Priyanka Aggarwal and Najia Saqib (2017) have considered variables such as FIX, exchange rate, gold price, fiscal deficit, IP and inflation measured with WPI, USA interest rate, USA inflation and USA GDP to estimate their impact on Indian stock market. Gagan Deep Sharma and Mandeep Mahendru (2016) examined the impact of macroeconomic variables on stock prices in India to understand whether the movement of the stock market is associated with the real sector of the economy or financial sector. Four macroeconomic variables such as gold price, Foreign Exchange Reserves, exchange rate and inflation are considered for analysis.

Gagan Deep Sharma and Mandeep Mahendru (2016) applied the techniques of correlation regression and ANOVA to test the casual relationship between BSE sensitive index and the four macroeconomic variables such as gold price Foreign Exchange Reserve exchange rate and inflation. Gurloveleen and Bhatia (2015), analysed the Augmented Dickey-Fuller test to check the stationarity of data, the Granger causality test to determine the casual relationship among variables and regression analysis have been adopted to know the impact of macroeconomic variables on the Indian stock market.

Venkatraja, B. (2014), investigated then relationship between five macroeconomic variables, namely, index of industrial production, wholesale price index, gold price, foreign institutional investment, real effective exchange rate and the Indian stock market performance of BSE Sensex. Pramod Kumar Naik (2013) examined the impact of macroeconomic factors on the Indian stock market index using monthly data macro economic variables namely industrial production index, inflation, money supply, short-term interest rate, and exchange rates and Indian stock market index.

Methodology

The study is conducted by using the data for a period of 5 years (2018 – 2022). The data collected for the study is secondary data. It is collected fromrbi.org.in, investing.com and other various journals and websites. Descriptive statistics, test of stationarity – Augmented Dickey-Fuller test (ADF), Correlation, and Granger casualty test, have been used to analyze the impact of macroeconomic variables such as Exchange rate, interest, interest rate, gold price and NIFTY 50 on Indian Stock market. The analyses are done using E views software.

Descriptive statistics parameters
The following are the descriptive methods used in the study.
- **Mean:** It is the average of the given set of values. It denotes the equal distribution of values for a given dataset.

$$Mean(\mu) = \left(\sum X_i\right) / N \qquad 3.1$$

Where, $\sum$ = Summation, X = Total Sore and N = Number of Scores

- **Median:** It is defined as the middle value in a set of numbers or data.

$$Median = \left(n + \frac{1}{2}\right)^{th} term \qquad 3.2$$

- **Standard Deviation (SD):** It is the root mean square deviation of the values from their arithmetic mean.

$$SD = \frac{\sqrt{\sum(x - \bar{x})^2}}{n - 1} \qquad 3.3$$

- **Skewness:** It is a measurement of the distortion of symmetrical distribution or asymmetry in a data set. Skewness is demonstrated on a bell curve when data points are not distributed symmetrically to the left and right sides of the median on a bell curve.

$$Skewness = \frac{\sum_1^{N_i}(X_i - X)^3}{(N - 1)} * \sigma^3 \qquad 3.4$$

Where:
$X_i X_i$ = ith Random Variable, $X = X =$ Mean of the Distribution
$N = N =$ Number of Variables in the Distribution

$\sigma3 = \sigma3 =$ Standard Distribution
- **Kurtosis:** It is a statistical measure that defines how heavily the tails of a distribution differ from the tails of a normal distribution.

$$Kurtosis = n * \sum_{n_i}(Y_i - \bar{Y})^4 \Big/ \left(\sum_{n_i}(Y_i - \bar{Y})^2\right)^2 \qquad 3.5$$

Where:
$Y_i Y_{i=} i^{th} i^{th}$ Variable of the Distribution, $\bar{Y} = \bar{Y} =$ Mean of the Distribution
$N = N =$ No. of Variables in the Distribution
- **Jarque-Bera (JB):** It is a test to determine if a set of data values follows the normal distribution based on the data's skewness and kurtosis.

$$JB = n\left[\left(\sqrt{b_1}\right)^2 / 6 + (b_2 - 3)^2 / 24\right] \qquad 3.6$$

Where, nn is the sample size, $\sqrt{b1}\sqrt{b1}$ is the skewness coefficient, $b2b2$ is the kurtosis coefficient.

Test of stationarity–Augmented Dickey-Fuller (ADF)
The ADF test is a widely used test for checking the stationarity of a time series, and it checks for the presence of aunitroot in the data.

Correlation

Correlation is a statistical measure that indicates the extent to which two or more variables fluctuate together. A correlation is a statistical measure of the degree to which changes to the value of one variable predict change to the value of another.

$$r = (n \sum XY - \sum X \sum Y)/[n \sum X^2 - (\sum X)^2 * n \sum Y^2 - (\sum Y)^2]^{0.5} \qquad 3.7$$

Where $r =$ correlation coefficient, $X \ and \ Y$ are the two variables, Σ is the summation symbol, $n =$ number of observations.

Granger CasualtyTest

The Granger causality test is a statistical hypothesis test for determining whether one time series isafactorandofferusefulinformationinforecastinganothertimeseries.

Results and Discussion

The descriptive statistics used to calculate the mean, median, standard deviation, skewness, kurtosis and JB value for the five macroeconomic variables and are shown in Table 1.

1. Tabulation of Descriptive Statistics

	Exchange Rate	Gold Price	Inflation	Interest Rate	NIFTY 50
Mean	73.14522	1616.33	5.23	5.306667	13356.89
Median	73.3295	1709.25	5.4	5.4	11900.13
Maximum	82.786	1985.9	7.8	6.75	18758.35
Minimum	63.688	1201.9	2	4.25	8597.75
SD	4.098097	246.7453	1.593238	0.976567	2912.86
Skewness	0.217605	-0.305791	-0.254127	0.132025	0.431488
Kurtosis	3.238293	1.624812	2.004026	1.398162	1.634968
JB	0.61548	5.662938	3.125719	6.589015	6.520098
Probability	0.735106	0.058926	0.209536	0.037086	0.038387

From the table values it is detected that the standard deviation is high for the Nifty 50 and there is low for interest rate. The result shows that interest rate, exchange rate, and Nifty50 are highly skewed towards the center between the values 0 and 0.5. Gold prices and Inflation are moderately skewed towards the center takingvaluesbetween-0.5and 0. The kurtosis values are positive, indicating the selected variables are peaked than normal. The values of probability are greater than 0.05 for the variable series Inflation and Exchange rate, they do not have a normal distribution and the skewness and kurtosis are not similar to the normal distribution. The values of probability are lesser than 0.05 for the variable gold price, interest rate and Nifty 50, they have a normal distribution and the skewness and kurtosis are similar to the normal distribution.
The estimated values of test of stationarity – ADF for the macroeconomic variables under consideration is shown in Table 2.

2. Tabulation of Stationarity Test

Sectoral Indices	At Level		At1stDifference	
	t-Statistic	Prob.	t-Statistic	Prob.
Exchange Rate	-2.55603	0.3014	-8.12075	0
Gold Price	-1.74237	0.7197	-7.19094	0
Inflation	-3.03542	0.1317	-7.10689	0
Interest Rate	-3.64977	0.084	-6.78915	0
Nifty50	-2.15394	0.5056	-7.64378	0

Null Hypothesis (H0)- There is aunitroot for the sectoral indices.
Alternative Hypothesis (H1) –There is no unitroot for the sectoral indices.
Criteria for hypothesis selection-Ifp-value>0.05, acceptH$_o$ and rejectH$_1$.
Ifpp-value<0.05, rejectH$_o$ and acceptH$_1$.

The result obtained from the ADF test shows that based on the p-value (greater than 0.05) null hypothesis is accepted and the alternative hypothesis is rejected and it is concluded that all the sectoral indices **have unitroots at the level**. Since there is a unitroot at level, the same test is performed for the 1st difference values, from which it is concluded that all the variables are **stationary at their1stdifferenced level.**
The relationship between the five macroeconomic variables is estimated using correlation factor and represented in Table 3.

3. Tabulation of Correlation

	Exchange Rate	Gold Price	Inflation	Interest Rate	NIFTY 50
Exchange Rate	1	-0.60589	-0.47381	-0.36413	-0.78704
Gold Price	-0.60589	1	0.582928	0.491356	0.605925
Inflation	-0.47381	0.582928	1	0.232771	0.341537
Interest Rate	-0.36413	0.491356	0.232771	1	0.80384
Nifty50	-0.78704	0.605925	0.341537	0.80384	1

As per the result obtained, the is a correlation between variable series Nifty 50 and Exchange rate. There is also correlation between variable series Interest rate and Nifty 50. There is no correlation between other variable series.

The cause – and – effect relationship between the variables is determined by the Granger Causality Test. The calculated values are shown in Table 4.4.

Null Hypothesis (H_0) –There is no relationship between the variables.

Alternative Hypothesis (H_1)- There is a relationship between the variables.

Criteria for hypothesis selection-If p-value>0.05, accept H_0 and reject H_1. If p-value<0.05, reject H_0 and accept H_1.

4. Tabulation of Granger Causality Test

	F-Statistic	Prob.
Nifty50 VS Exchangerate	1.26638	0.2904
ExchangerateVS Nifty 50	1.06403	0.3525
Nifty50VSGold price	1.19153	0.3119
GoldpriceVSNifty50	0.71367	0.4946
Nifty50VS Inflation rate	3.89367	0.0266
Inflation rateVS Nifty50	0.39845	0.6734
Nifty50VS Interest rate	0.91256	0.4078
Interest rate VS Nifty50	0.41873	0.6601

The obtained p-value is greater than 0.05 for both directions (from Nifty50 to Exchange rate and from Exchange rate to Nifty 50), so the null hypothesis is accepted and alternate hypothesis is rejected for both directions. Hence **there is no causality found between the Exchange rate and the Nifty 50.** The obtained p-value is greater than 0.05 for both directions (from Nifty 50 to Gold price and from Gold price to Nifty 50) so the null hypothesis is accepted and the alternate hypothesis is rejected for both directions. Hence **there is no causality found between the Nifty50 to Gold price.**
The obtained p value is lesser than 0.05 for one direction (from Nifty 50 to Inflation rate) and greater than 0.05 for another direction (from Inflation rate to Nifty 50), so null hypothesis is rejected and alternate hypothesis is accepted for one direction and null hypothesis is accepted and alternate hypothesis is rejected for another direction. Hence **there is a unidirectional causality found running from Nifty 50 to Inflation rate.**
The obtained p-value is greater than 0.05 for both directions (from Nifty 50 to Interest rate and from Interest rate to Nifty 50), so the null hypothesis is accepted and the alternate hypothesis is rejected for both directions. Hence **there is no causality found between the Nifty 50 and the Interest rate.**

Conclusion

The aim of the study is to investigate the relationship between selected macroeconomic variables and Indian stock market (NSE Nifty 50) and also, to determine how the selected variables affect the performance of the stock. The macroeconomic variables that are selected for this study are Gold price, exchange rate, Inflation, exchange rate and Nifty 50.From the descriptive selective analysis, it is determined that the variable Gold price, Interest rate and Nifty50, have a normal distribution and the skewness and kurtosis are similar to the normal distribution. ADF test determines that the selected macroeconomic variables are not stationary at level. Since there is a unit root at level, the same test is performed for the 1st difference values and found that all of them are

stationary at this point. From the correlation test, it is found there is a high level of correlation found for all the selected macroeconomic variables. The Granger Causality test shows that there is a bidirectional causality found between running from Nifty 50 to Inflation rate. There is no causality found between the Exchange rate and the Nifty 50 and the Nifty 50 to Gold price and the Nifty 50 and the Interest rate.

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