A Causal Study of The Linkages Between The Stock Market And Macroeconomic Variables

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Abstract: *With changes in economy comes in change in financial markets and stock movements, as the change is dynamic and previous research in the same area had happened in a different environment when compared to present economy, effect of macro-economic variables on stock prices has a further scope for research. Efficiency in capital markets can be categorized into three types as per Ongkrutaraksa, (1996) as (1) Allocate efficiency; 2) Transactional efficiency; and 3) Informational efficiency. Academic or Pareto efficiency is used in assessing the welfare effects of equilibrium market resource allocations. The objective of the present study is to explore the existence of causal relationship between select macro-economic variables and stock prices of Nifty 50, which is taken to be the proxy for stock market movement. Econometric analysis using granger causality test has been used on time series data for all the variables. The results indicate towards the existence of partial causal relationship.*

Keywords: *EMH, Granger Causality, Macroeconomic Variables, Nifty 50, Stock Markets*

I. Introduction

There are various factors which are believed to affect the share prices and research on this subject is extensive and debatable. As we understand stock markets are a part of nation's economy and there is a great scope for it to bring in change and economic development of nation. With changes in economy comes in change in financial markets and stock movements, as the change is dynamic and previous research in the same area had happened in a different environment when compared to present economy, effect of macro-economic variables on stock prices has a further scope for research.

The relationship of stock markets and macro- economic performance has been empirically analysed with the help of Capital Asset Pricing Model (CAPM) and Arbitrage Pricing model (APT).

An understanding about the effect of these macro-economic factors and various indicators guide us forward. In this context an analysis of the economic survey released by the Reserve Bank of India, and the Centre for Monitoring Indian Economy (CMIE) and such other accredited sources relating to leading indicators like rainfall, unemployment, credit off-take, corporate profit, money supply, stock market indices, Coincidental indicators like GDP/GNP or sectorial output, Index of Industrial production etc., and Lagging Indicators like piled up inventories, large scale unemployment, outstanding debt, interest rate on commercial loans etc., which help to predict the likely performance of the economy.

II. Review of Literature

1.Capital Market Efficiency: Efficiency in capital markets can be categorized into three types as per (Ongkrutaraksa, 1996)[1] as (1) Allocate efficiency; 2) Transactional efficiency; and 3) Informational efficiency. **Academic** or Pareto efficiency is used in assessing the welfare effects of equilibrium market resource allocations. Transactional efficiency is concerned with the costs and risks of exchange of economic resources (i.e., goods and services) and financial resources and assets in the marketplace. Informational efficiency deals with the relationship between market prices and information. Efficiency in capital markets can be categorised into three types as per informational efficiency as strong form, semi-strong form and weak form deals with the relationship between market prices and information.

Fama (1970)[2] developed Efficient Market Theory which states that asset prices fully reflect all available information, which implies that it is impossible to beat the markets by following market news or expert stock selection or timing and the only way an investor can possibly obtain higher returns is by purchasing riskier investments.

Nair & Ladha (2014)[3] Behavioural Portfolio Theory (BPT) was in existence even before the more famous Modern Portfolio Theory (MPT) was developed; Markowitz, 1999[4]; Shefrin and Statman, 2000[5]).

According to BPT, investment choices are affected by the investor's cognitive biases and emotions, because unlike MPT, in BPT, investors seek both 'utilitarian' (maximizing return and minimizing risk) and 'expressive' benefits (investment as a means of expressing personal values) from their investments. Thus,

investment choice is determined by a tradeoff between financial (utilitarian) benefits and psychic (expressive) benefits derived by an investor. In the late 1970's and early 1980's discussions on the environment and the negative impact of certain actions by individuals on the environment gained impetus.

Srivastava,A. (2010)[6] study concludes that emerging economies like India are most affected by domestic macro-economic factors than global factors. Industrial production, interest rate and Wholesale Price Index (WPI) are the most important variables affecting in the long run. Naka A, Mukherjee T, Tufte D, (2006)[7] found through their study that three long term equilibrium relationships exist among stock prices and macro-economic variables. Domestic inflation is the most severe deterrent to Indian stock markets performance, and domestic output growth is its predominant driving force.

(Ghosh, Saidi, & Johnson, 1999)[8] Rationales pairs of financial time series data according to financial theory hypothesis are projected to move together. It is also estimated that short run deviations will be brought to equilibrium in the long run on account of investor tastes and preferences, market forces and government regulations. By understanding these short term movements a better indulgent on the economic relationship between these variables in markets can be drawn.

Makan C, Ahuja A & Chauhan S (2012)[9] Three among seven factors studied are relatively more significant and likely to influence stock markets, these are exchange rate, foreign institutional investors and call rate; other factors are index of industrial production, consumer price index, dollar price, crude oil price.

Nainamod, Padhi P (2012)[10] in a granger causality sense found macro-economic variables cause the stock prices in the long run but not in the short run. There are bidirectional causality existence between industrial production and stock price, whereas; unidirectional causality from money supply to stock prices, stock price to inflation and interest rate to stock prices are found.

Bhatt, et.al. (2004)[11] in his study on significance of macro-economic variable suggest that monetary policy restrictions do have impact on cost of raising funds, and as information asymmetry between lenders and borrowers increases it forces companies to reduce their dividend payout. Sankar De (1975)[12] Provides evidence how the marginal investor is indifferent between dividend yields and capital appreciation through retained earnings. The study was conducted on selected segment of industries for data of 9 years duration.

It is also opined by various researchers that these models suffer from many limitations, assumptions and the existence of perfect market condition is far from reality. As we observe market imperfections in many developing markets it can be understood that each market has its own market characteristics, which makes these models unsuitable for developing country like India.

2. Relevant Literature on Methodology used for analysis:

Causality test are most popularly used methodology to establish the existence of causal relation between two time series variables. Granger Causality test by Engle & Granger (1987)[13] has been used to find out the direction of causality between the variables. Present objective is to examine the effect of each of the above mentioned macro-economic variable on stock returns of Nifty 50 Index. It has been found through literature similar studies have used causality tests for bivariate relation between variables.

Patel (2012)[14] in his study on the effect of macro-economic determinants on the Performance of the Indian Stock Market used bivariate granger causality test. Kibria et al. (2014)[15] study on Impact of Macro Economic variables on stock market returns: A case of Pakistan used descriptive analysis, correlation analysis, granger causality tests and regression analysis. Chen. et. al. (1986)[16] was one of the first studies on the relation between macro-economic variables and stock prices using APT (Arbitrate Pricing Theory) model.

Other study which have applied Granger Causality Test for studying the relation between macro-economic variables and stock prices are (Darrat & Mukherjee, 1987[17]; Brown & Otsuki, 1988[18]; Darrat, 1990[19]; Mukherjee & Naka, 1995[20]). The first part of the discussion is related to the methodology adopted for fulfillment of objective 1(b) for which secondary sources of data has been used. Srivastava A (2010)[21] study explains that emerging economies like India are most affected by domestic macro-economic factors than global factors. Industrial production, interest rate and Wholesale Price Index (WPI) are the most important variables effecting in the long run.

Naka Mukherjee & Tufte (2006)[22] found through their study that three long term equilibrium relationships exist among stock prices and macro-economic variables. Domestic inflation is the most severe deterrent for India stock markets performance and domestic output growth is its predominant driving force.

III. Objectives of the Study

(1) To examine the relationship between macro-economic variables and equity investment returns.
(2) To study the relationship between macro-economic variables and stock market returns with Nifty 50 as proxy for
market returns.

1.Hypotheses

H_1: There is a causal relationship between monthly stock returns of Nifty 50 Stocks and Crude Oil Prices (COP)

H_2: There is a causal relationship between monthly stock returns of Nifty 50 Stocks and Gold Prices (GP).

H_3: There is a causal relationship between monthly stock returns of Nifty 50 Stocks and Index of Industrial Introduction. (IIP)

H_4: There is a causal relationship between monthly stock returns of Nifty 50Stocks and Wholesale Price Index. (WPI)

H_5: There is a causal relationship between monthly stock returns of Nifty 50 Stocksand US Dollar to Indian Rupee   Exchange Rate.(DER)

H_6: There is a causal relationship between monthly stock returns of Nifty 50 Stocks and European Euro to Indian   Rupee Exchange Rate. (EER)

The objective of the current study is to analyse the current linkage between Nifty Stock Index Price Returns and other select macro-economic variables namely Index of Industrial Production (IIP), Crude Oil Prices (COP), Gold Prices (GP), certain other variables such as Exchange Rate of US Dollars (EDR), Exchange Rate of European Pounds (EEP) and Wholesale Price Index (WPI), using econometric tests. Limited to the availability and access to data an attempt is been made to include the most prominent macro-economic factors in the present study. As most of the above mentioned variables are available for monthly frequency, monthly data of all the variables has been included for the period April, 2006 to December 2015 which comprises of 117 observations for each variable.

2. Data Sources and Variable Description

Table 1: *Description of Macroeconomic Variables*

Acronym	Construction Of Variable	Data Source	Values
NSE	Monthly average of daily closing stock price index from Nifty 50 Index in India from NSE	From NSE India official website, www.nseindia.com	Closing Price in Indian Rupee INR.
COP	Crude Oil Prices monthly averages	Monthly averages of crude oil prices from commodity from MCX website.	Monthly average crude oil price per gallon in INR
GOLD	Monthly average price has been calculated from daily closing prices, of Mumbai city	From MCX Metal and Energy website	Actual monthly averages per 10 grams in INR
IIP	Monthly average of Index of Industrial production which measures the short term changes in the volume of output of Ind. sector in India	Monthly data for IIP general from India Stat database	Base year 2004-2005 =100
WPI	Monthly average of Wholesale Price Index which is a measure of changes in prices of all commodities at first transaction in bulk sale in Indian Markets.	Monthly data for WPI general for all commodities with base year 2004-05=100	Base year 2004-2005 =100
USD	Monthly average exchange rates of US Dollars in terms of Indian rupee.	From India Stat reports	Exchange monthly avg. in INR
EURO	Monthly average exchange rates of European Union Euros in terms of Indian rupee.	From India Stat reports	Exchange monthly average in INR

IV. Methodology

For the present objective which is to examine the presence of causal relationships between macro economic variables and the Nifty 50 Index (which is used as market proxy), granger causality test has been adopted similar study in Indian perspective have been conducted in Indian markets **Granger Causality Test**
Granger (1969)[22] and Sim (1972)[24] introduced granger causality test to examine the causality between variables in economics, it is a tool that determine the forecasting ability of one time series variable on other. It explains the direction of causality whether, uni-directional or bi-directional causality. We can test for the absence of Granger causality by estimating the following model:

$Y_t = a0 + a_1Y_{t-1} + ... + a_pY_{t-p} + b_1X_{t-1} + ... + bpX_{t-p} + u_t$……..**(Equation 1)**

$X_t = c_0 + c_1X_{t-1} + ... + c_pX_{t-p} + d_1Y_{t-1} + ... + d_pY_{t-p} + v_t$………   **(Equation 2)**

Then, testing H_0: $b_1 = b_2 = ... = b_p = 0$, against

H_a: 'Not H_0', is a test that X does not Granger-cause Y.

Similarly, testing H_0: $d_1 = d_2 = ... = d_p = 0$, against H_A: 'Not H_0', is a test that Y does not Granger-cause X. In each case, a rejection of the null implies there is Granger causality. The null hypothesis is tested by using the standard F-test of joint significance.

Here RSSR & RSSUR are the Restricted and Unrestricted Residual Sum of Squares respectively. M is the number of lags, n is the number of observations and k is the parameters in the unrestricted equation. If the computed F-value exceeds the critical F-value at the chosen level of significance, the null hypothesis is rejected.

This would imply that macroeconomic variable 'Granger cause' or improve the prediction in stock prices and vice versa.

(Note:That it has been taken one period lag in the above equation. In practice, the choice of the lag is arbitrary.)

H_o: Each macro economic variable do not granger cause Nifty Index Stock Prices

H_a: Each macroeconomic variable granger cause Nifty Index Stock Prices

Note : Lag of 2 years has been considered.

Prerequisite for conducting Granger Causality test are as follows:

Unit Root Test Augmented Dickey Fuller Test (ADF) is being used to check the time series data for stationarity. As most of the variables are based on time series data, and the stationarity of data is a prerequisite for using most of the econometric models. ADF test has been widely adopted for testing stationarity.

Stationarity of a data series implies that the means and variances are constant over a given period of time and the covariance between the two extreme time periods does not depend on the actual time at which it is computed but on lag between the two extreme time periods. E-Views software provides with a variety of powerful tools for testing a series (or the first or second difference of the series) for the presence of a unit root. In addition to Augmented Dickey-Fuller (1979)[25] and Phillips-Perron (1988)[26] tests, E-Views software allows to compute the GLS-detrended Dickey Fuller as mentioned in several studies. If the process has a unit root then the times series is non-stationary. The testing procedure for the ADF test is the same as for the Dickey–Fuller test but it is applied to the model

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \cdots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t \qquad \text{......(Equation 3)}$$

Where,

α Is a constant

β The coefficient on a time trend

p The lag order is of the autoregressive process.

Imposing the constraints $\alpha = 0$ and $\beta = 0$ corresponds to modeling a random walk and using the constraint $\beta = 0$ corresponds to modeling a random walk with a drift. Consequently, there are three main versions of the test, analogous to the ones discussed on Dickey–Fuller test.

By including lags of the order *p* the ADF formulation allows for higher order auto regressive processes. This means that the lag length *p* has to be determined when applying the test. One possible approach is to test down from high orders and examine the *t*-values of coefficients. An alternative approach is to examine information criteria such as the Akaike information criterion (AIC) which is widely accepted.

The unit root test is then carried out under the Null hypothesis $\gamma = 0$ a (Variable is not stationary) Alternative hypothesis of $\gamma < 0$. (Variable is stationary)

$$DF_\tau = \frac{\hat{\gamma}}{SE(\hat{\gamma})} \qquad \text{..............................(equation 4)}$$

5. Correlation Method

Correlation is computed using the correlation coefficient which ranges between -1 to +1. A correlation coefficient of +1 is read as perfect positive correlation and implies that the variables move up or down in the same direction. Alternatively correlation coefficient of -1 is read as perfect negative correlation and implies that the variables move up or down in opposite direction. If the coefficient is '0' the variables are having no relation, their movement is completely random.

The formula for correlation is as follows:

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}} \qquad \text{............(Equation 5)}$$

6. *Granger causality tests* seek to answer questions such as "Do changes in y1 cause changes in y2?" If y1 causes y2, lags of y1 should be significant in the equation for y2. It is a test which is sensitive to the number of lags used in the model. The assumption of data being stationary is followed. Gujarati (2007)[33] In economics the dependence of a variable Y (the dependent variable) on another variable(s) X (the explanatory variable) is rarely instantaneous. Very often, Y responds to X with a lapse of time. Such a lapse of time is called a lag.

Is it GDP that "causes" the money supply M (GDP→ M) or is it the money supply M that causes GDP (M→GDP), where the arrow points to the direction of causality. The Granger causality test assumes that the information relevant to the prediction of the respective variables, GDP and M, is contained solely in the time series data on these variables. The test involves estimating the following pair of regressions:

$$X_1(t) = \sum_{j=1}^{p} A_{11,j} X_1(t-j) + \sum_{j=1}^{p} A_{12,j} X_2(t-j) + E_1(t)$$

$$X_2(t) = \sum_{j=1}^{p} A_{21,j} X_1(t-j) + \sum_{j=1}^{p} A_{22,j} X_2(t-j) + E_2(t)$$

Where, it is assumed that the disturbances $E_1(t)$ and $E_1(t)$ are uncorrelated. In passing, note that, since we have two variables, we are dealing with bilateral causality.

Hypotheses can be tested within the F-test framework, since each set of restrictions contains only parameters drawn from one equation.

$$F = \frac{[(\llbracket RSS \rrbracket\_r - \llbracket RSS \rrbracket\_ur)] / m}{(\llbracket RSS \rrbracket\_ur / \llbracket (n-m) \rrbracket)}$$ ………………..**(Equation 8)**

V. Results from Analysis
Table 2: Descriptive Statistics for Macroeconomic Variables

S.No.	Variable	Range	Min.	Max.	Mean	Std. Deviation
1	Crude Oil Prices	98.32	41.68	140.00	83.15	19.80
2	Gold Prices	22942.18	8690.27	31632.44	19696.26	7541.20
3	Index of Industrial Production.	89.26	108.84	198.10	158.63	19.56
4	Wholesale Price Index	71.40	114.50	185.90	153.84	23.37
5	Dollar Exc. Rate	25.63	39.35	64.99	50.43	7.48
6	EURO Exchange Rate	30.21	54.76	84.97	67.02	8.12
7	NSE	6146.75	2755.10	8901.85	5404.08	1472.36
	Valid N (list wise)	117	117	117	117	117

Note. Statistics have been calculated on real values for all variables
Source: From analysis of secondary data for each variable between April, 2006 to December, 2015

Table 2 represents the summary of descriptive statistics of all variables from April, 2006 to December, 2015. Sample range, Minimum, Maximum, Mean and Standard Deviation have been reported for 117 observations from each variable. Standard deviation as a measure of dispersion explains how far or close is the data spread from its mean. Low standard deviation explains that the data is closer to the mean and a high standard deviation implies that the spread of data is far from its mean. From the above table we understand that:

➢ Crude Oil Prices had a mean of 83.15 with low standard deviation when compared to other macro-economic variables such as Gold rates and Nifty index. The range value between minimum and maximum also indicates high fluctuation in crude oil prices.
➢ Dollar Exchange Rate with Indian Rupee the range was Rs.25.63, indicating low fluctuation in the exchange rates. It is also found that the standard deviation is quiet low and is close to mean of Rs.50.43
➢ Euro Exchange Rate with Indian Rupee also indicated a low standard deviation and did not reflect much diversion from the mean.
➢ Gold prices had a very high standard deviation and indicate high fluctuation in their prices during the period of study. The range was Rs.22,942.18 which is a very high value.
➢ Index of Industrial Production did not show very high standard deviation and was around the mean of 158.63 during the period of study.
➢ Whole sale price index also does indicate a very high fluctuation in values and had a low standard deviation.
➢ Nifty closing prices had a very high standard deviation and indicate high fluctuation in their prices during the period of study. The range was Rs.6146.75 was observed which seems to be quiet high.

Table 3: Correlation and Descriptive Statistics of Macroeconomic variables

| Descriptive Statistics				
Type of Variables	**Mean**	**Std. Deviation**	**Correlations**	**Sig.(1-tailed)**
Crude Oil Prices(IV)	1.91	0.11	0.21	0.01
Exchange Rate For Dollar(IV)	1.82	0.05	0.54	0.00
Euro Exchange Rate(IV)	1.70	0.06	0.59	0.00
Gold Prices(IV)	4.26	0.19	0.65	0.00
Index of Industrial Production(IV)	2.20	0.06	0.75	0.00
Wholesale Price Index(IV)	2.18	0.07	0.76	0.00
NSE Nifty Closing Prices(DV)	3.72	0.12		

Note. IV means Independent variable & DV means dependent variables, values have been calculated after converting data to its natural log

From the above analysis it can be found that the USD exchange rate have lowest range and gold prices have the highest range, thus indicating that there is a huge fluctuation in gold prices and it is not the same in case for bank interest rates.   From the above analysis it can be concluded that for the given time frame and datasets of variables except in the case of gold all other variables moved along with NSE Index Prices.   From the above tables (2 & 3) it can be observed that IIP, WPI and gold prices have a high positive correlation with NSE closing prices.   Except in the case of crude oil prices all other variables have a statistically significant correlation with p-value < 0.001.   All the correlation values are substantially less than 0.9, hence there is no multi co- linearity in the data set.   It can also be observed that IIP and WPI have (r=.752, p<.001) and (r = .761, p<0.001) which is highest among all the predictors in the model so it is likely that these variables will predict NSE stock prices better.   The arithmetic meaning of range is the difference between the highest and lowest values in the data set.
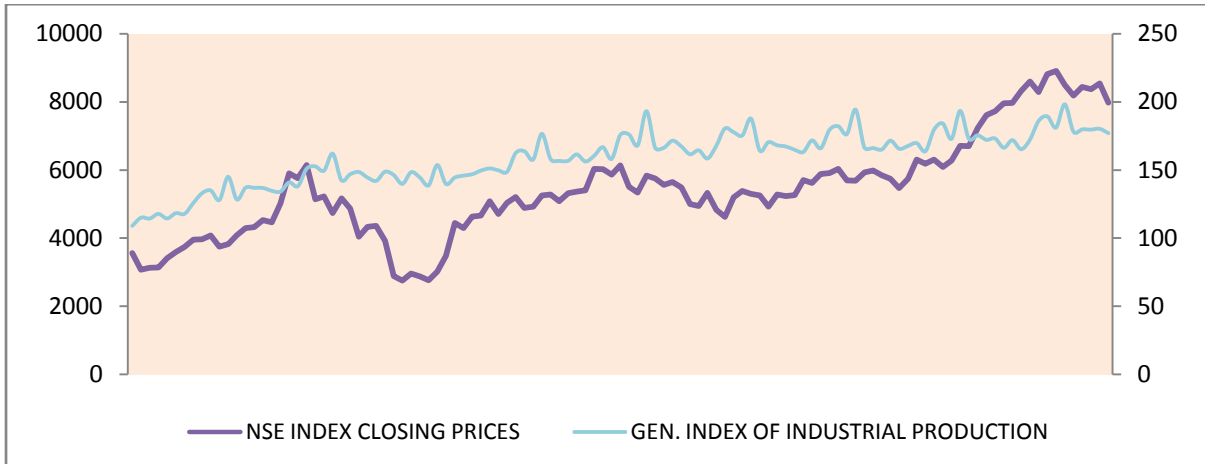
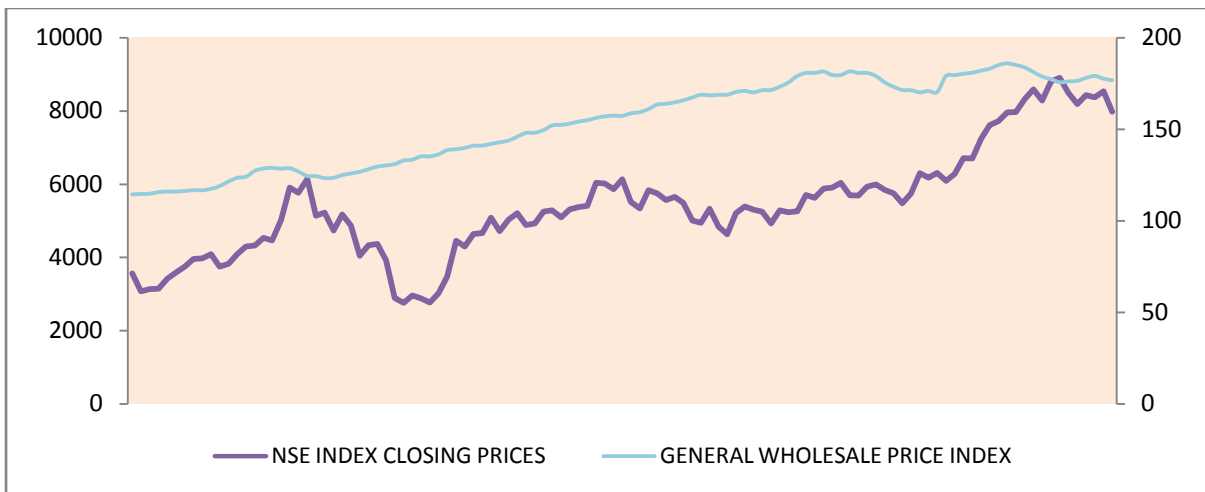**Graphical Representation of Relation between Variables**
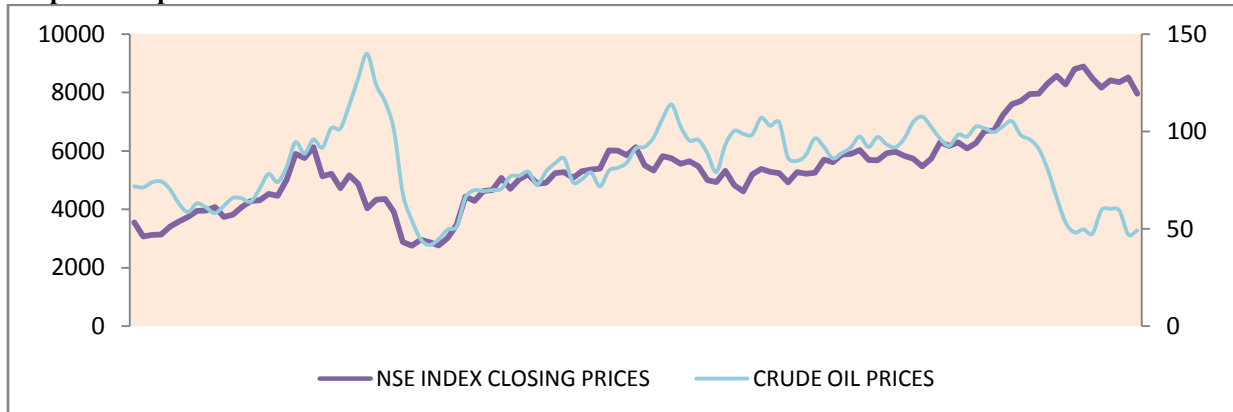
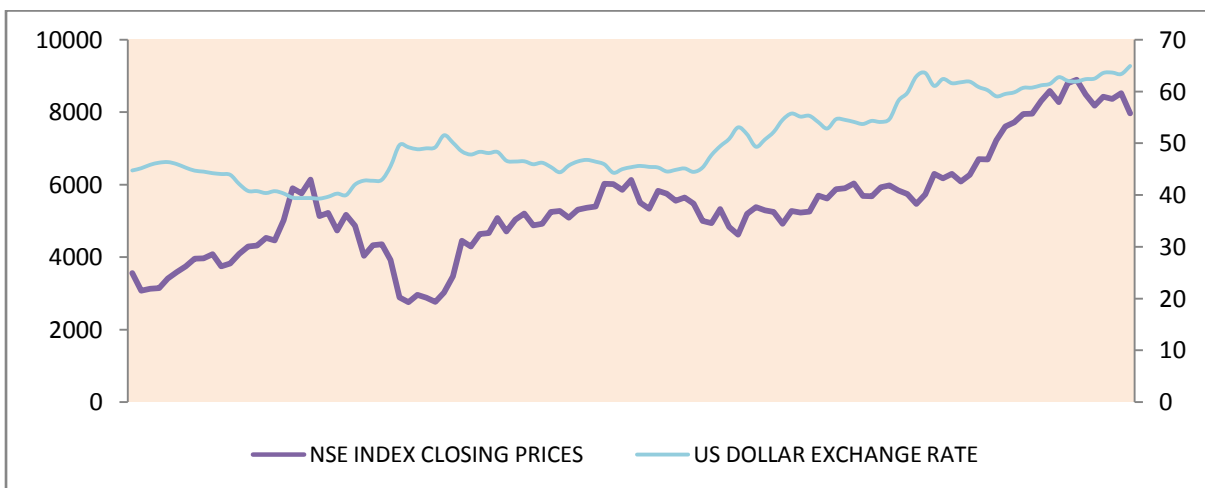**Fig. 1,** Movement of Nifty 50 Index and Crude Oil Prices
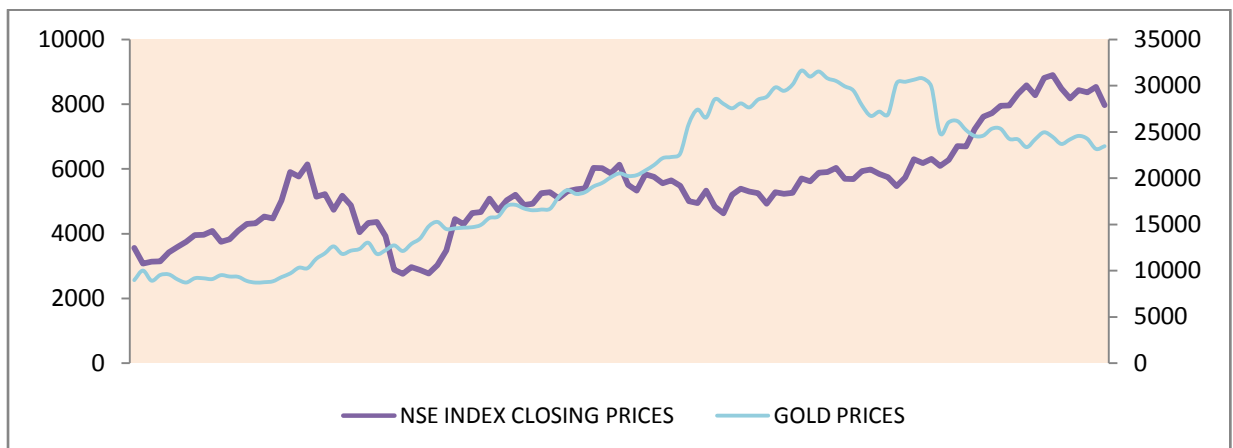
Fig. 2, Movement of Nifty 50 Index and Gold Monthly Closing Prices

Fig.3, Movement of Nifty 50 and Index General Index of Industrial Production

Fig.4, Movement of Nifty 50 Index General Wholesale Price Index

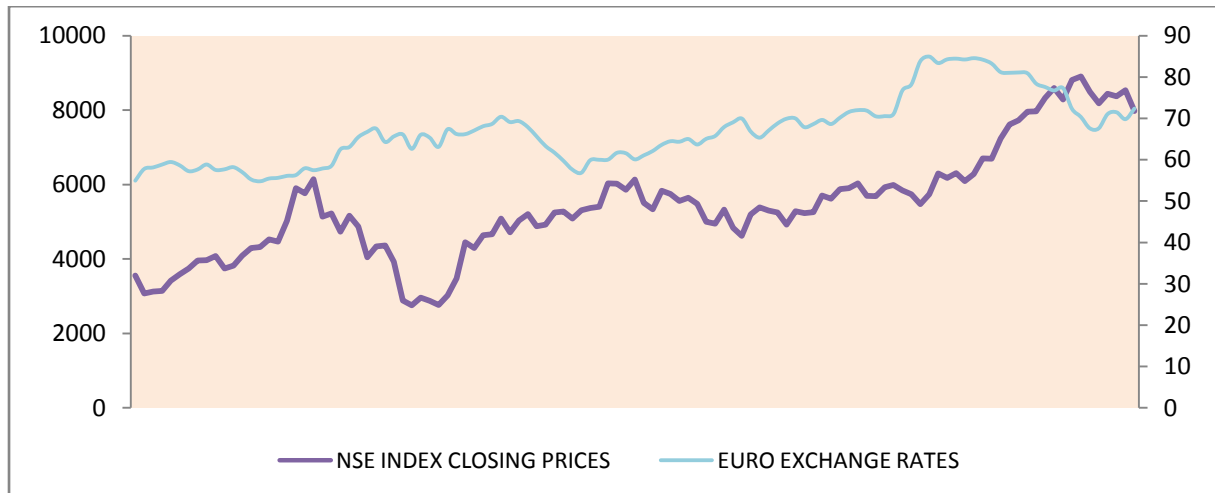**Fig.5,** Movement of Nifty 50 Index and US Dollar Exchange Rate

Fig. 6, Movement of Nifty 50 Index and Euro Exchange Rate

Observations from the graphical representation
➢ It's noticed from graphs that the gold and Nifty prices seem to move in a opposite directions during the period of study
➢ It is also found that US Dollar exchange rate and Nifty closing prices also move in sync but in opposite directions.
➢ In case of other variables there does not seem to be any significant trend.

From the visual inspection of the line graph of each variable it is difficult to make any conclusions therefore a stationarity test using Augmented Dickey Fuller Test (ADFT) in EViews software which is key assumption before Ganger Causality test for presence of stationarity is conducted. To understand the presence of any causal relationship between these macro economic variables and NSE Stock Index, Granger causality test is found appropriate. Before using this test it is important to check for presence of unit root.
Hypothesis for testing presence of stationary using ADF test in E-Views -8 software.
Ho: The time series has Unit Root (if sig at 1% then it is stationary)

Table 3: **Results Unit Root Test – Using ADF TEST**

Null Hypothesis	t-statistic	p-value	Remark
Crude Oil Prices are not stationary	-15.8	0.0000	Variable is stationary
Gold Prices are not stationary	-13.48	0.0000	Variable is stationary
Index of Ind. Production are not stationary	-9.26	0.0000	Variable is stationary
Wholesale Price Index are not stationary	-17.15	0.0000	Variable is stationary
US Dollar Exchange Rate are not stationary	-10.29	0.0000	Variable is stationary
Euro Exchange Rate are not stationary	-12.93	0.0000	Variable is stationary
Nifty Prices are not stationary	-9.3	0.0000	Variable is stationary

Sources: From the analysis of secondary data.

It can be concluded from the above table 4 that all the variables have attained stationarity in the time series. Basically t-statistics is checked, and when it is less than the values at 1%. (i.e.) 99% confidence interval with a significant p-value (less than 0.05) null hypothesis of present unit root (data series is non-stationary) can be rejected. From the above table it can be concluded that all the data series are stationary and we proceed with Granger causality test.

Table 4: Results of Granger Causality Test

Lags: 2				
Null Hypotheses	**Observation**	**F-Statistic**	**Probability**	**Type of Causality**
H_1: Crude Oil Prices does not Granger cause prices of Nifty Index Prices	117	1.493	0.229	No Causality
Prices of Nifty Index does not Granger cause crude oil prices		0.140	0.869	No Causality
H_2 : Gold Prices does not Granger cause prices of Nifty Index prices	117	0.526	0.592	No Causality
Prices of Nifty Index prices does not Granger cause Gold Prices		0.507	0.603	No Causality

H₃: Index of Industrial Production does not Granger cause prices of Nifty Index	117	0.774	0.463	No Causality
Prices of Nifty Index does not Granger Cause index of industrial production		3.114	0.048	No Causality
H₄: Wholesale Price Index does not Granger cause Prices of Nifty Index	117	1.953	0.146	No Causality
Prices of Nifty Index does not Granger cause Wholesale Price Index		1.283	0.281	No Causality
H₅: US Dollar Exchange Rate does not Granger cause NSE	117	5.305	0.006	Bi-Directional Causality
NSE does not Granger cause US Dollar Exchange Rate		3.791	0.025	Bi-Directional Causality
H₆: Euro Currency Exchange Rate does not Granger cause Prices of Nifty Index	117	1.749	0.178	No Causality
Prices of Nifty Index does not Granger cause Euro Currency Exchange Rate		0.023	0.976	No Causality

Source: From the analysis of secondary data of macro-economic variables
Note. We fail to reject H_o when the p-value is >0.05.

From the Table 4, it can be observed that there exists no causal relation between NSE Index and macro-economic variables except in the case of exchange rate with USD showing a uni-directional causal relationship. With the given values of F-statistic the p – values are all more than 5% therefore we accept the Null Hypothesis that there is no causal relation between the variables.

VI. Results of Analysis and Conclusions

The results of analysis indicated very high standard deviation for nifty 50 and gold prices which imply that the spread of these variables was away from their respective means. Correlation analysis of the variables has indicated that a very high correlation coefficient (0.76) between wholesale price index and Nifty was found, next the 0.75 with Index of Industrial Production and 0.65 with gold prices. Graphical representation of data indicated that gold and nifty almost seemed to move together although in opposite direction. There is strong positive correlation between Nifty 50 index movements with Gold prices. All the macroeconomic variables had a statistically significant correlation with Nifty 50 index; crude oil prices have the least correlation coefficient of (0.21) and wholesale price index having the highest coefficient (0.76).

The outcome of the study is consistent with the findings of Nataraja, et.al (2010)[27]; which was conducted to understand the relation between Nifty and INR to USD exchange rates for period 1st October, 2007 to 31st December, 2009 using daily closing prices after correction to natural log. Other such study by Baranidharan & Srinivasan (2014)[28] tested for the causal relation between CNX Bankex and exchange rate revealed the existence of causal relation between these variables. The study was conducted on monthly data during January 1st, 2004 to 31st December, 2013.

Ahuja et.al (2012)[9] In their study using seven macroeconomic variables and their effect on stock market has indicated that three important variables which were Sensex and exchange rate from INR to USD had a positive correlation coefficient.As indicated from analysis there is bidirectional causality between INR to USD exchange rate with Nifty 50 revealed through granger causality test, it may be concluded that these two variables may be used to forecast each other's movement. It is also concluded that the relation between Nifty 50 and USD to INR exchange rate is on account of influence of foreign investment which have a significant market participation in Indian markets.

Other variables such as Index of Industrial production have a unidirectional causality with the movement of Nifty 50. Samveg Patel (2012)[14] in the study found that IIP is a highly significant factor that influences Nifty stock price movement. Therefore there is a further need for policy makers to support industrial growth. Other perspective could be that a period of boom in stock markets means increase in prices of shares bringing in more capital to corporates therefore indicating a rise in index of industrial production.

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