Macroeconomic Indicators and Stock Market Boogie : The Case of National Stock Exchange, India

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Abstract

The present paper intended to inspect the relationship between the selected macroeconomic variables and the Indian stock market by taking quarterly observations from April 2005 to March 2015. We considered exchange rate, foreign institutional investment, call money rate, and consumer price index (CPI) as macroeconomic variables. We applied Pearson's correlation, Augmented Dickey Fuller unit root test, Johansen co-integration test, and Granger causality test to check the relationship between stock market returns and the above mentioned variables. Our results discovered that positive correlation existed between macroeconomic variables and stock market indices and long run equilibrium existed with the NIFTY 50 Index. In addition, the Granger causality test revealed that causality ran from NIFTY 50 Index to exchange rate and call money rate to NIFTY 50 Index. Moreover, it was also observed that the stock indices' returns were not a leading indicator for macro economic variables.

Keywords : **macroeconomic indicators, stock market return, augmented Dickey Fuller unit root test, Johansen co-integration test, and granger causality test**

JEL Classification : E44, G10, G14, G12

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The secondary market is a noteworthy part of the monetary system and represents the true portrait of an economy's financial health. The importance of secondary market is very well recognized from the individual traders and the company perspective. The secondary market pools the excess fund of the investors by opening up different avenues of investment and supplies these funds to the listed companies to fulfil their growth requirements. The secondary market acts as an important contributor for growth and improvement in the financial system of the country. In general, stock markets speed up the growth of an economy by providing funds for industries and thus, have opened the arena of investment all over the world contributing towards the development of the economy.

After major economic and monetary reforms in the year 1991, the Indian economy has gone through a sequence of extreme changes in the capital market. This resulted in exceptional development in the Indian stock market with a rise in the volume of transactions and investment inflow from foreign institutional investors. Considering the growth of the Indian capital market post liberalization, the market has been exposed to increasing financial instability. As a consequence of financial liberalization, a common phenomenon has been volatile movement of stocks due to market efficiency, and the impact can be assessed by looking at the stock market index.

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The word efficiency of the market indicates the relationship between available market facts and script value in the stock market. The dynamic nature of the secondary market is an essential aspect in order to understand the functioning of the secondary markets. The effectiveness of the growing markets presumes more significance as the pattern of investments is hastening in the secondary market as a consequence of political and legal changes and liberalizing all other blockades has opened the market to foreign investors. According to the effective market hypothesis advocated by Malkiel and Fama (1970), the stock price is a proficient market indicator which will respond to all information and facts about the changes in macroeconomic variables. The trend of market indices is extremely susceptible to the adjustments taking place in the economic indicators and the variations in anticipation about long-term projection and as a result, investors cannot make unusual returns from these markets. The findings of the efficient market hypothesis (EMH) was confirmed by arbitrage pricing theory developed in the year 1976 which further confirms the connection between the market price of the stock and various macroeconomic factors.

Expectations are affected by the micro and macro as well as several subjective factors, which are erratic and also very difficult to quantify. However, in the globally integrated economy, macroeconomic factors of the domestic country are also subject to changes in regulatory policies, and these changes are supposed to be espoused by other countries and thus, EMH theory was further crucially analyzed and validated by successive studies by Fama and Schwert (1977), Humpe and MacMillan (2009), Cheung and Ngb (1998), which additionally expounded that the market trend was being influenced by several macroeconomic factors such as inflation rate of a nation, interest rate, exchange rate, price of the crude oil, EXIM policies, FDI, and FII, etc. These are predominantly acknowledged as the global and domestic factors.

In this backdrop, the intent of this study is to probe into the course of relationship existing among four macroeconomic variables (exchange rate, foreign institutional investments, call money rate, and consumer price index) and stock market returns in India with reference to NSE (NIFTY INDEX).

Literature Review

Studies on the stock market and its impact on macro-economic factors are not nascent in the world. It is always considered that macroeconomic events have a specific quantity of pressure on the stock markets. Researchers worldwide are interested in knowing the amount of influence macroeconomic variables exert on the stock market and thus, quite a few well known studies have been conducted in this area. The outcome of the studies conducted globally using diverse methodologies, variable indicators, and statistical tests produced varied results. Thus, with reference to this, here we talk about previous research works that have been carried out in this sector. Mohapatra and Panda (2012) found that foreign institutional investors had a higher correlation with Sensex at the time of bearish market rather than when the stock trend was bullish.

Dornbusch and Fischer (1980) showed that variations in exchange rates impacted the financial standings of an organization as volatility in the exchange rate impacted the profits of the companies and also cost of capital as majority of the firms had their transactions in foreign denominated currencies. As a consequence, exchange rates created a force on the share prices of the firms which had an impact on the overall stock market index. The impact of several macroeconomic variables could be at variance from one market or exchange to another and from one time period to another. Darrat and Mukherjee (1986), in their study on the emerging economies of the globe using VAR model, revealed that there was a considerable causal relationship among the macro-economic variables chosen in the study and stock returns. Thus, they concluded by stating that the domestic factors in emerging economies were more influential in comparison with external factors in affecting stock returns.

Bahmani - Oskooee and Sohrabian (1992) considered S&P 500 and USD exchange rate as the variables for studying causal relationship for a short period of time. They ascertained that bidirectional causality relationship existed between the selected variables. On the contrary, co-integration analysis was abortive to recognize the long

term association between the two selected factors. Ang and Bekaert (2002) and Chen (2007) suggested that interest rate had a positive correlation with the stock market, which is in line with the study results of Mukherjee and Naka (1995) who probed the affiliation between six domestic and global macro-economic factors and the stock market of Japan, and discovered that co-integrating relation existed between secondary market and the macroeconomic factors. The study of Tripathi, Singh, and Singh (2016) found that foreign direct investment was a significant predictor of sensex.

Kim, Moshirian, and Wu (2005) studied the connection between macroeconomic variables and stock-bond connected to volatility of exchange rate. The outcomes of the study showed only marginal effect on macroeconomic variables, whilst Kurihara (2011) put forward that macroeconomic environment issues such as gross domestic product, foreign exchange rates, money supply, current account balance, and interest rate radically influenced the market capitalization rate.

Ratanapakorn and Sharma (2007) analyzed both short run and long run association among S&P 500 index and various macroeconomic factors. The study revealed the positive correlation among exchange rate, interest rates, money supply and inflation, while a negative correlation existed among interest rate and stock index.

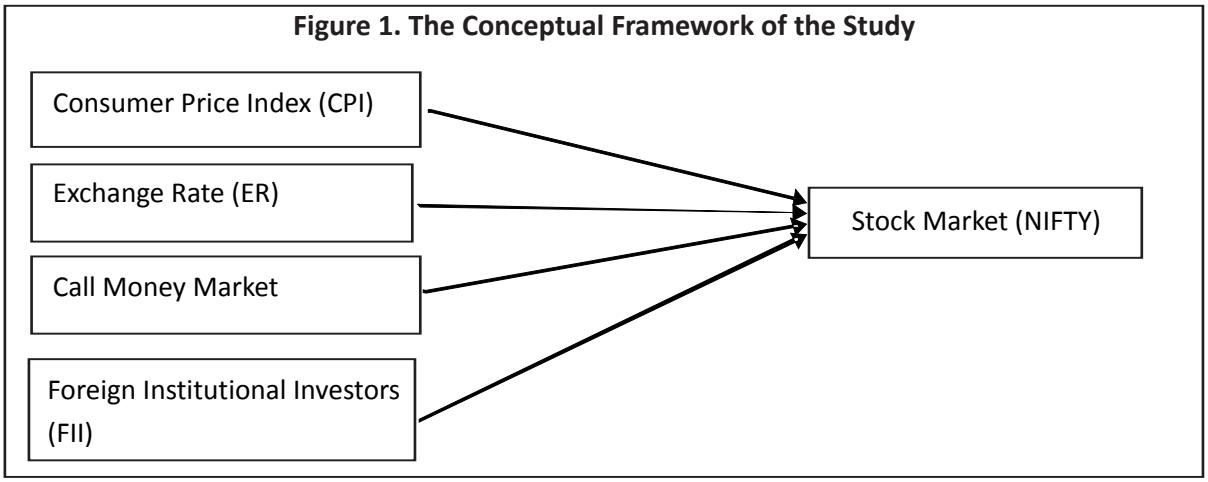
Aydemir and Demirhan (2009) in their study in Turkey found that there subsisted fundamental bidirectional association among market indices and foreign exchange rate. Emmanuel and Samuel (2009) in their impact study on stock market returns in Nigeria with respect to GDP, inflation rate, and domestic interest rate for 10 consecutive years using multiple regression analysis technique found that there existed a significant relationship among these variables. Singh (2010) tried to explore an affiliation among three macro-economic factors and BSE Sensex using unit root tests, correlation, and Granger's causality test. The outcome of the study revealed that the market index, exchange rate, index of industrial production, and wholesale price index held a unit root and was integrated. Moreover, the results of the Granger causality showed that bilateral causality existed between index of industrial production and Sensex, and on the other hand, Sensex had unilateral causality.

A study by Buyuksalvarci (2010) on Turkish Index returns established that out of the different macroeconomic variables, the following factors : interest rate, oil price, industrial production index, and foreign exchange rate had a negative effect on index returns. It appeared from the analysis that only money supply had a significant relationship on the Turkish Stock Index. Sharma and Mahendru (2010), in their study in the Indian context of four macroeconomic variables, noticed that foreign exchange rate and gold value had a positive impact on the stock market and found a constrained effect on foreign currency reserve and inflation rate. Srivastava (2010) came to the conclusion that in the long run, domestic macroeconomic variables like wholesale price index, interest rate, and industrial production significantly affected stock market index as compared to the global factors.

Goudarzi and Ramanarayanan (2011) established that causality relationship existed between BSE 500 index and foreign institutional investors and thus, the time series data were co-integrated. It was also observed by Jothi and Suresh (2016) that there was a high impression in the Indian stock market due to the volatility in the described macroeconomic factors.

Hosseini, Ahmad, and Lai (2011) observed that stock market indices and macro-economic variables had an association both in the long and short term. Agrawal and Srivastava (2011) also found a significant positive relationship between stock market index and exchange rate. Kumar and Puja (2012) conducted a detailed research on the dynamics of association among macro-economic factors and market index of various financial systems. The study showed that any variations that influenced the economic situations in common, such as eliminating constraints in foreign investment, would certainly lead to variations in the stock market and its connection to the macroeconomic variables. Thus, the study wrapped up by stating that re-examining the affiliation among the stock market and the macro-economic variables would be suitable and imperative for investors.

These studies stand testimony and made available to us a strong backup to examine the affiliation existing between macroeconomic variables and NSE NIFTY 50 index.



Variables and Data Sources

(1) Dependent Variables - Stock Market (Nifty) : The secondary market is a place where stocks are being offered for trade through registered stock exchanges. Till the 1980s, there was no formalized index to measure the performance of the Indian capital market. In the year 1986, the Bombay Stock Exchange for the first time introduced a stock index by the name SENSEX taking weightage of 30 companies that are subsequently being treated as the barometer for measuring the performance of the capital market in India. The important stock exchanges which have taken a benevolent role in transforming the investment scenario in the Indian capital market are Bombay Stock Exchange and National Stock Exchange. To fulfil the objective of our study, Nifty 50 index representing the stock market of India has been used to determine the performance of the top 50 major companies on the NSE.

(2) Explanatory Variables

(i) Consumer Price Index (CPI) : Inflation of a country is determined by alteration in the consumer price index. Higher the inflation, there will be an obvious increase in the living expenses and shifting of resources from investments to consumption. This will lead to tightening the monetary policy of the country and in addition, a plunge in demand for financial investment instruments, which, in turn, will direct to decrease in the trading volume. High inflation has an effect on corporate profits amalgamated with the rise in the cost of borrowing of the organizations, which, in turn, forces dividend downward and thereby, lowering stock prices. In view of that, it is said that equity prices are negatively related with inflation.

(ii) Exchange Rate (ER) : The second macro-economic factor selected in this manuscript is the exchange rate that is the bilateral rate of exchange of the Indian rupee (INR) against one unit of U.S. dollar (USD). It has been observed that with an appreciation in the foreign exchange rate, there will be an immediate decrease in the share prices with the assumption of rising inflation. Furthermore, import oriented firms will undergo huge losses for the reason being weaker home currency subsequently lowers returns and leads to lower stock prices. Consequently, the secondary market, which is a pool of listed firms, tends to react depressingly due to depreciation in the home currency. Even though decrease in exchange rate has a detrimental effect on the import oriented industry, nevertheless, it is beneficial for the export oriented industry as domestic products turn out to be cheaper for foreign clients. Thus, in general, the impact of exchange rate on stock prices can be an evidence for an

encouraging or an off-putting connection, as in most of the cases, a negative relationship is predominant (Doong, Yang, & Wang, 2005).

(iii) Call Money Rate (CMR) : The annotations with respect to the association among stock prices and interest rates put forward that an appreciation in the interest rates adds to the opportunity cost of holding money and thus causes a shift of the investment pattern from stocks to interest bearing instruments resulting in a decrease in stock prices. The anticipated inflation and exchange rate (INR vs USD) helps in determining the interest rate in the home country. In this study, CMR (call money rate) has been represented as an alternative to interest rate. Change in the call money rate will impact the Indian stock markets because of its comparative advantage of the contending financial assets such as bonds, stocks, and the expenses incurred to borrow the capital for purchasing the stocks.

(iv) Foreign Institutional Investors (FII) : FIIs comprise of either the investors or investment funds which have establishment in a country outside the geographical boundary of the country in which it is presently investing. Foreign institutional investors include insurance companies, corporate hedging funds, mutual fund companies, and pension funds. These institutional investors are required to register with the Securities and Exchange Board of India (SEBI) before investing in the Indian stock market. FIIs are permitted to invest in India through registered stock markets either in the form of debt or equity. As a result, the inflow or outflow of funds from FIIs makes an impact on the increase or decrease in the stock index, as FIIs are allowed to trade on a daily basis. Thus, the daily transactions of FIIs in the stock market are the cause behind the instability and market movement.

(3) Data Description : With a vision to achieve the predetermined goal of the study, four different macro-economic variables such as foreign institutional investments (equity + debt), exchange rate (INR/$), consumer price index (CPI), and call money rate (CMR) (four independent variables) were selected to examine the impact of these factors on the stock market with reference to NSE (dependent variables). The study consists of two domestic factors (CPI and call money rate) and two global factors (exchange rate and foreign institutional investors) which create pressure on the stock market. Different proxy data were employed to characterize different macroeconomic variables of the Indian economy such as CPI, which has been taken as an alternative to inflation rate and call money rate as a substitute of home country interest rate. The data period of the study is from April 2010 to March 2015, covering a period of five years which consists of 24 observations. For the purpose of data analysis and to arrive at a fruitful conclusion, quarterly data has been used.

(4) Empirical Tools : A set of tools and techniques have been adopted to arrive at the results. Central tendency and standard deviation - minimum and maximum value which provide a useful summary and inferential statistics such as Pearson's correlation, unit root test (Augmented Dickey - Fuller test), Granger causality test, and Johnson's cointegration test were employed to establish the relationship variables at 95% level of confidence using SPSS 17.0 and STATA 13.

(i) Pearson's Correlation Test : Pearson's correlation is a measure of linear correlation between two variables. The correlation value lies within +1 to -1. Correlation coefficient *(r)* is used for measuring short term comovement among the selected variables.

(ii) Unit Root Test (Augmented Dickey – Fuller Test) : Time series data is stationary if the data characteristics such as mean and variance do not change over time. The Augmented Dickey Fuller unit root test is on the basis of the null hypothesis that H0: *Yt* is not *I* (0), thus H (0) specifies the data of the specified variable is not stationary or has unit root. However, if the value of the calculated ADF test statistic is less than the critical value, then the null

hypothesis stands discarded. However, if the variable does not attain stationarity, that is, when the null hypothesis is accepted, then the ADF test will be carried out at the first difference. The entire model with trend and intercepts is shown in the equation (1):

$$\Delta Y_t = \alpha + \beta_T + \rho Y_{t-1} + \sum_{i=1}^{k} \gamma_i \Delta Y_{t-i} + e_t \ldots\ldots\ldots\ldots\ldots (1)$$

where,

Y_t is the variable selected for the period t, Δ is the difference operator, T denotes a time trend, e_t is an error term disturbance with mean 0 and variance as σ^2 , and k corresponds to the number of lags of the differences in the ADF equation. The unit root test is conducted on the basis of the coefficient of y_{t-1} in the regression. Thus, if the coefficient is significantly less than zero, then the hypothesis that variable data series contains a unit root is rejected.

(iii) Johansen Cointegration Test : The Johansen's co-integration test is being considered as a compact maximum likelihood test that assists in examining the co-integration in a whole system of equations. Johansen cointegration test through cointegration rank test was used to determine if long run association subsists between the change in the stock index and the four macroeconomic variables. Thus, if the error term arising from the linear combination of two variables is stationary, then a co-integration relationship exists between the two variables which further clearly specifies that long run affiliation exists between these variables. The trace statistics test is specified in the following equation (2) :

$$Trace\,(r,k) = -T \sum_{i=r+1}^{k} \text{In}\,(1 - \lambda_i) \ldots\ldots\ldots\ldots (2)$$

where,

λ_i is the i th largest Eigen value, and T is the number of observations in the variable selected. In this trace test, the null hypothesis states that there exists no co-integration between the variables ; whereas, the alternate hypothesis states that there is co-integration between the selected variables.

(iv) Granger Causality Test : Granger causality method developed by Engle and Granger (1987) has been used to locate the path of causality among the variables. It is a tool for discovering if one time series data is substantial in estimating another set of selected variables or not.

The null hypothesis (H_0) framed is that the variable X does not Granger cause variable Y and variable Y does not Granger cause variable X. To test for granger causality, the following regression equation (3) and (4) can be applied :

$$Y_t = \beta_0 + \sum_{k=1}^{M} \beta_k Y_{t-k} + \sum_{l=1}^{N} \mu_l X_{t-l} + u_t \ldots\ldots\ldots\ldots\ldots (3)$$

$$X_t = \gamma_0 + \sum_{k=1}^{M} \gamma_k X_{t-k} + \sum_{l=1}^{N} \delta_l Y_{t-l} + v_t \ldots\ldots\ldots\ldots\ldots (4)$$

where, X_t and Y_t are the time series data variables to be tested, and u_t and v_t are mutually uncorrelated errors, t refers to the time period, and $'k'$ and $'l'$ are the number of lags.

Empirical Analysis and Results

The Table 1 represents an outline of descriptive statistics of all the variables. The descriptive statistics indicate that the mean values of variables (FII, CPI, exchange rate, call money market, and Nifty) are 12584.33, 208.9271, 52.76084, 20.76125, 5791.049, respectively. The results of the descriptive study show the number of observations, maximum and minimum values, sample mean, and standard deviation. It is being observed that the volatility of the foreign institutional investments is considered to be the highest in comparison with the other variables accounted in the study.

The ADF test statistics given in the Table 2 reveal that except FII and Nifty, other variables do not attain stationarity in the time series data set. The significance value or *p* - value of the three variables namely CPI, exchange rate, and call money rate is greater in comparison with the critical *p*-value at 95% level of confidence interval. Therefore, the null hypothesis is accepted which connotes variables are not stationary and ADF test was carried out for the variable whose data set does not attain stationarity by taking the first difference to the time series of CPI, exchange rate, and call money rate in the Table 3.

The Table 3 illustrates the results of the ADF test after taking the first difference. The resultant value of the ADF test statistics are compared with critical values for the variables : CPI, call money rate, and exchange rate which specifies that the variables attain stationarity and all the series are co-integrated post application of the next Engel and Granger's (1987) co-integration test. Thus, the null hypothesis is declined at the 5% level of significance, indicating the data series of the variables as stationary.

The results of the Table 4 show that exchange rate has a significant positive correlation with consumer price index, and is moderately correlated with call money rate and NIFTY 50 Index ; whereas, low correlation exists with foreign institutional investment. CPI has a significant high positive correlation with exchange rate, call money rate, and NIFTY 50 Index. The results also reveal that CPI has a very low correlation with foreign

Table 1. Descriptive Statistics of the Study Variables

Variable	Obs	Mean	Std. Dev	Min	Max
FII	24	12584.33	10088.39	-9884.567	26506.33
CPI	24	208.9271	30.52986	151.3282	253.6662
Exchange Rate	24	52.76084	6.663653	44.65058	62.23037
Call Money Rate	24	20.76125	5.728708	9.76	27.63
NIFTY	24	5791.049	1197.338	3060.35	8639.569

Table 2. Augmented Dickey-Fuller Unit Root Test

No of Observation : 24

Exogenous: Constant

	Dickey-Fuller test for unit root		lags(0)	
Variables	**Test Statistic *Z(t)***	***p*-value**	**Null Hypothesis**	**Results**
FII	-3.584	0.0061	Reject	Variable is stationary
CPI	-2.092	0.2479	Accept	Variable is not stationary
Exchange rate	-1.469	0.5489	Accept	Variable is not stationary
Call Money Rate	-2.117	0.2377	Accept	Variable is not stationary
Nifty	-3.290	0.0153	Reject	Variable is stationary

Note: MacKinnon approximate *p*-value for *Z(t)* at 5% significant levels

Table 3. Results of ADF First Difference (Model 2)

No of Observation : 24

Exogenous: Trend & Intercept

	Dickey-Fuller test for Unit Root			lags(0)
Variables	**Test Statistic *Z(t)***	***p*-value**	**Null Hypothesis**	**Result**
CPI	-7.853	0.0000	Reject	Variable is stationary
Exchange rate	-4.625	0.0009	Reject	Variable is stationary
Call Money Rate (Avg %)	-4.811	0.0004	Reject	Variable is stationary

Note : Critical values at 5% level of significance

Table 4. Pairwise Pearson Coefficient of Correlation

Variables	FII	CPI	Exchange Rate	Call Money Rate	Nifty
FII	1.0000				
CPI	0.1601	1.0000			
Exchange Rate	0.1913	0.8758	1.0000		
Call Money Rate	-0.0045***	0.7933	0.6156	1.0000	
Nifty	0.4027	0.8187	0.6612	0.4977	1.0000

Note: Table 4 shows the correlation matrix where *** correlation is significant at the 0.01 level; ** significant at the 0.05 level (Pearson Correlation - Sig. 2-tailed).

Table 5. VAR Lag Order Selection Criteria

Endogenous Variables: FII, CPI, Exchange Rate, Call Money Rate, Nifty

Lag	Lag LL	LR	FPE	AIC	HQIC
0	-444.16	NA	1.7e+18	56.145	56.1574
1	-406.505	75.311	4.1e+17	54.5631	54.6373
2	-352.095	108.82	4.1e+16*	50.8869	51.0229
3	2104.52	4913.2	.	-253.065	-252.867
4	2139.61	70.171	.	-257.451	-257.253
5	2163.45	47.682	.	-260.431	-260.233
6	2223.17	119.44*	.	-267.896*	-267.698*
7	2183.48	-79.365	.	-262.936	-262.738
8	2143.54	-79.897	.	-257.942	-257.744

Note: "*" indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

institutional investment. FII has low correlation between exchange rate and call money rate, moderate relationship exists with NIFTY 50 Index, and negative correlation exists with call money rate. CMR is highly correlated with consumer price index and is moderately correlated with exchange rate and NIFTY 50 Index. The results also ascertain that CMR possesses negative correlation with foreign institutional investments. NIFTY

Table 6. Johansen's Cointegration Test

Maximum rank	LL	Eigen value	Trace statistics	5% Critical value	Result of null hypothesis
0	-603.82658	-	81.6307	68.52	Reject There is co-integration
1	-589.83728	0.71966	53.6521	47.21	Reject There is co-integration
2	-579.29351	0.61654	32.5646	29.68	Reject There is co-integration
3	-572.72639	0.44955	19.4303	15.41	Reject There is co-integration
4	-567.0565	0.40276	8.0906	3.76	Reject There is co-integration
5	-563.01122	0.30771			

Note: The Table 6 shows the results of Johansen co-integration test with constant trend and lag 2.

Table 7. Granger Causality Test

Null Hypothesis	*p*- value	Result	Relationship
Lagged FII variable does not Granger cause NIFTY.	0.5883	**ACCEPT**	Relationship does not exist
NIFTY does not Granger cause FII growth rate.	0.9748	**ACCEPT**	
Lagged CPI variable does not Granger cause NIFTY.	0.6169	**ACCEPT**	Relationship does not exist
NIFTY does not granger cause CPI growth rate.	0.2856	**ACCEPT**	
Lagged exchange rate variable does not Granger cause NIFTY.	0.9297	**ACCEPT**	Unidirectional Relation
NIFTY does not granger cause exchange rate growth.	0.0567	REJECT	
Lagged call money rate variable does not Granger cause NIFTY.	0.0524	REJECT	Unidirectional Relation
NIFTY does not Granger cause call money rate growth.	0.1859	**ACCEPT**	

Note: The Table 7 shows the results of Granger causality test.

possesses a positive moderate to high correlation with all the macro economic variables.

The Table 5 shows the VAR Lag selection which estimates the model to find the number of cointegrating relations in our model. The model lag length selection was determined by both Schwarz (SIC) and Akaike (AIC) Information Criterion using Lag 2 for conducting the Johansen co-integration test. The VAR model is a valuable means of exemplifying the dynamic associations among the economic variables and to make sure that there is no remaining autocorrelation in the VAR model. The application of the VAR model also permits inclusion of the apt lag lengths as this is significant due to the delay in production of information concerning the data series as it is not always immediate as was also supported by Abugri (2006) and Acikalin, Aktas, and Unal (2008).

Following determination of unit roots and integration at first order, Johansen co-integration tests were applied to control whether co-integration exists among these five variables. Co-integration analysis is important, since if the error term coming from the linear combination of two variables is stationary, then there is co-integration between the two variables.

The Table 6 encloses a separate row for each likely value of r that is the number of co-integrating equations. When $r = 5$, all the variables selected in this model are stationary. The value of trace statistic at $r = 0$ is 81.63, which goes beyond the critical value of 68.52, thereby rejecting the null hypothesis of no co-integrating equations. Since, the trace statistic value of $r = 1, 2, 3, 4$ exceeds its critical value, the alternate hypothesis stands accepted while rejecting the null hypothesis. Thus, from the Table 6, it is apparent that the trace statistics from 0 to 5 co-integration is higher than the 5% critical value, and we consider that the variables are co-integrated with each other, which means they have a long term association or they move collectively in the long run. This depicts that long-term established relationships exist among these five variables, namely returns on stock market and four macroeconomic variables. Thus, it may be concluded that all five variables move together in the long run as also seen in prior studies conducted by Sohail and Hussain (2009) and Adam and Tweneboah (2008).

The pair-wise Granger-Causality was employed to identify the presence of causality between macroeconomic variables and stock market returns of the NSE listed companies. The Table 7 portrays the outcome of the Granger causality test for four macroeconomic variables and Nifty Index returns. Consequently, from the results of the test, it is observed that there exists unidirectional affiliation among exchange rate & NIFTY and call rate & NIFTY at the 5% level of significance by accepting the alternate hypothesis due to the smaller *p*-value in comparison with the confidence interval. In addition, the test also reveals that NIFTY Index Granger causes exchange rate, whereas call money rate Granger causes NIFTY Index and there exists no relationship between FII, CPI, and NIFTY. As a result, the test implies that the returns of the stock market can be used to predict the exchange rate while call money rate (interest rate) can be used to predict NIFTY. Nevertheless, causalities were also reported between interest rate and stock market returns in previous studies conducted by Acikalin et al. (2008) in Turkey and Issahaku, Ustarz, and Domanban (2013).

Conclusion

After the advent of globalization, the Indian economy has surged towards a competitive economy in the global scenario. The growth of stock trading, industrial sector, and service sector has been phenomenal. Under the existing situation, the study performed the necessary analysis to magnify the relationship existing between four macroeconomic factors namely exchange rate, call money rate, foreign institutional investment, consumer price index, and Indian NIFTY 50 Index. The study reveals few attention-grabbing results. Firstly, the correlation analysis reveals that all the macro economic variables have a positive relationship with Indian NIFTY 50 Index. Thus, from the investors' perspective, the outcome will be helpful in understanding the macro factors and their impact on the stock market. It should be noted that stock price variability is fundamentally attuned to the changes in macroeconomic variables. Secondly, the integration test also reveals that long run equilibrium subsists between NIFTY Index and all the stated macroeconomic variables. Thirdly, in the midst of all the macroeconomic indicators, the Granger causality test substantiates the causality running from NIFTY 50 Index to exchange rate and call money rate to NIFTY 50 Index. This causality gives rise to help improvements in predictions of NIFTY changes by using the past information of exchange rate. The results further imply that investors may improve their portfolio performance in individual markets by focusing on the macro risk factors. The findings of the study show that exchange rate and call money market contains some significant information to forecast stock market performance. Even though the results of the analysis are not exhaustive for investment decisions in the capital markets of India, but the models discussed in this paper are expected to be practical and undeniably can be used as a consideration by investors, companies, and governments in the future.

Implications, Limitations of the Study, and Scope for Further Research

The present study has further scope for more comprehensive results. It can be extended over a longer period and more macroeconomic variables can be selected. Furthermore, the research area can be extended by analyzing the fundamentals, economy, stock prices, and stock markets of various developed and developing nations. The present study also focuses on only one market and fewer macro-economic variables. Therefore, other factors affecting the returns generating processes are outside the purview of the study. Therefore, for further development, this study proposes to investigate various other approaches with different variables such as the genetic algorithm, vector error correction model to increase the prediction ratio. Detection of interrelationships between stock markets and macroeconomic variables holds implications for investors as well as for policy makers. The short run analysis will reveal fundamental functions of stock markets in recognizing changes in economic conditions or in signalling the future performance of the macro-economy. The deficiencies of this

analysis include the lack of any explicit account of news and impact of global events and a lack of any formal sensitivity analysis apart from a sub-sample analysis of results and what impacts this event could have had upon the results. A more detailed study focusing on these events using data observed on intra-day, and focusing upon the evolution of the relative endogeneity and stability of the particular markets over time can provide a positive and practical step in this direction for future research in international finance.

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