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Impact of Selected Macroeconomics Variables on Sensex

Dr. Siby Joseph K., Jerin T Thomas

Associate Professor, MBA Dept: St. Berchmans College, Changanacherry Kottayam Dist, Kerala,
Research Scholar, MBA Dept: St. Berchmans College, Changanacherry, Kottayam Dist. Kerala. .

Abstract
The macroeconomic variables are crucial for any change in the economy of a country. It is strongly believed that, fluctuations in macroeconomic variables will have impact on the returns of stock. Any changes among these variables have impact on the economy in various ways. The aim of the study was to determine the impact of selected economic variables namely Index of Industrial production (IIP), Consumer Price Index (CPI), Crude Oil Prices (CO), Gold Price (GP) on Sensex in India. The data from 1st January 2013 to December 2019 were used for this specific study. Linear regression analysis was carried out to understand the effect of macroeconomic variables on Sensex. A granger causality test was applied on the data to understand the possible impact of macroeconomic variables on stock prices. The findings of the study revealed that, out of the four variables; Gold price, CPI, Crude oil price is relatively more significant and likely to influence Indian stock market. The study reveals that , the presence of long run relation between the Sensex and select macroeconomic indicators and the Indian stock market is more driven by domestic macroeconomic factors.

Keywords: Industrial Production, Consumer Price Index, Gross Domestic Production, Crude Oil Price, Gold Price, Sensex

1. Introduction

Stock market is the key driver for raising funds by corporates, thereby enabling financial development and economic growth for the country. The growth in Indian stock markets continues to be breath taking. Sensex crossed 5000 mark on October 1999 and has reached 52,000 level points in January, 2020.The critical question, in this context is whether the macro-economic variables had any impact on this market rally. It is strongly believed that, when macroeconomic variables fluctuate, it affects the returns of stock. There are some economic variables, which have strong relationship with stock market index. This paper examines whether the rapid movement of Sensex is having any linkage with the selected macroeconomic variables. Agrawalla (2006) had stated that increasing indices in the stock markets cannot be taken to be a leading indicator of the revival of the Indian economy. However, Shah and Thomas (1997) supported the idea that stock prices reflect the real economy. Kanakaraj et al. had similar conclusion (2009). Investigating the impact of macroeconomic variables on stock market is one of the most important areas of finance. In this context, the major objective of this paper is to examine the causal relations between stock market and macroeconomic aggregates of India for the period from 2013 to 2019. The macro economic variables such as Consumer Price Index (CPI), Crude Oil Price (C.P), Index of Industrial Production (IIP), Gold Price (GP), and Gross Domestic Production (GDP) were analysed for the study.

2. Objectives

This study was carried out, to find whether macroeconomic variables have any effect on the Indian stock market or not. The objectives are:

- To examine the relationship between Indian stock market and four macroeconomic variables namely Index of Industrial Production (IIP), Consumer Price Index (CPI),Gold Price (GP) and Crude Oil Price (CP).
- To assess the relevance of macro-economic variables in the Indian stock market.

3. Hypothesis

H_{a1}: There is significant relation between Industrial Production and SENSEX

H_{a2}: There is significant relation between Consumer Price and SENSEX

H_{a3}: There is significant relation between Crude Oil price and SENSEX

H_{a4}: There is significant relation between Gold Price and SENSEX

4. Literature Review

In the past decades, many researchers and financial analysts have attempted to predict the relationship between stock markets movement and macroeconomic variables. They have done empirical analysis to examine the effect of macroeconomic variables on stock price or vice versa. The relationship between the stock market and macro-economic variables and the results of all those analysis has provided various conclusions with respect to the combination of variables, methodologies and tests used.

Darat and Mukherjee (1987) used a Vector Auto Regression (VAR) model and concluded that a significant causal relationship exists between selected macroeconomic variables and stock returns of India, China, Brazil and Russia which are some emerging economies of the world using exchange rate, moving average lags, and oil price values as explanatory variables employed Moving Average method with OLS (Ordinary Least Square) and found insignificant results which suggest inefficiency in market. They concluded that in emerging economies the domestic factors influence more than external factors, i.e., exchange rate and oil prices. Mookerjee and Yu (1997) studied the Singapore stock market pricing mechanism by investigating whether there were long-term relationships between macroeconomic variables and stock market pricing. They found that three out of four macroeconomic variables were co-integrated with stock market prices. Using bi-vitiate co-integration and causality tests; they noted significant interactions between M2 money supply and foreign exchange reserves and stock prices for the case of Singapore'. Ibrahim (1999) also investigated the relation between the KLSE Composite Index, and seven macro-economic variables (CPI, industrial production index, money supply M1 and M2, foreign reserves, credit aggregates and exchange rate) and concluded that Malaysian stock market was information inefficient. Naka, Tufte and Mukherjee (2001) identified long-term equilibrium relationships between selected macro-economic variables and the BSE Sensex. The study employed data for the period 1960 to 1995 and macro-economic variables namely, the Industrial production index, the consumer price index, a narrow measure of money supply, and the money market rate in the Bombay inter-bank market. The study employed a VECM to avoid potential mis-specification biases that might result from the use of a more conventional VAR modeling technique. The study concluded that the five variables were co-integrated and there exists three long-term equilibrium relationships among these variables. By applying the unit–root tests, co-integration and the long–run Granger non–causality test Toda and Yamamoto (1995), suggested that there was no causal relation between stock prices and money supply, national income and interest rate while Index of industrial production lead the stock price, and there was two- way causal relation between stock price and inflation rate. Gan, Lee, Yong and Zhang (2006) have analyzed the macroeconomics variables and stock market: 'The study had a set of seven macroeconomic variables and used co-integration tests, Johansen maximum likelihood and granger-causality tests. In addition to that, their paper also studied the short run dynamic relation between NZSE40 and macroeconomic variables using innovation accounting analyses'. Kumar (2011) aimed at studying the nature of the causal relationships between stock prices and macroeconomic variables in India, if any such relationship exists. For this analysis the unit-root tests, co integration and the Granger causality test has been applied between the NSE Index 'Nifty' and the macroeconomic variables. Real effective economic rate (REER), Foreign International Research Journal of Finance and Economics – Issue 95 (2012) Exchange Reserves (FER), and Balance of Trade (BoT), FDI, IIP, WPI by using monthly data for the period from 1st April 2006 to 31st March 2010. The major findings of the study are that there was no co integration between Nifty and all other variables except WPI as per Johansen's co integration test. Therefore, causal relationships between such macroeconomic variables having no co integration with Nifty were not established. Also, Nifty did not Granger Cause WPI and WPI also did not Granger Cause Nifty.

Dharmendra Singh (2010) tried to 'study the relation especially the causal relation between BSE Sensex and three other macroeconomic variables by using correlation, ADF tests and Granger causality test'. Monthly

data has been used for all the variables and results showed that the BSE index, Index of industrial production, Whole sale price, and exchange rate contained a unit root and were integrated. They found that results show bilateral granger causality between IIP and Sensex while WPI is having strong correlation and unilateral causal relation with Sensex which means Indian stock market is moving towards informational efficiency with respect to two macroeconomic variables, with respect to, exchange rate and inflation. Tripathy (2011) investigated the market efficiency and causal relationship between selected Macroeconomic variables and the Indian stock market by using Ljung-Box Q test, ADF test, Granger Causality test. 'The study identifies the presence of auto correlation in the Indian stock market and macro-economic variables which imply that the market fell into form of Efficient Market Hypothesis'. 'Then the Granger-causality test projects the two way relationship between stock market and interest rate and exchange rate, international stock market and BSE volume, exchange rate and BSE volume'. The study also reported one way causality running from international stock market to domestic stock market, interest rate, exchange rate and inflation rate indicating sizeable influence in the stock market fluctuation. Patel Samveg (2012) studied on the topic "The effect of Macroeconomic variables on the performance of the Indian Stock Market" to identify the effect of macroeconomic variables on the performance of the Indian Stock Market with eight variables namely Interest Rate, Inflation, Exchange Rate, IIP, Money Supply, Gold Price, Silver Price & Oil Price, and two stock market indices namely BSE Sensex and S&P CNX Nifty using monthly data over the period Jan 1991 to December 2011. The study found the long run relationship between macroeconomic variables and stock market indices. The study also showed the causality run from exchange rate to stock market indices to IIP and Oil Price by applying ADF Unit root test, Johansen co-integration test, Granger Causality test and Vector Error Correction Model (VECM). Sangmi, Mohi-u-Din et al (2013) 'studied on the topic "Macroeconomic Variables on Stock Market Interactions: The Indian Experience" to examine the effect of macroeconomic variables on the stock price movement in Indian Stock Markets'. They used selected macroeconomic variables exchange rate, IIP, Money Supply, Gold price, interest rate and inflation as independent variables. BSE Sensex, NSE Nifty and BSE 100 were taken as dependent variable. The time series data were gathered monthly from RBI website over the period of 1st April 2008 to 31st June 2012. They used multiple regression analysis to construct a quantitative model showing their relationship between macroeconomics and stock price. 'The result of this paper found that significant relationship is occurred between macroeconomics variables and stock price in India'.

5. Research Methodology

Descriptive and analytical design was used in the study to analyse the impact of macro variables on Sensex. The secondary data of the variables were collected from authentic websites for a period ranging from 1st January 2013 to 31st December 2019. RBI website, International economic websites and journals were referred for the study. The variables used for the study were Industrial Production Index(IP), Consumer Price Index (CPI), Crude Oil Price (CP), Gold Price (GP) and Sensex.

Tools employed for the analysis.

Descriptive Statistics technique like mean, standard deviation, and variance were carried to show the nature and basic characteristics in the analysis.

Unit Root Test (Augmented Dickey –Fuller Test)

The stationarity of a data series is a prerequisite for drawing significant in a time series analysis and to increase the accuracy and reliability for the model created. Augmented Dickey -Fuller (ADF) was used to find whether a time series is stationary or not.

Granger Causality Test

Granger causality test was used to determine whether one time series is significant in forecasting another and whether past values of a variable helps to predict changes in another variable. Granger causality technique measures the information given by one variable in explaining the latest value of another variable.

Econometric Regression Analysis

Linear regression analysis was used to know the relationship between the independent variables (referred to as X) and dependent variable (referred to as Y).

6. Result and Discussion

Table 1 :Descriptive Statistics of Sensex and Macro-Economic Variables

	SENSEX	CP	CPI	GP	IIP
Mean	29159.96	4362.201	94.64920	83485.74	118.7679
Median	27943.85	4126.320	95.30640	82321.63	118.7000
Maximum	41253.74	6926.830	114.5760	107755.2	144.1000
Minimum	18619.72	2004.000	76.73120	71639.46	101.0000
Std. Dev.	6296.609	1285.113	9.587717	8132.987	9.908000
Skewness	0.124706	0.365414	0.120925	1.130180	0.191994
Kurtosis	2.048136	2.025124	2.262167	4.431776	2.303571

Source: Primary

The table 1 represents the summary statistics of the variables under study. Sample mean, median, standard deviation, minimum, maximum, skewness and kurtosis are calculated. The variables are Sensex, crude oil price, consumer price index, gold price, index of industrial production. In the group of 84 observations, the mean of share price (SENSEX) is 29159.96, while its maximum price is 41253.74 for their data series and the standard deviation is 6296.6 which are considered to be very high. It reflects significant variability in stock price (SENSEX). Crude oil price have an average of 4362.2 and its standard deviation is also high which amounts to 1285.1. The crude oil has gone up to a price of 6926 and it has a minimum value of 2004. Consumer price index mean is 94.64 and SD is 9.58 implying that there is moderate variability in consumer price index. Maximum value of CPI is 114.57 and minimum is 76.73. Gold price mean is 83485.74 and standard deviation is 8132.98. It shows high variability in the prices. The Index of Industrial production, which represents the status of production in the industrial sector, is with an average of 118.76 during the period of study. The standard deviation of inflation is low which projects the lower variability of the values.

The value of skewness for the variables chosen for study in the above table has pointed out that all the variables are positively skewed and it indicates a deviation from normal distribution of the data and volatility in those parameters. The variables like SENSEX, CPI, and IIP have small positive skewness and gold price have comparatively higher positive skewness. The kurtosis value of all variables like Sensex (2.04), Crude oil price (2.02), Consumer price index (2.26), Index of Industrial Production (2.30), indicates platykurtic distribution (i.e., <3) and the values are wide spread around the mean. Gold price indicate leptokurtic distribution as the kurtosis value is 4.43.

ADF TEST

At Level

As already stated stationarity of a data series is a prerequisite for drawing meaningful inferences in a time series analysis. It enhances the accuracy and reliability of the models constructed. Reason being that if the variable is not stationary it might lead to wrong conclusion. The first and simplest type of test which can be applied to check for stationarity is ADF. This may actually plot the time series and may look for possibility of trend with the help of mean and variance. This is done to check evidence of autocorrelation and seasonality in the data. If these patterns are found in the series then the series can be regarded as non-stationary.

Table 2 : Stationarity in the Time Series -P Value

Null Hypothesis	P Value	Null Hypothesis	Result
Sensex is not stationary	0.919	ACCEPT	Variable is not stationary
Crude oil price is not	0.3394	ACCEPT	Variable is not

stationary			stationary
CPI is not stationary	0.9987	ACCEPT	Variable is not stationary
Gold price is not stationary	0.8702	ACCEPT	Variable is not stationary
IIP is not stationary	0.8034	ACCEPT	Inflation is not stationary

Source: Primary

From the table 2 it can be concluded that none of the variables attains stationarity in the time series as the P-values of all these variables is greater than the critical P-value at 5%. Thus the null hypotheses that variables are stationary were accepted.

Now in order to do analyse it is mandatory to make these variables stationary. Thus the first differencing of all the variables is calculated.

At First Difference

From the below data it is clear that first differencing of the variables is stationary at 5 % as the P value is less than the critical p value (0.05) thus rejecting the null hypothesis and accepting the alternative hypothesis that the variables are stationary.

SENSEX is stationary

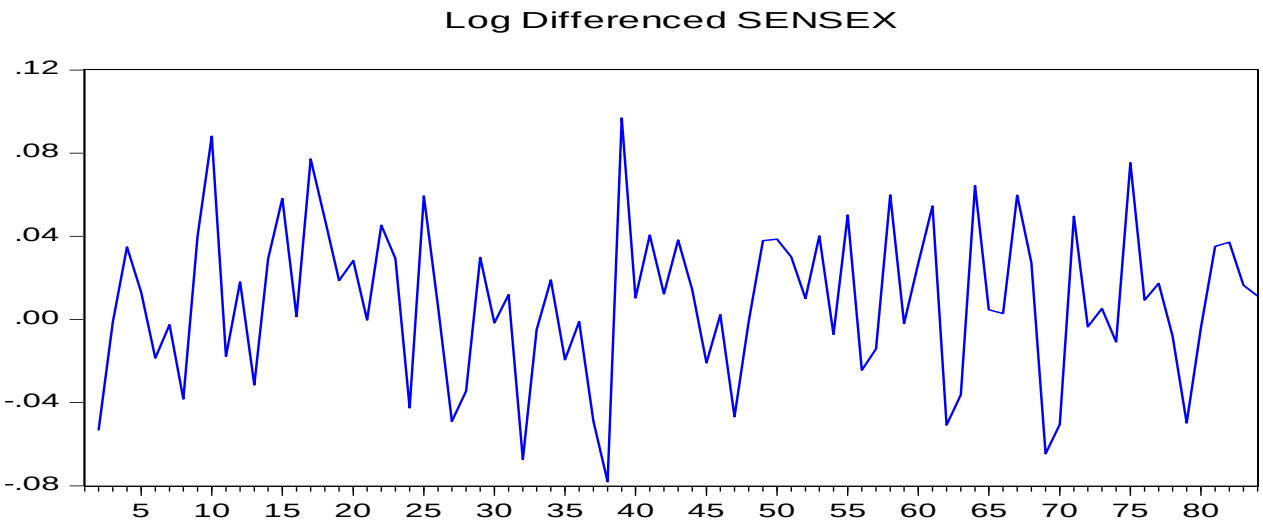
Table 3 : ADF of Sensex at first difference

Null Hypothesis: D(SENSEX) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.174952	0.0000
Test critical values:	1% level	-3.512290	
	5% level	-2.897223	
	10% level	-2.585861	

Source: Primary data

Graph 1



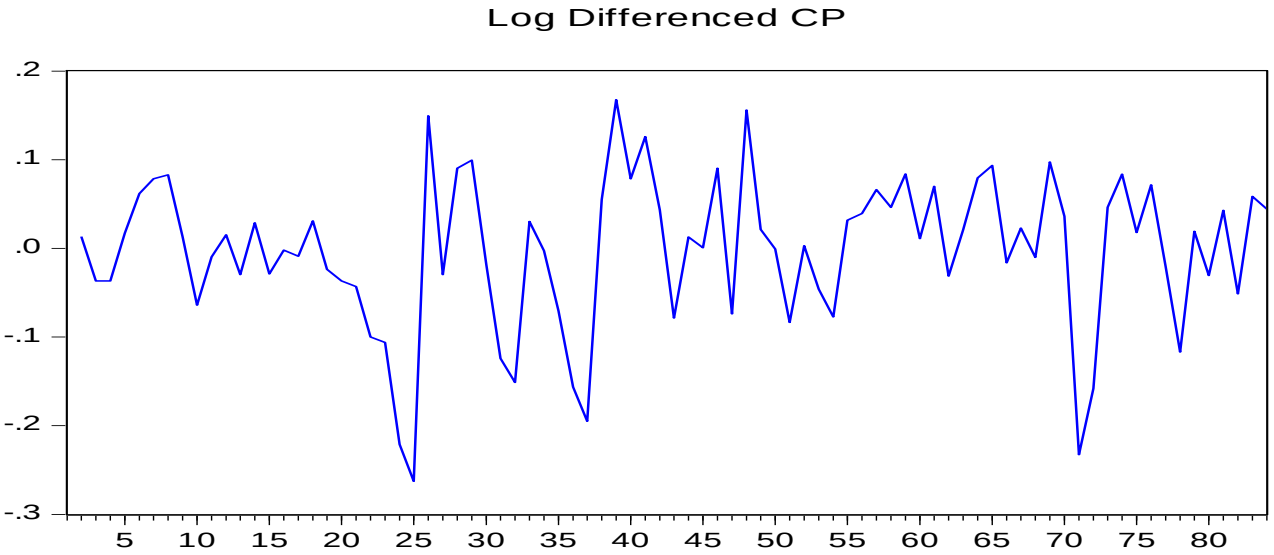
CRUDE OIL PRICE is stationary

Table 4 : ADF of Crude Oil Price at first difference

Null Hypothesis: D(CP) has a unit root Exogenous: Constant Lag Length: 0 (Automatic - based on SIC, maxlag=11)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.337138	0.0000
Test critical values:	1% level	-3.512290	
	5% level	-2.897223	
	10% level	-2.585861	

Source: Primary data

Graph 2



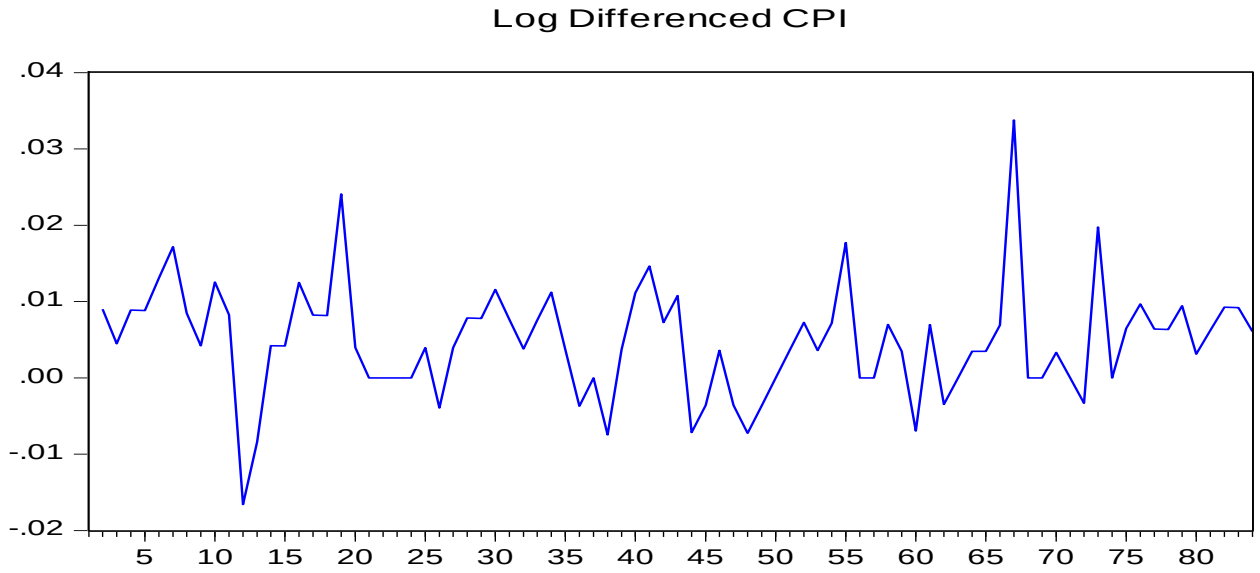
CPI is stationary

Table 5 : ADF of Consumer Price Index at first difference

Null Hypothesis: D(CPI) has a unit root Exogenous: Constant Lag Length: 6 (Automatic - based on SIC, maxlag=11)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.657850	0.0000
Test critical values:	1% level	-3.519050	
	5% level	-2.900137	
	10% level	-2.587409	

Source: Primary data

Graph 3



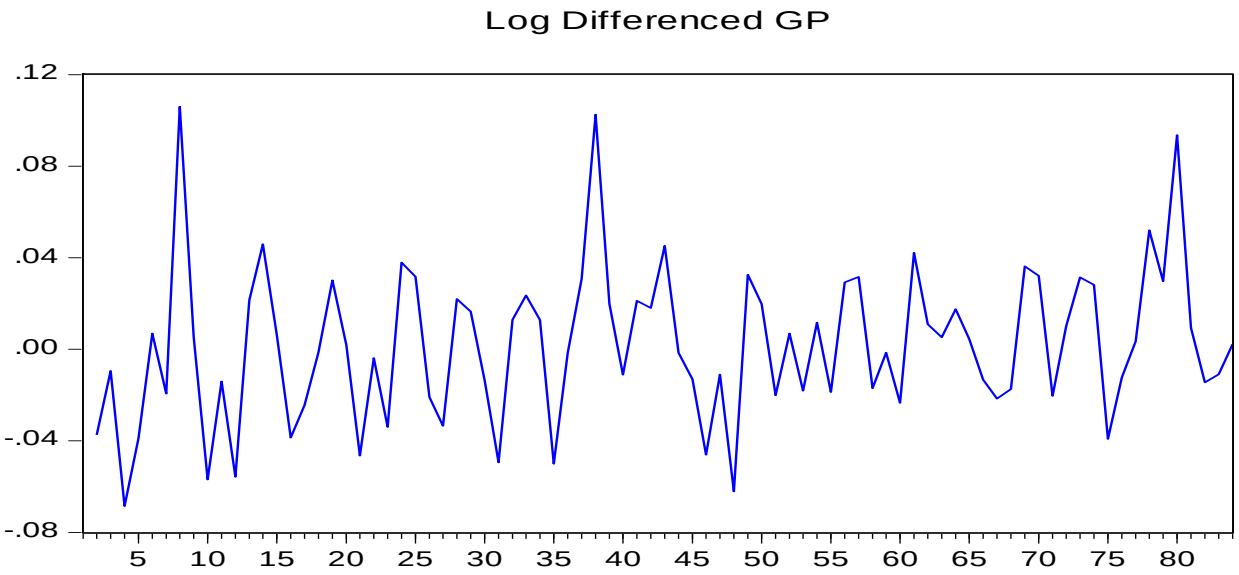
GOLD PRICE is stationary

Table 6 :ADF of Gold Price at first difference

Null Hypothesis: D(GP) has a unit root Exogenous: Constant Lag Length: 0 (Automatic - based on SIC, maxlag=11)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.622476	0.0000
Test critical values:	1% level	-3.512290	
	5% level	-2.897223	
	10% level	-2.585861	

Source : Primary data

Graph 4



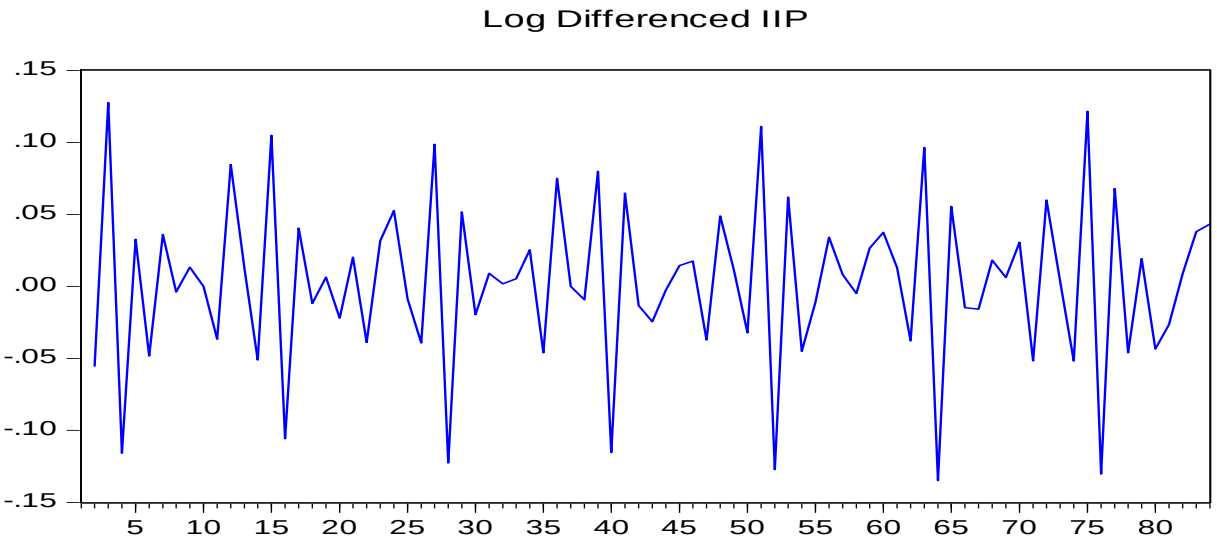
IIP is stationary

Table 7 : ADF of Index of Industrial Production at first difference

Null Hypothesis: D(IIP) has a unit root				
Exogenous: Constant				
Lag Length: 11 (Automatic - based on SIC, maxlag=11)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-3.723599	0.0057
Test critical values:	1% level		-3.525618	
	5% level		-2.902953	
	10% level		-2.588902	

Source: Primary data

Graph 5



The graphs of first difference of the variables also show a trend of stationarity (shown in the graphs below). Hence now granger causality test & regression analysis can be applied using first differencing of the variables.

Econometric Regression Analysis

Econometric Regression analysis is a technique to check the effect macroeconomics variables on stock exchange indices (share price) and some interesting results for a the relationship are found. IIP does not have a significant relation with the Sensex. All other variable affect the BSE index. The impact of macroeconomic variables on the BSE Sensex has been captured statistically by the multiple regression models. The null hypothesis has been tested on the basis of the P-value while the overall significance of model has been tested on the basis of F-sign. If the P value and F- sign is less than the critical P value and F-sign at 5% than the null hypothesis is rejected and there will be a significant relation between the variables.

Table 8 : Multiple Regression

Dependent Variable: LOG(SENSEX)		
Method: Least Squares		
ample: 2013M01 2019M12		
Included observations: 84		

Test				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.044619	0.963143	3.161130	0.0022
LOG(CP)	0.111966	0.028815	3.885631	0.0002
LOG(CPI)	2.244374	0.158043	14.20106	0.0000
LOG(GP)	-0.472392	0.111880	-4.222305	0.0001
LOG(IIP)	0.299359	0.162973	1.836862	0.0700
R-squared	0.917127	Mean dependent var		10.25680
Adjusted R-squared	0.912931	S.D. dependent var		0.221490
S.E. of regression	0.065356	Akaike info criterion		-2.560252
Sum squared residual	0.337443	Schwarz criterion		-2.415560
Log likelihood	112.5306	Hannan-Quinn criterion.		-2.502087
F-statistic	218.5666	Durbin-Watson stat		0.364227
Prob(F-statistic)	0.000000			

Source: Primary data

The above output shows the multiple regression tests for four macroeconomic variables and BSE SENSEX. It was found through P-value and F-sign that there is significant relationship between Crude oil price and SENSEX, Gold price and SENSEX, CPI and SENSEX. All the P-value is less than 0.05 except for IIP. Therefore, four macroeconomic variables other than IIP have a significant relation with the BSE SENSEX. Index of industrial production has probability value of 0.130 which is greater than the critical value of 0.05.

As shown in Table 8, the $R^2 = 0.917$. It implies that the macroeconomic variables account for 91.7 percent variation in the Sensex. However, in a multiple regression model adjusted R^2 is the more reliable explanatory of dependent variable than R^2. In the model, adjusted R^2 is 0.912 which endorses that 91.2 per cent of the variation in BSE Sensex is explained by the four macroeconomic variables, viz. consumer price index, index of industrial production, gold price, and crude oil price. It could be interpreted that 8.8 per cent change in Sensex is caused by the factors outside the model. Thus, BSE Sensex is highly sensitive to the variations in CPI, IIP, CP, and GP.

The output of Table 8 presents an analysis of variance (ANOVA). A good regression model generates high level of F value and very low level of F-significance value. In line with the thumb rule, the F-value is very high (218.56) and its significance value is the lowest (0.000) at 5 percent level of significance. This signals the goodness of fit of the model.

The estimated regression coefficients for predicting the BSE Sensex can be derived from Table-8 and is presented in a regression model as follows:

Sensex = (2.244) CPI + (0.299) IIP + (-0.472) GP + (0.126) CP - 3.044

These coefficients indicate the direction of relationship between independent and dependent variables. These coefficients also talk about what degree each predictor affects the outcome when the effects of all other predictors are held constant. The signs of coefficients of all the independent variables except IIP are as per theoretical predictions. Among the four independent macroeconomic variables CPI appears to have very high influence on BSE Sensex. As the returns of CPI increases by 1 unit, the returns of Sensex increases by 2.244 units. Crude oil price also represents a positive relation with Sensex. Gold price has a significant negative impact on the Sensex. Among all the four variables gold price has the highest negative effect, with every 1 unit increase in gold price the Sensex is decreased by 0.472 units. This implies that as the gold price rises, Indian investors tend to invest less in stocks, causing stock prices to fall and vice versa.

Granger Causality Test

Granger causality test is a technique for determining whether one time series is significant in forecasting another or not. Here Granger-causality test has been conducted to study the causal relationship between macroeconomic variables and the Indian stock market. The results below reports granger causality test results with lag of 2 that is the appropriate selection of lags. The null hypothesis has been tested on the basis of the P-value. If the P-value is less than the critical P value at 5% than the null hypothesis is rejected and there will be a significant relation between the variables. First differencing of the variables has been used to apply granger causality test.

The hypothesis test results of relation between SENSEX and Crude oil price using Granger causality are as follows:

Table 9 : **Pairwise Granger Causality Tests: Sensex and Crude Oil Price**

Pairwise Granger Causality Tests

Sample: 184
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
D(SENSEX) does not Granger Cause D(CP)	81	0.03342	0.9671
D(CP) does not Granger Cause D(SENSEX)		1.08305	0.3437

Source: Primary

Here the probability value (P-value) of both null hypothesis are greater than the critical value 0.05 so the null hypothesis of Granger non – causality from Crude oil price to SENSEX as well as the null hypothesis of granger non-causality from SENSEX to Crude oil price. The result suggests that the BSE Index do not lead Crude oil price and vice versa.

The hypothesis test results of relation between SENSEX and Consumer price index using Granger causality are as follows:

Table 10 : Pairwise Granger Causality Tests: Sensex and Consumer Price Index

Pairwise Granger Causality Tests

Sample: 1 84
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
D(CPI) does not Granger Cause D(SENSEX)	81	0.23248	0.7931
D(SENSEX) does not Granger Cause D(CPI)		0.24362	0.7844

Source: Primary

From the result it is evident that the probability values (P-value) of both variables are greater than the critical value (0.05). Therefore the null hypotheses for both the variables are accepted. CPI does not granger cause SENSEX and vice versa. The result suggests that SENSEX do not lead to CPI and vice versa.

The hypothesis test results of relation between SENSEX and Gold price using Granger causality are as follows:

Table 11 : Pairwise Granger Causality Tests: Sensex and Gold Price

Pairwise Granger Causality Tests Sample: 1 84 Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
D(GP) does not Granger Cause D(SENSEX)	81	1.24725	0.2931
D(SENSEX) does not Granger Cause D(GP)		0.76146	0.4705

Source: Primary

From the result it is evident that the probability values (P-value) of both variables are greater than the critical value (0.05). Therefore the null hypotheses for both the variables are accepted. Gold price does not granger cause SENSEX and vice versa. The result suggests that SENSEX do not lead to Gold price and vice versa. This test shows no relationship between SENSEX and Gold price.

The hypothesis test results of relation between SENSEX and Index of Industrial Production using Granger causality are as follows:

Table 12 : Pairwise Granger Causality Tests: Index of Industrial Production

Pairwise Granger Causality Tests Sample: 1 84 Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
D(SENSEX) does not Granger Cause D(IIP)	81	4.07807	0.0208
D(IIP) does not Granger Cause D(SENSEX)		1.34108	0.2677

Source: Primary

Here probability value (P-value) of null hypothesis: Sensex does not Granger causes IIP is less than critical probability value 0.05 so we reject the null hypothesis. The result suggests that the BSE Index leads or lags Index of Industrial Production. However, in the second null hypothesis IIP does not Granger causes SENSEX is greater than critical P-value. From this, the second null hypothesis cannot be rejected. That is IIP in India did not determine the trend to SENSEX. This test shows a uni-directional relationship between Index of Industrial Production and BSE Index.

Table 13 : Summary Table

Null hypothesis	Lag	F-statistic	P value	Accept/Reject Null hypothesis	Result
D(SENSEX) does not Granger Cause D(CP)	2	0.03342	0.9671	Accept	No relation

D(CP) does not Granger Cause D(SENSEX)	2	1.08305	0.3437	Accept	
D(CPI) does not Granger Cause D(SENSEX)	2	0.23248	0.7931	Accept	No relation
D(SENSEX) does not Granger Cause D(CPI)	2	0.24362	0.7844	Accept	
D(GP) does not Granger Cause D(SENSEX)	2	1.24725	0.2931	Accept	No relation
D(SENSEX) does not Granger Cause D(GP)	2	0.76146	0.4705	Accept	
D(IIP) does not Granger Cause D(SENSEX)	2	1.34108	0.2677	Accept	Unidirectional relation
D(SENSEX) does not Granger Cause D(IIP)	2	4.07807	0.0208	Reject	
D(SENSEX) does not Granger Cause D(INFLATION)	2	1.02946	0.3621	Accept	No relation
D(INFLATION) does not Granger Cause D(SENSEX)	2	1.37464	0.2591	Accept	

Source: Primary

The macroeconomic variables and the SENSEX are stationary at their first difference even though they were non stationary at the level. Unit root test was used to identify the stationarity. The regression results suggest that the macroeconomic variables, namely crude oil price, gold price, and consumer price index, significantly affect the BSE INDEX. IIP does not have a significant relation with Sensex. Consumer price index and crude oil price affect the Sensex positively but gold price has a negative impact on Sensex. From the test it can be concluded that the movement of Sensex is affected by the macroeconomic variables. The Indian stock market is significantly affected by the four macroeconomic variable namely, gold price, crude oil price, consumer price index. Around 92 percent of stock market movement is caused due to these factors. A unidirectional relation exists between Sensex and IIP. There is a relation between Sensex and Index of Industrial Production, such that the trend of Sensex influences the change in Index of Industrial Production in India. However, IIP did not show any relation towards Sensex. There is no significant relation between any other macroeconomic variables and Sensex.

8. Conclusion

The empirical results of the study help the investors, traders, stock brokers, institutional investors, macroeconomists and monetary authorities to develop a better and real time understanding of potential

macroeconomic determinants of Indian financial sectors. Developing Eonomies must consider the strong interactions between macroeconomic variables and stock markets. The policy makers of such economies should design policies for minimizing the negative effects of macroeconomic variables shocks, particularly during the time of financial volatility. The study explores the relationships between stock prices and the selected key macro variables representing real and financial sector of the Indian economy. The macroeconomic variables are represented by the industrial production index, consumer price index, crude oil price, gold price. Indian stock market is represented by BSE SENSEX. Monthly data for a short time span of (from April 2013 – March 2019) was considered. The paper employed Granger causality test and regression analysis to examine such relationships. The results are interesting and useful in understanding the Indian stock market pricing mechanism based on economic variables as well as its return generating process. On the basis of overall analysis it can be concluded that three out of four variables specifically, gold price, CPI, crude oil price are relatively more significant and likely to influence Indian stock market. There is a positive relation between CPI and Sensex, crude oil price and Sensex whereas gold price and Sensex show a negative relation. The result has been concluded on the bases of the granger causality test in which Sensex has been seen as affecting IIP and regression analysis in which all four macroeconomic except IIP are affecting BSE index. The study concludes that in long term the Indian stock market is more driven by domestic macroeconomic factors rather than global factors. The results of this analysis should not be treated as conclusive for an investment decision. Apart from understanding Indian stock market based on the contributions of the significant variables, there remain other important issues that affect the return generating process. These issues are the cost of equity capital, asset valuation, industry analysis, a firm's management and operational efficiency analysis, and so on. Investors should also consider these factors relevant before making an investment decision.

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17. LINKS

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APPENDIX

YEAR	MONTH	IIP	CP	CPI	GP	SENSEX
2013	JANUARY	107.2	5,708.32	76.7312	90,803.52	19894.98
2013	FEBRUARY	101.4	5,784.94	77.4256	87,471.13	18861.54
2013	MARCH	115.2	5,575.84	77.7728	86,644.73	18835.77
2013	APRIL	102.6	5,375.04	78.4672	80,903.44	19504.18
2013	MAY	106	5,468.66	79.1616	77,818.80	19760.3
2013	JUNE	101	5,817.69	80.2032	78,355.69	19395.81
2013	JULY	104.7	6,292.38	81.5920	76,847.65	19345.7
2013	AUGUST	104.3	6,836.67	82.2864	85,441.92	18619.72
2013	SEPTEMBER	105.7	6,926.83	82.6336	85,891.21	19379.77
2013	OCTOBER	105.7	6,497.77	83.6752	81,142.34	21164.52
2013	NOVEMBER	101.9	6,435.78	84.3696	80,007.36	20791.93
2013	DECEMBER	110.9	6,534.28	82.9808	75,670.14	21170.68
2014	JANUARY	112.3	6,344.00	82.2864	77,312.91	20513.85
2014	FEBRUARY	106.7	6,529.28	82.6336	80,943.59	21120.12
2014	MARCH	118.5	6,343.00	82.9808	81,456.73	22386.27
2014	APRIL	106.6	6,329.60	84.0224	78,370.05	22417.8
2014	MAY	111	6,273.13	84.7168	76,477.43	24217.34
2014	JUNE	109.7	6,471.05	85.4112	76,378.35	25413.78
2014	JULY	110.4	6,320.51	87.4944	78,718.95	25894.97
2014	AUGUST	108	6,092.56	87.8416	78,867.16	26638.11
2014	SEPTEMBER	110.2	5,835.69	87.8416	75,285.57	26630.51
2014	OCTOBER	106	5,280.84	87.8416	74,997.34	27865.83
2014	NOVEMBER	109.4	4,748.53	87.8416	72,491.16	28693.99
2014	DECEMBER	115.3	3,806.55	87.8416	75,291.99	27499.42
2015	JANUARY	114.3	2,927.20	88.1888	77,715.80	29182.95
2015	FEBRUARY	109.9	3,398.51	87.8416	76,113.23	29361.5
2015	MARCH	121.3	3,299.23	88.1888	73,605.25	27957.49
2015	APRIL	107.3	3,611.03	88.8832	75,236.65	27011.31
2015	MAY	113	3,988.78	89.5776	76,484.80	27828.44
2015	JUNE	110.8	3,915.30	90.6192	75,451.46	27780.83
2015	JULY	111.8	3,458.51	91.3136	71,812.23	28114.56
2015	AUGUST	112	2,973.16	91.6608	72,746.31	26283.09
2015	SEPTEMBER	112.6	3,064.43	92.3552	74,476.64	26154.83
2015	OCTOBER	115.5	3,055.95	93.3968	75,438.75	26656.83
2015	NOVEMBER	110.3	2,847.43	93.7440	71,759.82	26145.67
2015	DECEMBER	118.9	2,435.40	93.3968	71,639.46	26117.54
2016	JANUARY	118.9	2,004.00	93.3968	73,882.06	24870.69
2016	FEBRUARY	117.8	2,117.58	92.7024	81,857.57	23002
2016	MARCH	127.6	2,503.95	93.0496	83,496.73	25341.86
2016	APRIL	113.7	2,708.63	94.0912	82,572.44	25606.62
2016	MAY	121.3	3,072.75	95.4800	84,340.04	26667.96
2016	JUNE	119.7	3,208.66	96.1744	85,878.28	26999.72
2016	JULY	116.8	2,966.28	97.2160	89,845.99	28051.86
2016	AUGUST	116.5	3,004.16	96.5216	89,707.71	28452.17

2016	SEPTEMBER	118.2	3,006.05	96.1744	88,540.40	27865.96
2016	OCTOBER	120.3	3,290.46	96.5216	84,551.36	27930.21
2016	NOVEMBER	115.9	3,056.29	96.1744	83,622.54	26652.81
2016	DECEMBER	121.7	3,572.84	95.4800	78,583.48	26626.46
2017	JANUARY	123.1	3,649.89	95.1328	81,191.05	27655.96
2017	FEBRUARY	119.2	3,647.03	95.1328	82,818.17	28743.32
2017	MARCH	133.2	3,355.09	95.4800	81,169.45	29620.5
2017	APRIL	117.3	3,365.04	96.1744	81,731.26	29918.4
2017	MAY	124.8	3,213.83	96.5216	80,267.72	31145.8
2017	JUNE	119.3	2,975.01	97.2160	81,206.16	30921.61
2017	JULY	118	3,071.23	98.9520	79,702.45	32514.94
2017	AUGUST	122.1	3,194.46	98.9520	82,070.82	31730.49
2017	SEPTEMBER	123.1	3,413.19	98.9520	84,705.81	31283.72
2017	OCTOBER	122.5	3,574.53	99.6464	83,278.23	33213.13
2017	NOVEMBER	125.8	3,887.81	99.9936	83,160.05	33149.35
2017	DECEMBER	130.6	3,930.99	99.2992	81,231.20	34056.83
2018	JANUARY	132.3	4,215.16	99.9936	84,729.66	35965.02
2018	FEBRUARY	127.4	4,085.16	99.6464	85,664.20	34184.04
2018	MARCH	140.3	4,171.72	99.6464	86,116.81	32968.68
2018	APRIL	122.6	4,516.93	99.9936	87,643.83	35160.36
2018	MAY	129.6	4,959.75	100.3408	88,040.16	35322.38
2018	JUNE	127.7	4,879.75	101.0352	86,881.56	35423.48
2018	JULY	125.7	4,992.51	104.5072	85,032.02	37606.58
2018	AUGUST	128	4,942.53	104.5072	83,560.63	38645.07
2018	SEPTEMBER	128.8	5,448.55	104.5072	86,643.99	36227.14
2018	OCTOBER	132.8	5,648.69	104.8544	89,474.27	34442.05
2018	NOVEMBER	126.1	4,476.09	104.8544	87,672.27	36194.3
2018	DECEMBER	133.9	3,822.07	104.5072	88,567.77	36068.33
2019	JANUARY	134.4	4,003.08	106.5904	91,392.22	36256.69
2019	FEBRUARY	127.6	4,352.94	106.5904	93,999.48	35867.44
2019	MARCH	144.1	4,432.04	107.2848	90,384.77	38672.91
2019	APRIL	126.5	4,761.33	108.3264	89,277.40	39031.55
2019	MAY	135.4	4,664.02	109.0208	89,588.57	39714.2
2019	JUNE	129.3	4,149.67	109.7152	94,370.20	39394.64
2019	JULY	131.8	4,230.22	110.7568	97,215.99	37481.12
2019	AUGUST	126.2	4,102.97	111.1040	106,747.70	37332.79
2019	SEPTEMBER	122.9	4,282.87	111.7984	107,755.20	38667.33
2019	OCTOBER	124	4,069.14	112.8400	106,209.10	40129.05
2019	NOVEMBER	128.8	4,314.32	113.8816	105,057.20	40793.81
2019	DECEMBER	134.5	4,509.77	114.5760	105,296.50	41253.74