# A Study of Impact of Selected Macro Economic Variables on Nifty

## Nitu Omprakash Gupta[1]

## Abstract

The dynamic linkage between stock market and macro-economic variables is one of the most enduring thoughts in the present scenario. The study focuses on this relationship only with due consideration towards the most important macro-economic variables like index of industrial production, consumer price index as a proxy for inflation and interest rates along-with the major stock index Nifty. The paper uses Johansen and Juselius (1990) cointegration technique to explore the long-run relationship between NSE-Nifty share price index and above mentioned macroeconomic variables. For examining the short run relationship Vector Error Correction Model (VECM) was applied. The empirical results revealed that the NSE-Nifty index does not have a significant long-run relationship with interest rate, index of industrial production, and consumer price index but there were existence of short run relationship. Based on this relationship a model was created and residual testing of the model was conducted to check its validity with respect to heteroskedasticity, auto correlation and normality tests. Further, Granger Causality test revealed bi-directional relationship between CPI, IIP, interest rates and nifty. Lastly, application of impulse response function resulted negative impact on Nifty in the initial years when standard deviation shocks were given to the variables like CPI, IIP and interest rates.

**Keywords:** Nifty, macro-economic variables, VECM, co integration

## 1. Introduction

Stock market contributes to the mobilization of domestic savings by enhancing the set of financial instruments available to savers to diversify their portfolios providing an important source of investment capital at relatively low cost. A well-functioning and liquid stock market, that allows investors to diversify away unsystematic risk, will increase the marginal productivity of capital (Pagano, 1993). The movement of stock indices is highly sensitive to the changes in fundamentals of the economy and to the changes in expectations about future prospects. Expectations are influenced by the micro and macro fundamentals which may be formed either rationally or adaptively on economic fundamentals.

In the last three decades, numerous empirical studies have examined the dynamic relationships between stock market behavior and economic activity, particularly for developed stock markets such as the U.S., U.K., Germany, and Japan. Examples of pioneer studies are Fama (1981, 1990), Geske and Roll (1983), and Chen, Roll, and Ross (1986). Related studies are different in terms of their hypotheses and the methods used. Several studies investigated the predictive power of stock returns for real economic activity. These studies trace the issue of market efficiency, or the existence of the efficiency of the market hypothesis. A large body of research focuses on the integration of stock markets across economies. However,

[1]Research Scholar at Veer Narmad South Gujarat University, nitu_gupta05@yahoo.co.in

research on the relationship between real economic activity and the stock market in developing countries is still ongoing.

Presently, a large number of global players are analysing carefully the movements of stock markets in India. Therefore, at this point, an understanding of macroeconomic variables that affect Indian stock markets may be useful for policy makers, traders, investors and all other stakeholders.

## 2. Literature Review

In the present-day scenario, the activities in the stock markets and their relationships with the macro economy have assumed significant importance. The presence of such a relationship has been widely documented in the finance literature. **Abugri (2008)** considered to study the linkage between macroeconomic variables like exchange rates, interest rates, industrial production, money supplyand the stock returns of four Latin American countries namely Argentina, Brazil, Chile and Mexico taking into account the data from January 1986 to August 2001. Even MSCI world index and the U.S. 3-month T-bill yield were also used to study the returns on the four markets as global variables. A six-variable vector autoregressive (VAR) model was applied and the results showed that the MSCI world index and the U.S. T-bills were consistently significant for all the four markets. On the other hand, the country specific variables had varying effects in terms of significance and magnitude on all markets.

**Aisyah, Noor and Fauziah (2009)** observed the effect of macroeconomic variables on Malaysian Stock Index. The monetary policy variables (money supply, interest rate, exchange rate and reserves) and domestic supply factor (industrial production index) have significant co-integrating relationship on Malaysian Stock Index using VAR framework.

**Brahmasrene and Jiranyakul (2007)** studied association between money supply, index of industrial production, exchange rate, and world oil prices and share prices on emerging markets focused on the Thailand stock market from 1992 to 2003 by applying unit root, co-integration and Granger causality tests. Johansen co-integration test showed positive correlation between the money supply and share prices in the post the periods and all other variables were having a negative impact.

**Das (2017)** inspected the relationship between selected macroeconomic variables on Indian stock market (NIFTY Index) using quarterly data over the period from April 2005 to March 2015. Four macroeconomic variables, namely exchange rate, foreign institutional investment, call money rate and consumer price index had been taken into consideration to find out the effect of the macroeconomic indicators on the Indian Stock Exchange. By applying Pearson's correlation and Multiple Regression Equation model, the study found that correlation exists between macroeconomic variables and stock market indices.

**John and Owusu-Nantwi (2011)** investigated the impact of macro-economic variables (consumer price index (for inflation), crude oil price, exchange rate and 91 day Treasury bill rate (for interest rate)) on stock market returns of Ghana using monthly data from January 1992 to December 2008 and used Full Information Maximum Likelihood Procedure to establish the relationship. It was found that inflation had positive significant impact on GSE and treasury bills and exchange rate have significant negative impact and crude oil fail to show any significant effect on stock returns.

**Oskenbayev, Yilmaz and Chagirov (2011)** investigated the causal relationship between macroeconomic indicators like the index of industrial production, inflation, exchange rate, oil prices volatility, volume of trade and long & short term interest rates, and the Kazakhstan Stock Exchange (KASE) taking monthly values from 2001 to 2009. They measured the long-term relationship using Autoregressive Distributed

Lag model and even used the Johansen co-integration test and Granger causality test for identifying the equilibrium relationship. The results derived showed co-integration between the stock prices and the variables which clearly proved that efficient market hypothesis doesn't applies well.

## 3. Research Methodology

### 3.1 Research Problem

To study the Impact of Selected Marco Economic Variables (Index of Industrial production (IIP), Consumer price Index (CPI), Interest Rate ) on Indian Stock Market Index - Nifty.

### 3.2 Objectives

- To study the pattern of series of the selected macro-economic variables.
- To study the causality between stock index and selected macro-economic variables.
- To study the existence of long run and short run relationship among these macro-economic variables and Stock Index.
- To design an appropriate model for forecasting the same.

### 3.3 Hypothesis

$H_{11}$: Time series data does not have unit root(i.e., data is stationary) (For Stationarity)

$H_{12}$:  Macroeconomic variables are caused by stock market returns or vice versa.

$H_{13}$: Serial Correlation is present among residuals (For Serial Correlation)

$H_{14}$: Heteroskedasticity is present among residuals (For Heteroskedasticity)

$H_{15}$: Distribution of residuals is not normal (For Normality)

### 3.4 Research Design

The study is a combination of exploratory and descriptive research design. It is exploratory in a manner it provides better understanding of the situation and descriptive because emphasis is on determining the extent to which variables covary.

## 4. Data Collection

The research is purely based on secondary data. Monthly data are considered from period 2009 to 2017. The data of macro-economic variables is collected from Reserve Bank of India's data base of Indian Economy, Ministry of Statistics and Programme Implementation, the Organisation for Economic Co-operation and Development (OECD) and Bloomberg and Nifty figuresare taken from NSE website.

## 5. Sampling Plan and Technique

For the purpose of better understanding and comparison the combinations of independent and dependent variables is formed based on time as a major variable.Independent variables are IIP, CPI and BR where monthly data of these variables are considered along with NIFTY as a dependent variable.

## 6. Analysis & Findings

Analysis is carried out using E-VIEWS software. Descriptive statistics of the variables is studied. ADF test is used for checking the stationarity of the data. Johansen cointegration technique is applied to check cointegration and find long and short run relationship. As these variables are cointegrated, they tend to move together in the long run, while experiencing short run transitory deviations from their long run relationship. From a cointegration system, an error correction model (ECM) is derived that allows to study both the short run dynamics and the effect of long run restrictions on stock price variations.  Residual testing of models is done using heteroskedasticity, auto correlation and normality tests.  Also cause and effect relationship is studied using Granger Causality tests. Impulse Response function is used to check the impact of coefficients over time. Theils U Statistics is studied to find appropriateness of the models.

## 7. Findings

**Descriptive Statistics:** Descriptive statistics are basically the measures of central tendency and measures of variability or spread.

**Table 1:** Descriptive Statistics

| Particulars | NIFTY | CPI | IIP | BR |
|---|---|---|---|---|
| Mean | 6648.200 | 86.27493 | 172.2821 | 7.406019 |
| Median | 6023.825 | 89.12975 | 172.7000 | 7.000000 |
| Maximum | 10530.70 | 110.1690 | 205.3000 | 10.30000 |
| Minimum | 2763.650 | 56.61460 | 138.5057 | 6.000000 |
| Std. Dev. | 1789.352 | 16.29203 | 13.67756 | 1.355462 |
| Skewness | 0.252740 | -0.217691 | -0.196745 | 0.273987 |
| Kurtosis | 2.215804 | 1.722191 | 2.857066 | 1.486027 |
| Jarque-Bera | 3.917138 | 8.200591 | 0.788690 | 11.66576 |
| Observations | 108 | 108 | 108 | 108 |

**Unit Root Tests:**For all the variables (IIP, CPI, BR and Nifty), the absolute values are lesser than critical values at 5%. In addition, by comparing p-values of all variables with 5%, the p-values are all greater than 5% respectively. Thus the null hypothesis of having unit root in the data cannot be rejected and is thus accepted by considering both t-statistic and p-values. Now the data is transformed by differencing, and thus ADF test is conducted at first difference. For all variables absolute ADF test values are higher than critical values at 5%. Also p-values of all the variables are lesser than 5%.Hence it can be concluded from ADF results that all the variables are stationary at first difference and can thus be further used for cointegration tests.

**Table 2:** Unit Root Test Results

| Variables | ADF at I(0) | | | ADF at I(1) | | |
|---|---|---|---|---|---|---|
| | Test Statistics | Critical Values at 5% | P-value | Test Statistics | Critical Values at 5% | P-value |
| IIP | -1.9747 | -2.8892 | 0.2975 | -11.6284 | -2.8892 | 0.0000 |
| CPI | -1.6907 | -2.8889 | 0.4330 | -7.6423 | -2.8889 | 0.0000 |
| BR | -1.6953 | -2.8886 | 0.4308 | -9.9605 | -2.8886 | 0.0000 |
| NIFTY | -0.8154 | -2.8886 | 0.8105 | -11.1328 | -2.8886 | 0.0000 |

**Cointegration Tests:** There exists at most 1 cointegrating relationship among the variables Bank Rate, Index of Industrial Production, Consumer Price Index (Inflation) and Nifty.

**Table 3:** Cointegration Test Results

| Unrestricted Cointegration Rank Test (Trace) | | | |
|---|---|---|---|
| **Hypothesized** | | **Trace** | **0.05** |
| No. of CE(s) | Eigenvalue | Statistic | Critical Value | Prob. |
| None | 0.287526 | 56.96769 | 47.85613 | 0.0055 |
| At most 1 | 0.111058 | 22.04947 | 29.79707 | 0.2958 |
| At most 2 | 0.079558 | 9.923974 | 15.49471 | 0.2866 |
| At most 3 | 0.013358 | 1.385158 | 3.841466 | 0.2392 |
| **Trace test indicates 1 cointegrating eqn(s) at the 0.05 level** | | | |
| **Unrestricted Cointegration Rank Test (Maximum Eigenvalue)** | | | |
| **Hypothesized** | | **Max-Eigen** | **0.05** |
| No. of CE(s) | Eigenvalue | Statistic | Critical Value | Prob.** |
| None * | 0.287526 | 34.91822 | 27.58434 | 0.0048 |
| At most 1 | 0.111058 | 12.12550 | 21.13162 | 0.5353 |
| At most 2 | 0.079558 | 8.538816 | 14.26460 | 0.3265 |
| At most 3 | 0.013358 | 1.385158 | 3.841466 | 0.2392 |
| **Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level** | | | |

**Lag Determination:** SIC showed the lowest at lag length=1. In our study we will use SIC criterion, and thus will select lag length as 1.

**Table 4:** Lag Determination Results

| Method | LR | FPE | AIC | SIC | HQ |
|---|---|---|---|---|---|
| Lags | 12 | 4 | 12 | 1 | 2 |

LR: sequential modified LR test statistic (test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SIC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

**Error Correction Model:** In equation estimates of VECM Model, C (1) coefficient is positive and p-value of C (1) is more than 5% (58.98%) which is insignificant and thus error correction term becomes insignificant. To estimate long run relationship from error correction model, C (1) coefficient should be negative and p-value of the same should be less than 5%, but as C (1) value is positive and p-value is more than 5%, it can be said that the variables does not have long run causality with Nifty index, i.e., IIP, CPI and BR does not cause Nifty index in long run.

After concluding that there exists no long run relation between Nifty index and selected macroeconomic variables, unrestricted VAR model is applied for short run relationship.

Short run equation is:

$$NIFTY = 0.894398*NIFTY(-1) + 0.009666*NIFTY(-2) + -6.184014*IIP(-1) + 3.656163*IIP(-2) + -59.59666*CPI(-1) + 70.61880*CPI(-2) + -68.76567*BR(-1) + 40.07563*BR(-2) + 446.1533$$

### 8. Residual Testing of Vector Auto Regressive Model:

**Serial correlation** - P-value of the observed R-squared value of Breusch-Godfrey Serial Correlation LM Test is 0.9339 which is more than 0.05, meaning that null hypothesis of no serial correlation between the variables should be accepted. Thus there is no serial correlation in the model which is also a good property of the model.

**Table 5:** Breusch-Godfrey Serial Correlation LM Test

| F-statistic | 0.061415 | Prob. F(2,95) | 0.9405 |
|---|---|---|---|
| Obs*R-squared | 0.136876 | Prob. Chi-Square(2) | 0.9339 |

**Heteroskedasticity** - Chi-square p-value of Observed R is 0.0.7354, which is more than 0.05, meaning that the null hypothesis stating residuals are not heteroskedastic can be accepted and thus residuals are not heteroskedastic in the model which is a desirable property for the model.
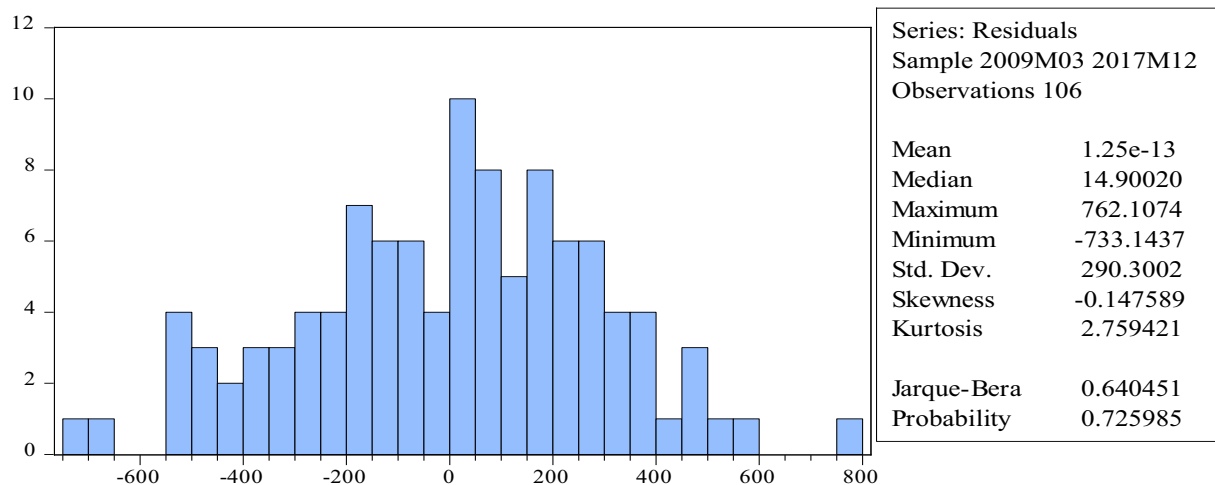


**Figure 1:** Histogram and Jarque Bara Test Results

**Table 6:**  Heteroskedasticity TestBreusch-Pagan-Godfrey

| F-statistic | 0.626208 | Prob. F(8,97) | 0.7540 |
|---|---|---|---|
| Obs*R-squared | 5.205626 | Prob. Chi-Square(8) | 0.7354 |
| Scaled explained SS3.834816 | | Prob. Chi-Square(8) | 0.8717 |

**Normality Jarque Bara** - P-value of Jarque-Bera statistics is 0.7259 which is greater than 0.05, meaning that the null hypothesis is accepted (residual is normally distributed) and alternative hypothesis stating residuals are not normally distributed is rejected.
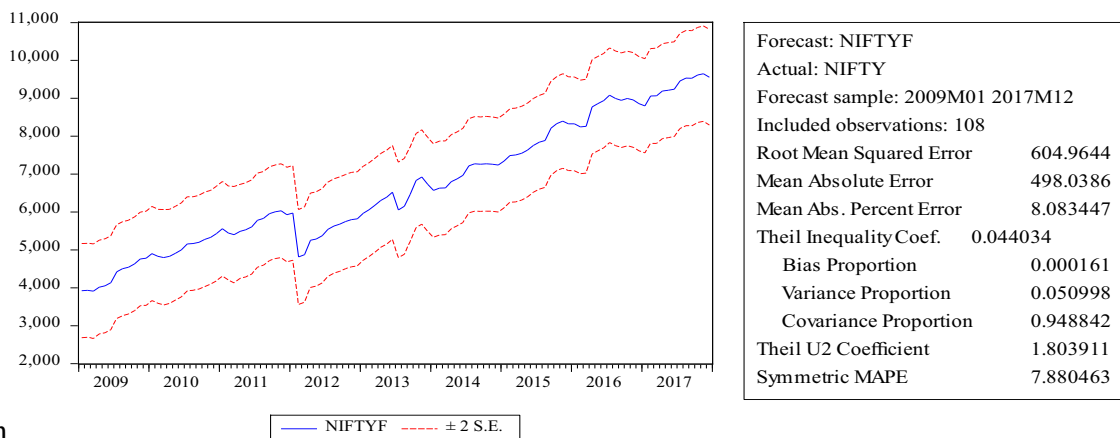
## 9. Granger Causality Test:

Granger causality test analyses the cause and effect relationship i.e., whether dependent variable (Nifty) affect independent (macroeconomic) variables or vice versa. There is bidirectional causality from IIP, CPI, BR to Nifty meaning that if CPI, IIP, BR moves in positive direction than Nifty figures will also move in positive direction all other things being equal except the movement of IIP from Nifty. So we can use these variables to predict Nifty figures and vice-a-versa.Even bidirectional relationship is found between IP, CPI and BR except from CPI to IIP. So the past values of these variables could be used to predict future values.

**Table 7:** Pairwise Granger Causality Tests

| Null Hypothesis: | Obs | F-Statistic | Prob. |
|---|---|---|---|
| CPI does not Granger Cause BR | 106 | 0.11238 | 0.8938 |
| BR does not Granger Cause CPI | | 0.94679 | 0.3914 |
| IIP does not Granger Cause BR | 106 | 0.29649 | 0.7441 |
| BR does not Granger Cause IIP | | 0.16380 | 0.8491 |
| NIFTY does not Granger Cause BR | 106 | 0.60145 | 0.5500 |
| BR does not Granger Cause NIFTY | | 0.51100 | 0.6014 |
| IIP does not Granger Cause CPI | 106 | 0.59857 | 0.5515 |
| CPI does not Granger Cause IIP | | 18.2905 | 2.E-07 |
| NIFTY does not Granger Cause CPI 106 | | 1.16259 | 0.3168 |
| CPI does not Granger Cause NIFTY | | 1.84918 | 0.1627 |
| NIFTY does not Granger Cause IIP | 106 | 7.08007 | 0.0013 |
| IIP does not Granger Cause NIFTY | | 1.12063 | 0.3301 |

## 10.Forecasting

Evaluating the static forecast, as *Theil Inequality coefficient* is way less than 1 implying a good forecast. Also the forecast is "good", as the bias and variance proportions are small with most of the bias concentrated in the covariance proportion.

| Forecast: NIFTYF | |
|---|---|
| Actual: NIFTY | |
| Forecast sample: 2009M01 2017M12 | |
| Included observations: 108 | |
| Root Mean Squared Error | 604.9644 |
| Mean Absolute Error | 498.0386 |
| Mean Abs. Percent Error | 8.083447 |
| Theil Inequality Coef. | 0.044034 |
| Bias Proportion | 0.000161 |
| Variance Proportion | 0.050998 |
| Covariance Proportion | 0.948842 |
| Theil U2 Coefficient | 1.803911 |
| Symmetric MAPE | 7.880463 |

Graph

**Figure 2:** Forecasting

## 11. Impulse Response Function

By giving one standard deviation positive shock to IIP, Nifty will respond negatively at a consistent rate till 10th year.Similarly, by giving one standard deviation positive shock to CPI,  than in that respect Nifty responds negatively for first 5 years and then slowly and gradually it moves to the positive side and increases simultaneously for the next 5 years.Likewise, one standard deviation positive shock given to BR, takes the response of Nifty towards the negative side where it almost remains constant till 10 years.
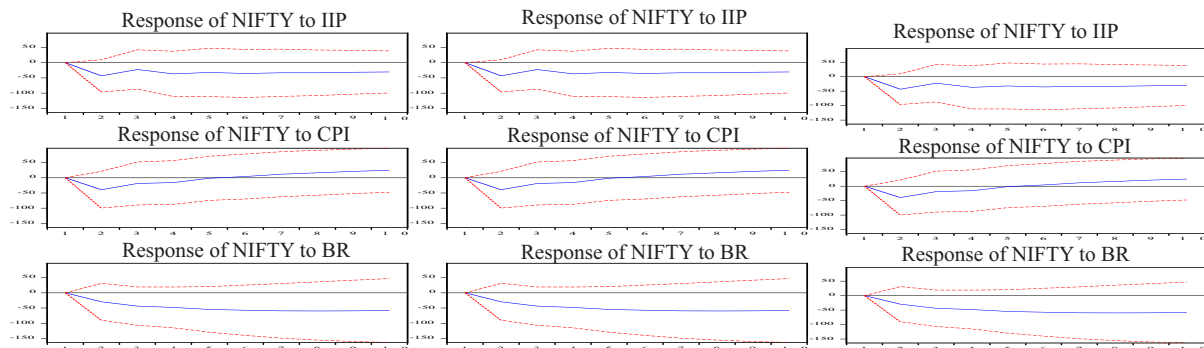


**Figure 3:** Impulse Response Function Results

## 12. Conclusion

For the application of VECM model the first step of lag selection was conducted and the optimum lag used was two, step twowas to apply Johansen cointegration test for which the precondition is that all variables must be non-stationary at level but should become stationary by converting them to first difference was successfully met, thus application of Johansen test results showed that variables had one cointegration vector among them. Step three was to apply VECM model to develop long run relation but selected macroeconomic variables (IIP, CPI and BR) does not have any long term relationship with Nifty Index meaning these variables does not cause Nifty in the long run. So, further short run relationship was calculated using VAR model. All residual testing suggested that model is good and acceptable. Even the Theil U

statistics is less than 1, it can be said that the model is good and reliable.Using Impulse response function showed how one variable reacts to a shock in another variable over time i.e., how a variable i responds to a shock(impulse) in variable j at time t over the time period t to t+h, where h is a forecast horizon.

## 13. Limitations

1. The study is based on the analysis of the secondary data therefore error and inconsistencies of such data will be applicable to the study.
2. The study mainly focuses on selected macroeconomic variables.
3. The data collected are all at a particular point of time and therefore the results may not be relevant over a period of time.
4. Monthly data is used for the study, but dependent variable Niftyis more volatile as it is traded on daily basis.

## 14. Referencecs

Abugri, B.A. (2008), "Empirical relationship between macroeconomic volatility and stock returns; evidence from Latin American markets", International Review of Financial Analysis, Vol. 17, No. 2, pp. 396-410.

Ahmed, S. (2008), "Aggregate economic variables and stock market in India", International Journal of Finance & Economics, Vol. 14, pp. 144-64.

Aisyah, A.R., Noor, Z.M.S. and Fauziah, H.T. (2009), "Macroeconomic Determinants of Malaysian Stock Market", African Journal of Business Management, Vol. 03, Issue No. 03, pp. 095-106.

Brahmasrene, T. Jiranyakul, K., (2007), "Cointegration and causality between stock index and macro-economic variables in emerging markets", Academy of Acounting and Financial Studies Journal, September, 2007.

Chen, N.F., Roll, R., & Ross, S. A. (1986), "Economic forces and the stock market", The Journal of Business, Vol. 59, Issue No. 03, pp. 383–403.

Damodar N. Gujarati, Basic Econometrics, Tata Mc Graw Hill Publication, New Delhi, Fourth Edition.

Das, A. (2017), "An Association of Macroeconomic Variables and Stock Index, India: An Empirical Evidence", MERC Global's International Journal of Management, Vol. 05, Issue No. 01, pp. 01-07

Fama, E. F. (1981). Stock returns, real activity, inflation and money. American Economic Review, 71 (4), 545–565.

Geske, R., & Roll, R. (1983), "The fiscal and monetary linkage between stock returns and inflation", Journal of Finance, Vol. 38, Issue No. 1, pp. 1-33.

John, K.M.K. and Owusu-Nantwi, V. (2011), "Macroeconomic Variables and stock market returns: Full Information Maximum Likelihood Estimation". Research Journal of Finance and Accounting, Vol. 2, No. 4, pp. 49-64.

Maysami, R. C., Howe, L. C., &Hamzah, M. A. (2004), "Relationship between Macroeconomic Variables and Stock Market Indices: Co-integration Evidence from Stock Exchange of Singapore's All-S Sector Indices", Journal Pengurusan, Vol. 24, pp. 47–77.

Oskenbayev, Y., Yilmaz, M. and Chagirov, D. (2011), "The impact of macro-economic indicators on stock exchange performance in Kazakhstan", African Journal of Business Management, Vol. 5, Issue No. 7, pp. 2985-91.

Pagano M, 1993. Financial markets and growth: An overview. European Economic Review, 37: 613-622.