Relevance of Macroeconomic Variables in the Indian Stock Market

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Abstract

The study analyzed the impact of macroeconomic variables on the functioning of the Indian stock market. To achieve the research objective, monthly data of 10 macroeconomic variables, namely broad money, call money rate, crude oil price, exchange rate, foreign exchange reserve, foreign institutional investors, gross fiscal deficit, index of industrial production, inflation rate, and trade balance and one stock market index BSE 500 was used. Descriptive statistics, graphs, unit root tests, multiple regression, and Granger causality tests were employed for the study. All the variables became stationary at first difference with ADF test and PP test. This stationary data was used to find out the significant macroeconomic variables by using the multiple regression technique. One variable, that is, exchange rate was found to be significant. Granger causality test was used to check the causality relationship between the significant variable and BSE 500. It was observed that exchange rate had no relationship with closing prices of BSE 500 manufacturing firms. The study also revealed that the Indian stock market is weak form efficient because no relationship was found among the variables during the study period.

Keywords: economy, macroeconomic variables, stock market, BSE 500, ADF test, PP test, multiple regression, granger causality

JEL Classification: E44, E51, E62, F31, G10, G14

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The Indian stock market plays a pivotal role in the growth of the Indian economy. Its movement impacts the performance of the economy. Various proponents have opined that macroeconomic variables have a significant bearing on the stock market. Macroeconomics is the analysis of the nation's economy as a whole. It scrutinizes the cyclical movements and trends that exist in the economy such as those for Gross Domestic Production (GDP), unemployment, inflation, money supply, budget deficits, international trade, and Exchange Rate (ER). Various schools of thoughts such as the Classical theory (Adam Smith,1723-1790,David Ricardo, 1772-1823, Thomas Robert Malthus, 1766-1834 & John Stuart Mill,1806-1873), Keynes's theory (John Maynard Keynes,1883-1946), New Classical theory, New Keynesian theory, and New Growth theory developed their own views about the role of macroeconomic variables in the economy by considering different assumptions. However, they accepted that macroeconomic variables are the most remarkable variables and governments cannot make their policies, rules and regulations without contemplating on them. So, macroeconomic variables are the key indicators to show the prevailing trends in the economy.

Victor (1992) that the macroeconomic variables are significant factors which push the US economy to move according to their performance. Naka, Mukherjee, and Tufte (1998) found a long term relationship between the macroeconomic variables M_1, interest rate, Index of Industrial Production (IIP) and Bombay Stock Exchange (BSE) Sensex. Similarly, Tripathy (2011), Sivagnanasithi (2012), and Parmar (2013) observed the significant relationship between macroeconomic variables and the Indian stock market. They proved that Indian stock

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market was not weak form efficient. The causal relationship between the Sensex, IIP, ER and wholesale price index (WPI) was observed by Singh (2010). The author found the unidirectional relationship between IIP & Sensex, Sensex & WPI, Sensex & ER, and Sensex & IIP. Ray (2012) also found the unidirectional relationship between Foreign Exchange Reserves (FER) and BSE Sensex. Kumar (2011) did not observe any significant relationship between the Nifty and REER, FER and WPI. The study claimed that Indian stock market was weak form efficient. The same results were observed in the study done by Jha and Singh (2014). The authors opined that no relationship exists between the BSE, NSE and IR, ER, MS & FIIs. The present study selected ten macroeconomic variables to check their association with the stock prices of BSE 500 manufacturing firms.

A Bird's Eye View of Literature

✦ **Relationship Between Macroeconomic Variables and Stock Market Movements :** Many academic researchers, financial and industry analysts and practitioners have tried to envisage the relationship between macroeconomic variables and stock market movements. They have done several empirical and descriptive studies to ascertain the effect of macroeconomic variables on stock prices or vice-versa and the existing relationship between the two. Different conclusions have been provided by various studies conducted with different variables, methodologies, techniques and tests. Here, we discuss some previous research work and the conclusions that are related to our research work.

Victor (1992) examined lead lag interactions between macroeconomic variables and a non-duplicative leading index. Interest rates, inflation rate along with monetary, output and fiscal variables were selected for the study. The entire study was divided into three periods: prewar (1886-1914), interwar (1919-1940) and postwar (1949-1982). Quarterly data was used to check the impact of these periods on the U.S. business cycle. Real GNP, Implicit price deflator, Money Supply, M1,M2,Commercial paper rate, Federal expenditures, Fiscal Index, Diffusion Index, 75 leading series, Amplitude-adjusted index, six leading series, a composite index of leading indicators were commuted as macroeconomic variables. It was observed that short term nominal interest rates had an inverse effect on real GNP during 1949-1982. The role of monetary variables appeared greater in the interwar period, i.e. 1914-1940 as compared to fiscal and output variables. The selected variables were found significant and effective for the US economy but only for the limited period.

Naka, Mukherjee, and Tufte (1998) examined the nexus between macroeconomic variables and the Indian stock market. Vector Error Correction Model (VECM) was employed to check the long term and short term relationships between the BSE Index and a set of five variables such as IIP, Consumer Price Index (CPI), M_1, interest rate, and inflation. The study found the long term equilibrium relationship between the three selected variables and BSE Sensex, but the cointegration with each other. Long term relationship was observed between M_1, IIP, interest rate & BSE Sensex. The study found that (IIP) was the positive determinant in regulating the Indian stock market and inflation was the negative determinant. The study suggested that Indian stock market appeared to be drawn downward due to the residual negative trend. Economic mismanagement was the dominant responsible factor for the downward trend even after the economic reforms of 1990.

Singh (2010) studied the causal relationship between macroeconomic variables and the stock market. The focus of study was to check the causal relationship and correlation between the selected variables by using trend analysis, correlation, Augmented Dickey Fuller, and Granger Causality techniques. Sensex Index prices, IIP, ER and Wholesale Price Index (WPI) were selected. Monthly data of fifteen years was used in the study. It has been observed that all the variables like Sensex and IIP, Sensex and WPI were highly correlated except the Sensex and ER. The data became stationary at first difference with the ADF test. Granger causality test rejected all the results which were compiled at the earlier stage. It was detected that Sensex granger causes WPI, ER ,and IIP. The macroeconomic variable IIP granger causes Sensex. It means that only IIP performance can be used to predict the future returns of Sensex and investors can use this variable as a predictive variable for their investment decisions.

Hosseini, Ahmad, and Lai (2011) investigated the nature of the causal relationships between stock prices and the key macroeconomic variables of India and China for the period January 1999 to January 2009 using monthly data. The selected variables were the Bombay Stock Exchange (BSE) stock prices, Shanghai Stock Exchange (SSE) stock prices, Crude Oil Price (COP), Money supply (M2), index of industrial production, and inflation rate. Augmented Dickey Fuller (ADF) unit root test, Johansen-Juselius Multivariate Cointegration and VECM techniques had been applied to explore the long-run and short-run relationships. The results of the study revealed both long-run and short-run linkages between the macroeconomic variables and stock market indices of both countries.

Kumar (2011) employed unit root tests, Cointegration, and Granger causality test to examine the casual relationship between the stock market and macroeconomic variables in India from 2006 to 2010. Monthly data of Real Effective Economic Rate (REER), FER, TB, Foreign Direct Investment (FDI), IIP, WPI, and Nifty were used. No cointegration was found between the selected variables except between WPI and Nifty using Johansen Cointegration test. It was also scrutinized that WPI, and Nifty had no unidirectional and bidirectional relationship with each other. They did not Granger cause each other.

Tripathy (2011) examined the weak form market efficiency and casual relationship between the selected macroeconomic variables and the Indian stock market by conducting Ljung-Box Q test, Breusch-Godfrey LM test, Unit Root test, and Granger causality test on data from January 2005 to February 2011. The weekly observations of BSE Sensex, WPI, Treasury Bill Rate, ER, S &P 500 and BSE trading volume were used for analysis. The presence of autocorrelation was found in the Indian stock market. Bidirectional relationships between interest rate and the stock market, international stock market and BSE volume, ER and stock market and ER and BSE volume were observed. Unidirectional causality between the international stock market and domestic stock market, interest rate and stock market, ER and stock market and inflation rate and stock market was also found. The study further revealed that the Indian stock market was not weak form efficient and investors could earn abnormal profits by considering changes in the macroeconomic variables and historical prices of stocks.

Patel (2012) analyzed the effect of macroeconomic determinants on the performance of the Indian stock market from January 1991 to December 2011. Monthly data on interest rate, inflation, ER, IIP, money supply, gold price, silver price and oil price used to show their effect on the performance of two major stock market indices i.e. Sensex and Nifty. ADF Unit Root Test, Johansen Cointegration test, Granger causality test, and VECM were applied to find the co-integration, long run and short run equilibrium relationship and causality among the variables. It was found that a long run equilibrium relationship between stock market indices and all macroeconomic variables existed. The study also confirmed the evidence of causality among the variables.

Sivagnanasithi (2012) used time series analysis to explore the relationship between macroeconomic variables and the Indian stock market. The entire study covered the monthly data of WPI, IIP, ER, Call Money Rate (CMR), FIIs, MS and Sensex from April 2007 to March 2012. ADF test was employed to check the stationarity of the data. It found that all the selected variables were positively correlated with each other. The causality relationships between the dependent and independent variables were confirmed by using the Granger causality test. Bidirectional relationship between WPI and IIP and unidirectional relationship between Foreign Institutional Investors (FIIs) & BSE Sensex, WPI & BSE Sensex, WPI & Call Money Rate (CMR), WPI & ER, Money Supply & IIP, Money Supply & WPI were found. But, no causality relationship between CMR & BSE Sensex, ER & BSE Sensex, ER & CMR and IIP & FIIs was observed.

Ray (2012) looked at the relationship between FER and BSE market capitalization using annual data for the period of 1990-91 to 2010-2011. To measure this relationship, simple linear regression model, unit root test, and granger causality test were used. The study found positive impact of FER on BSE stock market capitalization. cointegration and unidirectional relationships were observed. This unidirectional relationship runs from FERs to stock market capitalization of BSE but not vice versa. Noteworthy information was provided to stock brokers,

planners, agents, and government policy makers to take their decisions about the Indian stock market. They can also check past data and trends of FERs to forecast the performance of BSE stock market capitalization.

Walia (2012) studied and analyzed the impact of the global financial crisis on the Indian economy (from 2006 - 2015). The scholar exposed various reasons of initiation and its impact on various Indian sectors such as agriculture, manufacturing, construction, finance, insurance, real estate, etc.; nine sectors were considered. GDP, Trade Balance (TB), balance of payment position, foreign investments, income flow in India and the cumulative change in equity indices were studied. The entire study is divided into two parts, i.e. pre meltdown and post meltdown periods. It has been found that initially, India was not affected by this crisis, but later the bankruptcy of Lehman Brothers and occurrence of some other events shook the Indian economy too.

Kumar (2013) opined on the effect of macroeconomic factors on the performance of the Indian Stock Market. Twelve internal and external macroeconomic variables along with stock prices of CNX Nifty were selected to establish this relationship. The average monthly data of thirteen years have been gathered from reliable sources. Out of these twelve selected variables, three factors were sorted out through data reduction technique labeled as macro environment, policy rates and industrial growth. It was found that favorable macro environment, passive growth pattern and effective policy rates exist and positively affect the Indian capital market. Multiple regression was used to establish the causal relationship between the selected factors and the dependent variable i.e. CNX Nifty stock prices. The author concluded that apart from the macroeconomic variables, other factors like firm's performance and unseen factors also affect the Indian stock market.

Parmar (2013) studied the inter-linkage between macroeconomic variables and Indian stock market movements. Reverse repo rate, cash reserve ratio (CRR), statutory liquidity ratio (SLR), repo rate, inflation rate, CPI, IIP, gold rate, oil rate and ER have been covered under the purview of macroeconomic variables and SENSEX in the Indian stock market. It also predicted the stock market behavior in future. Correlation and ANOVA test were used to analyze yearly data from 2004 to 2012. The study concluded that the Indian stock market was more driven by domestic factors as compared to global ones.

Jha and Singh (2014) analyzed within the framework of an autoregressive conditional heteroskedastic model, whether the number of macroeconomic variables were useful to predict the volatility of the Indian stock market. The study also measured the interaction between the selected macroeconomic variables and stock prices of BSE and NSE exchanges. Johansen cointegration test and Innovation accounting techniques have been applied to analyze the long term relationships and short term dynamics between the stock prices of BSE & NSE and Interest rate, ER, Money Supply and FIIs. Cointegration was found in a long run equilibrium path between the selected macroeconomic variables and stock price indices.

Objectives of the Study

This work was executed with the objective of finding out whether macroeconomic variables are actually putting an effect on the functioning of the Indian stock market or not during the global financial crisis period. Thus, the objectives are:

(1) To assess the relevance of macroeconomic variables in the Indian stock market.

(2) To scrutinize the weak form efficiency of the Indian stock market.

Data and Methodology

(1) Need of the Study : Stock markets of any economy play a pivotal role in its development and growth. They affect every sector of the economy. They provide a number of opportunities to investors to earn profits and

enhance the worth of their investments. They become the basis for the government and regulatory authorities to plan their policies. They play an important role in the mobilization of capital from domestic as well as from foreign investors.

The importance of this research stems from the crucial role played by the Indian stock market in developing the Indian economy. The most important tasks performed by stock market is collection of money from investors and encouragement provided to invest. So, this study was conducted to check the influence of some macroeconomic variables on the performance of BSE 500 manufacturing firms.

Secondly, this study would be helpful for investors at the time of making investment decisions because they can consider all the affecting variables and take suitable actions. Individual investors, institutional investors, portfolio managers and foreign investors may use this study to assist their work.

Thirdly, all the firms whether already listed or going to be listed on any stock exchange might refer all the variables that affect the performance of stock market prices. The Indian Government and other regulatory authorities can use the study results to make their policies and take any specific decision related to macro-economic variables impact on the stock market.

(2) Scope of the Study : The scope of the study was limited to 150 manufacturing firms listed on BSE 500. BSE 500 is constructed by BSE Ltd. after taking into consideration the changing pattern of the economy and market. It represents nearly 93% of the total market capitalization of BSE. It covers all 20 major industries of the economy. M, its calculation methodology was decided to be free-float on August 16, 2005 before the global financial crisis. Its base year is 1999. The market capitalization position represented by this index showed most reliable and valid values as compared to those indices whose base years happen to be 1995-96 (NSE) and 1978-79 (BSE).

A sample size of 150 manufacturing firms had been selected on the basis of higher closing prices of stocks on 31st March 2015. All the manufacturing firms traded on BSE 500 were identified as per the classification given by National Industrial Classification (NIC) 2008. 258 firms belonged to the manufacturing industry out of which 124 firms fell in small cap, 46 firms in mid cap and 88 firms in large cap categories. Proportionately, 150 firms were picked out of which 72 were from small cap, 27 from mid cap and 51 from large cap.

A time span of ten years from April 2006 to March 2015 had been chosen for the research. The monthly data against the yearly and quarterly data was employed to depict a larger prospect of the relationship between macroeconomic variables and BSE 500. The monthly closing prices of all the selected manufacturing firms were collected and then average values were calculated for further research.

The ten macroeconomic variables Broad Money, CMR, COP, ER, FER, FIIs, Gross Fiscal Deficit, IIP, Inflation Rate and TB were selected for the study on the basis of their importance and literature studied. Domestic as well as international macroeconomic variables had been chosen to carry out the research.

Secondary data was used for the entire study. The data related to closing prices of manufacturing firms were collected from the website www.moneycontrol.com. The database of Reserve Bank of India (RBI) was used to gather   monthly data of all macroeconomic variables except crude oil prices which was taken from www.indexmundi.com. Table 1 indicates symbol and proxy used for selected macroeconomic variables and stock index to conduct the study.

(3) Techniques Used : Descriptive statistics, graphs, unit root tests, multiple regression and Granger causality test were used to assess the relevance of macroeconomic variables for the Indian stock market. EViews software was used for the tests.

The descriptive statistics were used to check the basic nature and characteristics of the data. Graphs were drawn to check the historical performance of the selected variables in pictorial form. ADF test and PP test were employed to check stationarity of data. When the data became stationary, multiple regression was applied to find out significant variables. Granger causality test was used after multiple regression to check the causal relationship

Table 1. Description of Data

Name of Variables	Symbol Used	Proxy Used
Stock Index	BSE 500	Average Monthly closing prices
Call Money Rate	CMR	Weighted Average Call Money Rates
Crude Oil Price	CO	Indian Rupee per Barrel
ER	ER	Average Rupees per unit of US $
Foreign Exchange Reserve	FER	Total Foreign Exchange Reserve in Rs. Billion
Foreign Institutional Investment	FII	Net Investment in Rs. Billion
Gross Fiscal Deficit	GFD	Centre Gross Fiscal Deficit in Rs. Billion
Index of Industrial Production	IIP	General Index Numbers of Industrial Production
Money Supply	MS	Broad Money (M3) in Rs. Billion
TB	TB	TB in Rs. Billion
Inflation Rate	IR	WPI-Inflation

Table 2 . Results of Descriptive Statistics

	Average Closing Prices	Weighted Average Call Money Rate	Crude Oil Prices (Indian Rupee per Barrel)	ER (₹ Per unit of US Dollar)	Foreign Exchange Reserves	Foreign Institutional Investors (₹ Billion)	Gross Fiscal Deficits (₹ Billion)	Index of Industrial Production	Broad Money (₹ Billion)	TB (₹ Billion)	WPI infla. (Inflation rate)
Mean	471.6683	6.888704	4347.151	49.8288	13888.6	87.00824	392.1984	157.6643	62221.52	535.2692	6.480926
Median	436.05	7.425	4089.145	47.7	13454.11	71.195	350.765	162.1312	59898.71	529.771	7
Maximum	1269.45	14.07	6928.11	63.75214	21376.4	295.07	1273.83	197.3	105756.8	1071.658	11.1
Minims Um	156.85	0.73	2020.1	39.37	7225.63	0.17	6.34	108.8396	27634.9	153.757	0.17
Std. Dev	242.7942	2.080053	1347.241	7.133426	3495.988	68.88655	265.6278	19.47514	23306.08	241.9663	2.857311
Skewness	1.559804	-0.37689	0.165598	0.526164	-0.07538	0.945076	0.796375	-0.42021	0.202037	0.304465	-0.48826
Kurtosis	5.504547	3.896827	1.72037	2.07937	2.463526	3.025604	3.453298	2.75704	1.820056	2.180856	2.51386
Jarque Bera	72.0212	6.176173	7.862145	8.797297	1.397395	16.07999	12.3405	3.443992	6.999952	4.688071	5.354702
Probability	0	0.045589	0.019623	0.012294	0.497232	0.000322	0.002091	0.178709	0.030198	0.09594	0.068745

between dependent and independent variables. The causal relationship was confirmed for those which were found significant after the results of multiple regression.

Data Analysis and Interpretation

(1) Descriptive Statistics : Table 2 shows the results of Descriptive Statistics in which the values of mean, median, maximum, minimum, standard deviation, skewness, kurtosis, Jarque Bera statistic were given for the average closing prices (ACP) of BSE 500, weighted average call money rate, crude oil, ER, foreign exchange reserves (FER), foreign institutional investment (FII), gross fiscal deficits (GFD) , IIP, broad money, TB (TB) and WPI. Monthly data was used to assess the results during the research period April 2006 to March 2015.

Table 2 depicts the mean values of all the variables as 471.6683, 6.888704, 4347.151, 49.8288, 13888.6, 87.00824, 392.1984, 157.6643, 62221.52, 535.2692, and 6.480926 for the ACPs, weighted average CMR, COP, FERs, FIIs, GFD, broad money, TB, and WPI respectively. Broad Money achieved the highest mean value and the lowest was seen in the case of inflation rate.

The median values for average closing prices, weighted average call money rate, crude oil prices, ER, FER, foreign institutional investors, gross fiscal deficit, IIP, broad money, TB, and WPI were 436.05, 7.425, 4089.145, 47.7, 13454.11, 71.195, 350.765, 162.1312, 59898.71, 529.771, and 7, respectively. The standard deviation values for all the variables were greater than zero, hence it can be said that there is wider spread from its mean values.

The maximum values of the variables (ACP, CMR, COP,ER, FER, FIIs, GFD, IIP ,M3, TB, and WPI) were 1269.45, 14.07, 6928.11, 63.75214,21376.4, 295.07,1273.83,197.3,105756.8, 1071.658, and 11.1, respectively during the study period. The minimum values of ACP, CMR, COP, ER, FER, FIIs, GFD, IIP, M3, TB, and WPI were 156.85,0.73, 2020.1,39.37,7225.63,0.17,6.34,108.8396,27634.9,153.757, and 0.17, respectively.
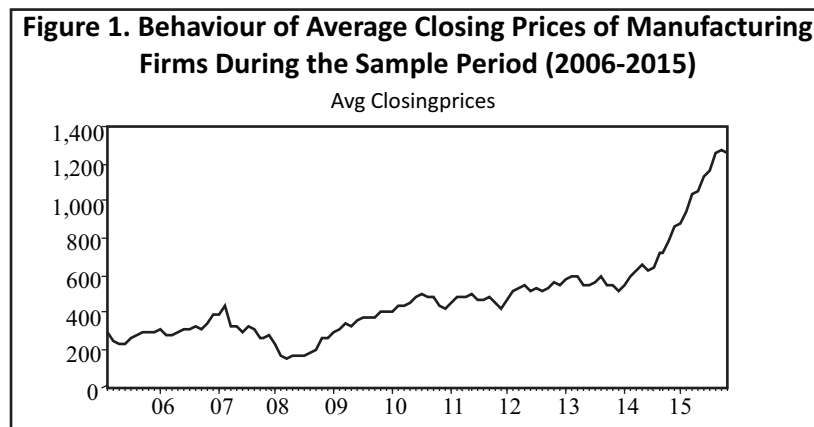
It is revealed from the Table 2 that all variables were asymmetrical distributed. The average closing prices, COP, ER, foreign institutional investors, GFD, broad money and TB were positively skewed with their respective values of 1.559804, 0.165598, 0.526164, 0.945076, 0.796375, 0.202037, and 0.304465. It also defines that their right tail is greater and fatter then the left tail. The weighted average call money rate, foreign institutional investors, IIP and WPI were negatively skewed with -0.37689, -0.07538, -0.42021, and -0.48826 values. It conveys that the left tail is longer and fatter than the right tail.
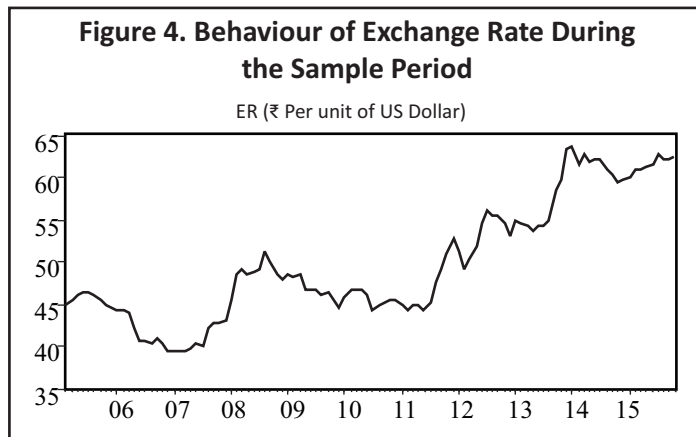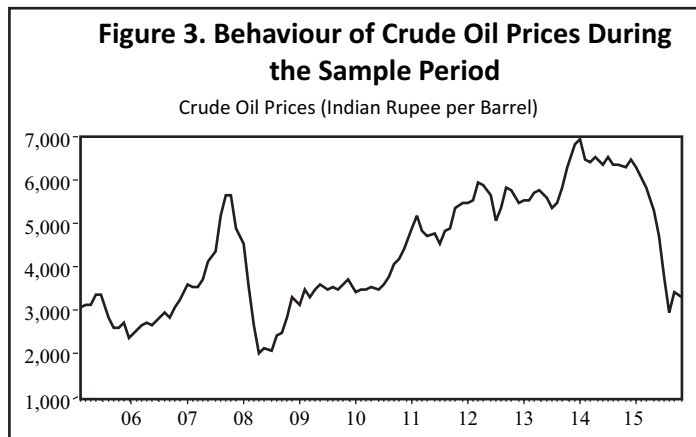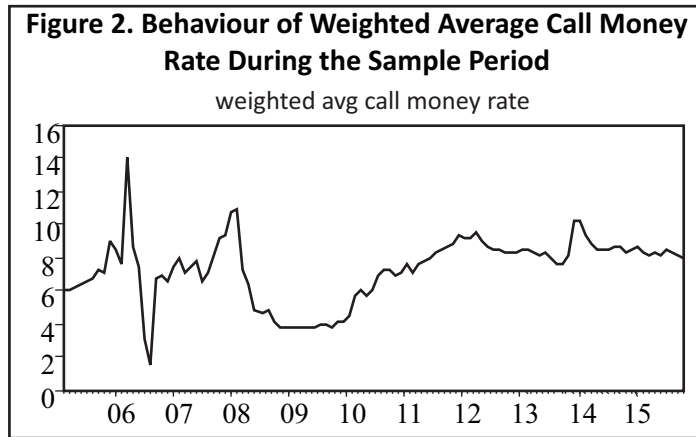
The average closing prices with value 5.504547, weighted average CMR with value 3.896827, foreign institutional investors with value 3.025604, and GFD with value 3.453298 have been found leptokurtic. Crude oil prices with value 1.72037, ER with value 2.07937, FER with value 2.463526, IIP with value 2.75704, M3 with value 1.820056, TB with value 2.180856, and WPI with value 2.51386 were found platykurtic.

The p-value of the Jarque Bera test for ACP, CMR, COP, ER, FIIs, GFD, M3, TB, and WPI was lesser than the critical value of 0.05. The Null hypotheses have been rejected for these variables and it was shown that data was normally distributed. On the second side, the p-value for FER, IIP were greater than 0.05, the critical value. It means that data was not normally distributed.

(2) Historical Behaviour of the BSE 500 and Macroeconomic Variables During the Study Period : The graphical representations of the historical behavior of chosen variables, i.e. ACP of BSE 500, Weighted Average CMR, COP, ER, FER, Foreign Institutional Investment, GFD, IIP, Broad Money, TB and WPI during the period of April 2006 to March 2015 are shown in the following figures. The historical behavior being represented by the graphs is helpful in identifying the presence of some important components such as trends, seasonality, cyclical effects, stationarity.

The Figure 1 represents the historical behavior of monthly data of the ACP of BSE 500 during the period April 2006 to March 2015. The behavior indicates falling trend in stock prices in the initial year, then a sudden rise in 2007 and again a sharp downfall in 2008 due to global financial crisis. An upward trend with slight downfall for a

Figure 1. Behaviour of Average Closing Prices of Manufacturing Firms During the Sample Period (2006-2015)

Figure 2. Behaviour of Weighted Average Call Money Rate During the Sample Period

weighted avg call money rate

Figure 3. Behaviour of Crude Oil Prices During the Sample Period

Crude Oil Prices (Indian Rupee per Barrel)

Figure 4. Behaviour of Exchange Rate During the Sample Period
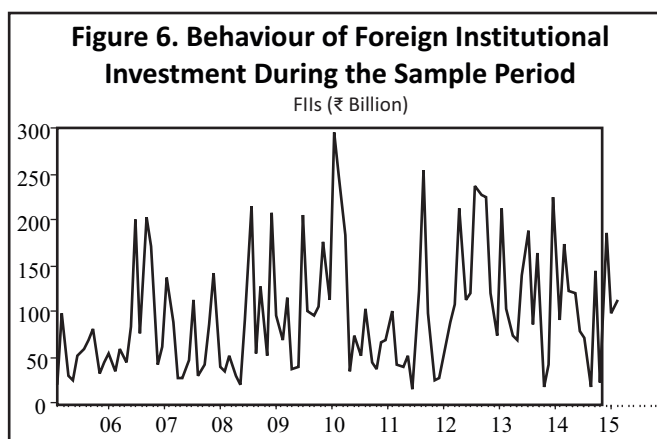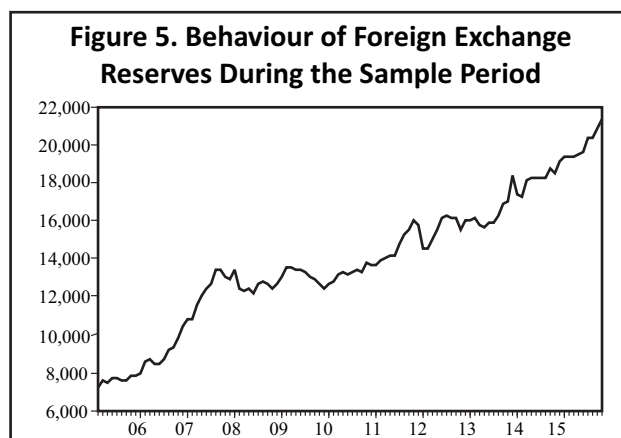
ER (₹ Per unit of US Dollar)

certain time period from 2009 to 2014 was observed. In 2015, a sharp upward movement existed which can be seen from the Figure 1.

The Figure 2 depicts the historical behavior of weighted average CMR from April 2006 to March 2015. It started rising in 2006 with minor ups and downs. The biggest downfall was observed in the mid of 2006 and 2007. Again, a fall was examined from the mid of 2008 to 2010. After this, it had risen with the slight ups and downs from 2010 to 2015.

The Figure 3 depicts the historical behavior of crude oil prices in the form of ups and downs during the research period. It is clear from the figure that the entire situation was uneven. A concept of stationarity did not seem to

Figure 5. Behaviour of Foreign Exchange Reserves During the Sample Period

Figure 6. Behaviour of Foreign Institutional Investment During the Sample Period
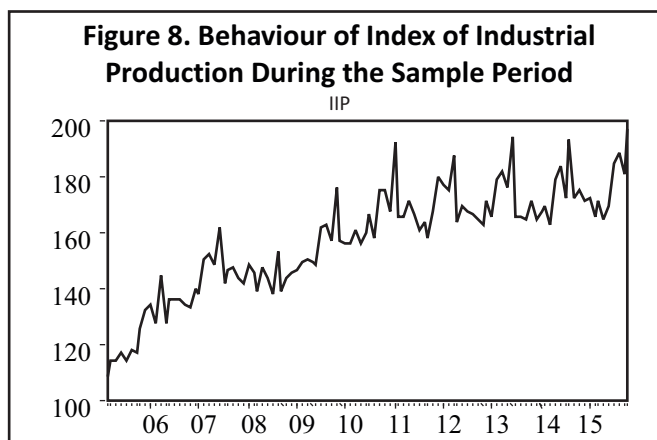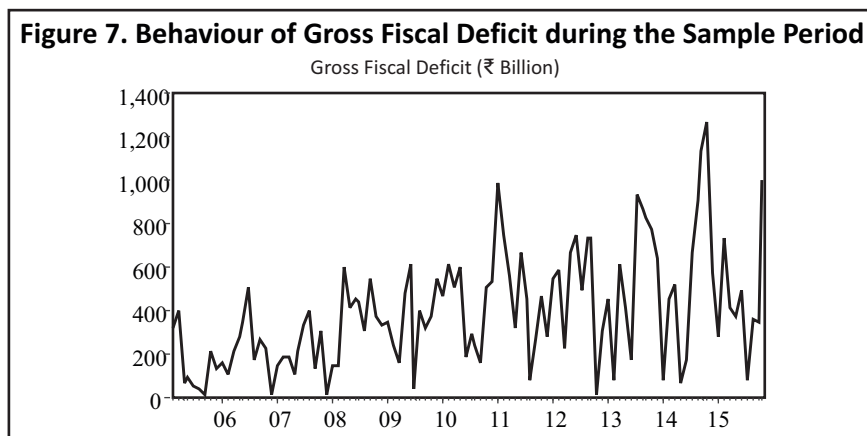
FIIs (₹ Billion)

exist here. It started with the falling trend in 2006 but a small one. After the completion of 2006, it started rising with minor falls. The biggest fall was observed in the mid of 2008 and 2009. After this an uneven trend existed for the entire sample period. It rose from the mid of 2008-2009 to 2014- 2015 with modest falls.

Figure 4 demonstrates the historical behavior of ERs expressed in Indian Rupee (INR) vs. US Dollar (USD) during the sample period of April 2006 to March 2015. The historical behavior indicated the presence of ups and downs. After 2008, it has been rising, immediately converted into unpredictable mood with smaller ups and downs shocks. In the mid of 2011 and 2012, it rose and a rising trend with slightest downs and again ups was observed can be seen from the figure.

Figure 5 demonstrates the trends and stationarity of FER from April 2006 to March 2015. Rising trend was witnessed for the entire research period with the slightest downs and ups movements. This is the only variable in which the presence of volatility is least as compared to other macroeconomic variables depicted in Figure 5.

The high volatility and non-stationarity can be observed in Figure 6. FIIs are the dominant source of bringing foreign capital in the domestic market. A downward trend in FII was examined in 2006 with slight ups. It rose in the mid of 2006-07and again fell in 2007. After this up and down shocks existed in the market. The sharpest downfall was observed in the mid of 2008-2009, then in 2012 and in the mid of 2014-15. This trend actually shows how unpredictably FIIs withdrew their capital from the Indian stock market and infused capital in other investment alternatives. They brought huge investment in the Indian capital market in the mid of 2010 and 2011.

The highest fall was observed in 2006, 2007, 2008 and 2013 for a specific time period along with ups and downs. In these years, the trend line actually touched the *x*-axis. The highest increase was in the mid of 2014 and 2015, then in the mid of 2013 and 2014, and then in 2011 was observed. The volatility and non - stationarity in

Figure 7. Behaviour of Gross Fiscal Deficit during the Sample Period

Gross Fiscal Deficit (₹ Billion)

Figure 8. Behaviour of Index of Industrial Production During the Sample Period

IIP

GFD existed during the sample period of 2006 to 2015. A period of crisis has shown almost similar trends (Figure 7).
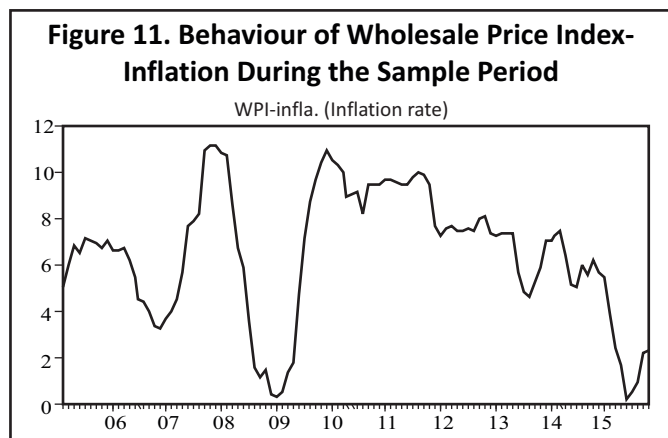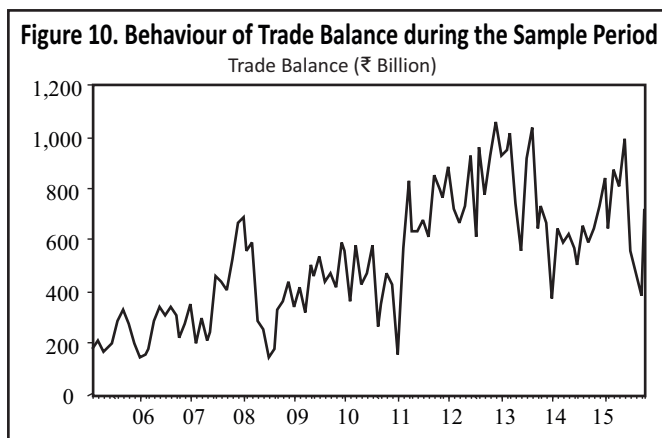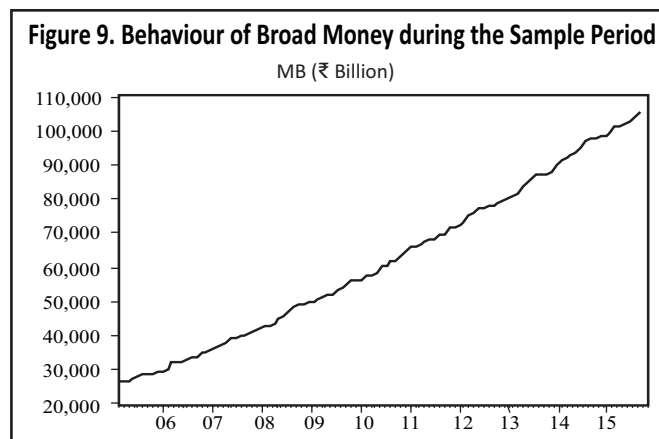
The Figure 8 demonstrates the historical behavior of IIP by using monthly data for the period April 2006 to March 2015. The historical behavior of IIP indicates the presence of long-term and overall positive trends. A sudden minimal downfall and then an increasing trend were observed in IIP during the research period.

The Figure 9 represents the historical behavior of monthly data of Broad Money during the research period of 2006 to 2015. It is the component of the money stock in India and has been expressed as M3. The historical behavior of broad money has shown stable and increasing trend from its initial period to its end.

The Figure 10 depicts the historical behavior of TB from April 2006 to March 2015. The highest rise was seen in the mid of 2012 and 2013, then in the mid of 2013 and 2014. In the initial period of 2006 and 2007, it was stable with sudden ups and downs. Then from 2008, it rose and again fell in the mid of 2008 and 2009. Again it started rising and fell in 2011, after this it rose with high volatility and showed upward and downward trends.

The Figure 11 represents the historical behavior of inflation rate expressed in WPI during the sample period of April 2006 to March 2015. The historical behavior shows the presence of cyclical effects of inflation in the stock market. A sudden downfall and then a sudden rise in it can be observed from the graph. It was closer to the *x*-axis in 2009 and 2015. The highest inflation rate was seen in the mid of 2007 – 2008, then in 2010. The inflation rate has been varied at large during the sample period and exhibits high volatility and non-stationarity in the data.

(3) Unit Root : It is a recognized fact that financial time series contains a unit root. The data may be random walk or non stationary. Test of unit root is necessary for BSE 500 index and macroeconomic variables as the presence of unit root may give invalid inferences in the analysis. In other words, before testing the impact of the selected

Figure 9. Behaviour of Broad Money during the Sample Period

MB (₹ Billion)

Figure 10. Behaviour of Trade Balance during the Sample Period

Trade Balance (₹ Billion)

Figure 11. Behaviour of Wholesale Price Index-Inflation During the Sample Period

WPI-infla. (Inflation rate)

macroeconomic variables on the BSE 500 index, it is necessary to test the presence of a unit root in the series. Augmented Dickey-Fuller (ADF) test and Phillips Perron (PP) test are the popular tests to check the existence of unit root in time series.

Table 3 shows the results of Unit Root Test for the BSE 500 and macroeconomic variables by using the ADF Test and PP Test with intercept, with trend and intercept, and none (intercept, trend & intercept, and none are the three different levels to check the stationarity of data through ADF & PP test. Here, the data attained the stationarity). The results indicated that BSE 500 average closing stock prices of 150 manufacturing firms along with the ten macroeconomic variables are non-stationary at first level. They became stationary at their first difference as shown in the table. From the Table 3, it is clear that all the variables were non-stationary at level with intercept, trend and intercept and none. It attained stationarity at 5 % significance level; however, the actual *p*-value of all other variables was greater than the critical *p*-value, hence found non-stationary at level and null hypotheses were accepted here. BSE 500 Sensex, CMR, COP, ER, FER, GFD, inflation rate, TB, broad money and IIP became stationary at Ist difference and null hypotheses was rejected at this level.

(4) Regression Analysis : Regression analysis provides a tool that can integrate the relationship of intentions with two, three, or more variables simultaneously. This technique was used to investigate the effect of selected macroeconomic variables on the closing prices of selected manufacturing firms of BSE 500. The results are given in Table 4 which shows the relationship between the ten macroeconomic variables and BSE 500.

It can be concluded from Table 4 that all the macroeconomic variables except ER had no significant relationship with the closing prices of selected manufacturing firms listed at BSE 500 at 5% significance level.

Table 3 . Results of Unit Root Tests

	ADF Test			PP Test		
	With Intercept	With Trend & Intercept	None	With Intercept	With Trend & Intercept	None
Average Closing Prices						
At level	3.394798 (1.0000)	0.991009 (0.9999)	4.217861 (1.0000)	3.099084 (1.0000)	0.627812 (0.9999)	3.403579 (0.9999)
At Ist Difference	-8.438005	-9.039825	-7.888132	-8.821551	-9.199892	-8.435603
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Crude Oil Prices						
At level	-2.050301	-2.785432	-0.582922	-1.822795	-1.791676	-0.48572
	(0.2653)	(0.2060)	(0.4626)	(0.3678)	(0.7021)	(0.5043)
At Ist Difference	-6.621892	-6.470619	-6.556396	-20.40257	-20.22321	-20.53018
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Exchange Rate						
At level	-0.438107	-2.533636	1.006424	- 0.239155	-2.191142	1.246311
	(0.8975)	(0.3117)	(0.9165)	(0.9288)	(0.4893)	(0.9452)
At Ist Difference	-8.140813	-8.096680	-8.183452	-30.82020	-30.24628	-31.10811
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Foreign Exchange Reserve						
At level	-0.127608	-1.856505	3.45826 8	-0.106964	-1.919955	3.528703
	(0.9428)	(0.6700)	(0.9998)	(0.9451)	(0.6372)	(0.9999)
At Ist Difference	-5.109906	-5.08924	-5.140767	-77.42295	-79.76468	-76.36274
	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0000)	(0.0000)
Foreign Institutional Investment						
At level	-7.196381	-7.636286	-2.983199	-7.183471	-7.636286	-5.842075
	(0.0000)	(0.0000)	(0.0032)	(0.0000)	(0.0000)	(0.0000)
At Ist Difference	-6.425000	-6.380622	-6.46813	-150.6408	-150.2801	-151.4397
	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0000)	(0.0000)
Gross Fiscal Deficit						
At level	-1.516947	-1.24845	0.283429	-8.378508	-8.546277	-5.979237
	(0.5209)	(0.8941)	-0.766	(0.0000)	(0.0000)	(0.0000)
At Ist Difference	-7.827148	-7.764981	-7.873096	-112.2083	-110.8358	-101.1397
	(0.0001)	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0000)
Index of Industrial Production						
At level	-2.000359	-2.042595	1.724614	-2.425757	-6.388634	2.154372
	(0.2863)	(0.5704)	(0.9791)	(0.1372)	(0.0000)	(0.9924)
At Ist Difference	-7.316904	-7.376703	-7.32245	-123.5746	-129.2748	-124.5363
	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0001)
Broad Money						
S	2.971852	-0.986876	0.810048	7.397607	-1.895971	15.12177
At level	(1.0000)	(0.9403)	(0.8854)	(1.0000)	(0.6497)	(1.0000)
At Ist Difference	-7.598072	-7.55903	-7.521119	-49.84096	-50.10322	-51.00431

(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0000)

Trade Balance

At level	-2.250618	-3.992458	-0.403907	-3.292549	-5.559653	-73.55529
	(0.1901)	(0.0117)	(0.5359)	(0.0176)	(0.0001)	(0.0000)
At Ist Difference	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0000)

Wholesale Price Index

At level	-2.284491	0.217219	-0.771953	-1.855695	-1.925982	-1.205405
	(0.1789)	(0.9918)	(0.3793)	(0.3520)	(0.6340)	(0.2078)
At Ist Difference	-5.187406	-5.126809	-5.233518	-23.42367	-23.32788	-23.5624
	(0.0000)	(0.0003)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Weighted Average Call Money Rate

At level	-2.345269	-2.583145	-0.333700	-3.37907	-3.607967	-0.446981
	(0.1601)	(0.2889)	(0.5627)	(0.0139)	(0.0338)	(0.5190)
At Ist Difference	-6.420897	-6.400929	-6.44908	-56.76417	-56.39608	-57.12175
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Null Hypothesis (Ho): Selected variable is not stationary

Alternative Hypothesis (Ha): Selected variable is stationary

Level of Significance : 5%

Table 4. Results of Multiple Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Results
CMNEW	0.003298	0.025066	0.13157	0.8956	Accepted Ho
COPNEW	0.044953	0.086931	0.517111	0.6063	Accepted Ho
ERNEW	-1.766061	0.355379	-4.969514	0	**Rejected Ho**
FERNEW	0.023542	0.281547	0.083616	0.9335	Accepted Ho
FIINEW	0.004036	0.005094	0.792327	0.4301	Accepted Ho
GFDNEW	-0.00977	0.005821	-1.678385	0.0965	Accepted Ho
IIPNEW	0.008076	0.127339	0.063422	0.9496	Accepted Ho
M3NEW	-0.486283	0.797954	-0.609412	0.5437	Accepted Ho
TBNEW	-0.024478	0.023761	-1.030197	0.3055	Accepted Ho
WPINEW	-0.01573	0.019245	-0.817356	0.4157	Accepted Ho

Null Hypothesis (Ho): No significant relationship between BSE 500 Sensex and selected macroeconomic variable

Alternative Hypothesis (Ha): Significant relationship between BSE 500 Sensex and selected macroeconomic variable

Level of Significance : 5%

Broad Money, CMR, COP, FER, FIIs, GFD, IIP, inflation rate and TB were found insignificant in building any relationship with its dependent variable (dependent variable is BSE 500). The p-value of ER is 0 that is lesser than its critical value of 0.05. So, ER exhibited the significant relationship with the closing prices of selected manufacturing firms of BSE 500.

(5) Granger Causality : A statistical approach proposed by Clive W. Granger (1969) to infer cause and effect relationship between two or more time series is known as Granger Causality. Granger Causality is based on the

Table 5. Results of Pairwise Granger Causality Test

Null Hypothesis:	Obs	*F*-Statistic	Prob.	Result	Relationship
ERNEW does not Granger Cause ACPNEW	105	2.2553	0.1101	Accepted Ho	No relation
ACPNEW does not Granger Cause ERNEW	105	1.16883	0.3149	Accepted Ho	No relation
Null Hypothesis (Ho): No causal relationship between BSE 500 and ER					
Alternative Hypothesis (Ha): causal relationship between BSE 500 and ER					
Level of Significance-5%					

Source: Author's own work

simple logic that effect cannot precede cause. It is important to note that the statement "*x* Granger causes *y*" does not imply that *y* is the effect or the result of *x*. In other words, Granger Causality is a technique for determining whether one time series is useful in forecasting another. This section analyzed the causal relationship between the stock prices of 150 manufacturing firms of BSE 500 and macroeconomic variables like Broad Money, CMR, COP, ER, FER, Foreign Institutional Investment, GFD, IIP, inflation rate and TB from April 2006 and March 2015.

To study the stationary of the data series, ADF and PP tests had been conducted. The direction of the causal relationship between the variables has been tested by applying Granger causality test. The hypotheses have been developed for the purpose as shown in the Table 5. If calculated *p*-value is less than the significant value of 0.05, the null hypothesis is rejected which implies *x* Granger cause *y*. The results of the Granger causality test are presented in Table 5.

The Table 5 shows the results of granger causality test for ER which was found significant after applying multiple regression and average closing price of 150 manufacturing firms of BSE 500. It has been found that ER do not granger cause BSE 500. The calculated p-value for ER was 0.1101, it was greater than its critical p-value i.e. 0.05. It exhibited no causality relationship between ER and BSE 500 ACP. The results show that no unidirectional and bidirectional relationship between the variables has been detected during the global financial crisis.

Research Implications

The results of the study can be used by financial analysts and various other professionals to make investment related decisions. Specifically, the study was done by considering 150 manufacturing firms listed on BSE 500. Analysts can easily judge the performance of this sector during the research period and use it for taking decisions. The study found no significant relationship between dependent and independent variables. The study claimed that the Indian stock market was weak form efficient and no one can earn extra profits by using historical data. Investors can keep this in their mind at the time of investing in stocks of various manufacturing companies. The government and other regulatory authorities can make their policies and plans to make the Indian stock market more effective and attractive.

Conclusion

This paper has checked the relevance of various macroeconomic variables like Broad Money, CMR, COP, ER, FER, FIIs, GFD, IIP, inflation rate, and TB on the performance of closing prices of 150 manufacturing firms listed on BSE 500. The purpose of this study was to find out whether Indian stock market is affected by any changes in macroeconomic variables. To check this effect ADF test, PP test along with multiple regression and Granger Causality have been used. Stationary data was used to unearth significant macroeconomic variables through

multiple regression technique. Only ER out of ten macroeconomic variables has been found significant. The causality relationship between ER and ACP of BSE 500 was tested with Granger Causality technique. It has been found that this variable has no unidirectional and bidirectional relationship with closing prices of BSE 500 manufacturing firms. The study revealed that Indian stock market was weak form efficient .The entire information about the stock market is available in the market. It can be concluded that investors would not be able to gain abnormal profits by using historical information.

Limitations of the Study and Scope for Further Research

The study has been done for the limited time period from April 1, 2006 to March 31, 2015. The research period might be extended for further studies. It considered only 150 manufacturing firms listed on the BSE 500 Index. Further, these were chosen from the three caps, i.e. large cap, medium cap, and small cap. Only 10 macroeconomic variables were covered in this study. More indices and macroeconomic variables can be selected for further research. Banking and insurance companies and other allied services companies may be chosen along with manufacturing firms. Even the impact of macroeconomic variables on different sectors can be checked. The monthly data of 10 macroeconomic variables and closing prices of 150 firms were taken from secondary sources. This data may contain some limitations that were inherent in the collection sources. Primary study can be done to attain the same objectives. The results were drawn on the basis of descriptive statistics, graphs, ADF test, PP test, multiple regression, and Granger Causality. Different statistical techniques can be used for the same study.

References

Hosseini, M. A., Ahmad, Z., & Lai, Y.W. (2011). The role of macroeconomic variables on stock market index in China and India. *International Journal of Economics and Finance, 3* (6), 233-243. doi: http://dx.doi.org/10.5539/ijef.v3n6p233

Jha, A.K., & Singh, N.K. (2014). Predicting the volatility of stock markets and measuring its interaction with macroeconomic variables: Indian evidence, A case study of NIFTY & SENSEX. *International Journal of Sciences: Basic & Applied Research, 13* (1), 371-393.

Kumar, A. (2011). An empirical analysis of causal relationship between stock market and macroeconomic variables in India. *International Journal of Computer Science and Management Studies, 11* (1), 8-14.

Kumar, R. (2013). The effect of macroeconomic factors on Indian stock market performance: A factor analysis approach. *IOSR Journal of Economics and Finance, 1* (3), 14-21. DOI: 10.9790/5933-0131421

Mohanamani, P., & Sivagnanasithi, T. (2012). Indian stock market and aggregates macroeconomic variables: Time series analysis. *IOSR Journal of Economics & Finance, 3* (6), 68-74.

Naka, A., Mukherjee, T., & Tufte, D. (1998). *Macroeconomic variables and the performance of the Indian Stock Market* (Working Paper 15). Department of Economics and Finance Working Papers, 1991-2006. Retrieved from http://scholarworks.uno.edu/cgi/viewcontent.cgi?article=1014&context=econ_wp

Parmar, C. (2013). Empirical relationship among various macroeconomic variables and Indian stock market. *International Journal of Advance Research in Computer Science and Management Studies, 1* (6), 190-197.

Ray, S. (2012). Foreign exchange reserve and its impact on stock market capitalization: Evidence from India. *Research on Humanities and Social Sciences , 2* (2), 46-60.

Singh, D. (2010). Causal relationship between macroeconomic variables and stock market: A case study for India. *Pakistan Journal of Social Sciences , 30* (2), 263-274.

Tripathy, N. (2011). Casual relationship between macro-economic indicators and stock market in India. *Asian Journal of Finance & Accounting, 3* (1), 208-226. doi: http://dx.doi.org/10.5296/ajfa.v3i1.633

Victor, Z. (1992). Major macroeconomic variables and leading indexes. In Z. Victor, (ed.), *Business cycles: Theory, history, indicators and forecasting* (pp. 357 - 383). Cambridge, MA : National Bureau of Economic Research, University of Chicago Press.

Walia, S. (2012). Impact of global economic crisis on Indian economy: An analysis. *International Journal of Latest Trends in Engineering and Technology , 1* (2), 31-36.