# A STUDY OF THE INFLUENCE OF SELECTED MACROECONOMIC VARIABLES ON   INDIAN STOCK MARKET

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## ABSTRACT

*A study to identify the impact of selected macroeconomic variables on Nifty 50 is carried out in this paper. It also tries to find out if the macroeconomic variables have any relation with the industry stock indices of the National Stock Exchange. Secondary data pertaining to the period from April 2000 to March 2015 was collected for six selected macroeconomic variables and eleven industry indices. The analysis carried out in the study came to identify that except Nifty Metals and Nifty Media all other indices including Nifty 50 are influenced by the six macroeconomic variables selected for the study. The regression analysis conducted to understand the collective impact of macroeconomic variables on Nifty 50 gave the results that the index can be predicted the best using the model formulated using only three macroeconomic variables namely, US Dollar, M3 and gold prices.*

**Key Words:** Macroeconomic variables, Nifty 50, Indian stock market, industry indices, predictability model.

### Introduction

The financial markets provide a platform for the mobilization of funds from saving public to business and industries and vice versa. Surplus money with the individuals gets transmitted to the areas in need of funds through money market or capital market which together constitute the financial market. Capital markets in general and secondary markets or stock markets in

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**International Research Journal of Management and Commerce (IRJMC) ISSN: (2348-9766)**

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particular, play a vital role in the flow of money in an economy. The undeniable prominence of the stock markets in investment decisions began with the introduction of limited liability concept. The concept was introduced for the first time by the United Kingdom under Limited Liability Act, 1855(Malik, 2006). The limited liability concept led to the increased involvement of public investors into share market which also encouraged individual and institutional investors to go for risky investments (Malik, 2006). This makes a study of investments in the stock market and their influencing factors significant.

There are several factors that affect the stock market fluctuations. India is an emerging economy and it is generally considered that the stock exchanges of emerging economies are more volatile in nature. This makes the macro economic factors of the country play a crucial role in its stock market dynamics.

The dynamics of the financial markets are studied based on fundamental and technical analysis. The performance of an enterprise is evaluated by analyzing its financial statements. The financial statements provide information about the true and fair position of the company. The company's activities and accomplishments are influenced a lot by the macroeconomic factors, industry factors and the internal factors of the organization. The detailed study of the economy as a whole; the industry in which the company belongs to and the financial statements which give an insight into the company's state of affairs is known as fundamental analysis. Fundamental analysis entails the use of information in current and past financial statements, in conjunction with industry and macroeconomic data to arrive at a firm's intrinsic value (Kothari, 2001).

"In general, I believe that fundamental analysis has more value than technical analysis because it provides a much deeper framework for valuing stocks or bonds than just looking at patterns in past price movements," says Andreas Sauer, as cited in Harrington (2003, p. 36-37). For an investment decision which has a long term perspective the best and the most reliable method is to evaluate the stocks using fundamental analysis ratios (Samaras, Matsatsinis, & Zopounidis, 2008). In the light of the arguments put forward by these researchers, this study tries to understand the predictability of the index of National Stock Exchange of India, Nifty 50 using the macroeconomic fundamentals.

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**Review of literature**

Chen (2009) focuses on the US stock market and investigates its stock returns using the monthly returns on the S&P 500 price index from 1957 to 2007. Yield spreads (the difference between the 3-Month Treasury Bill Rate and the 10-Year Treasury Constant Maturity Rate, and the difference between the 3-Month Treasury Bill Rate and the 5-Year Treasury Constant Maturity Rate), inflation rates (consumer prices), money stocks (M1 and M2), aggregate output (industrial production), unemployment rates, federal funds rates, nominal effective exchange rates, and federal government debts are the other variables considered by the researcher. Unit root tests conducted on the variables led to the rejection of all the hypotheses which indicates to the absence of a unit root in the series being tested. The researcher states that term spreads and inflation rates are the most useful predictors of recessions in the US stock market, according to both in-sample and out-of-sample forecasting performance. He further states that macroeconomic variables can be useful in predicting bear markets than returns in the stock market.

Kumar and Puja (2012) studied the Granger causality based on VECM conducted between Sensex and macroeconomic variables in India and found that no unidirectional or bidirectional causality existed between Sensex and macroeconomic variable with IIP as an exception. On the other hand, long run causal relationship is found in the direction from a few macroeconomic variables like money supply, and interest rates to stock prices.

Long run and short run co-integration techniques like Johansen and Juselius multivariate co-integration technique and multivariate VECM were used by Srinivasan (2011)to establish the relationship between six macroeconomic variables and NSE-Nifty in India. The study disclosed that the NSE-Nifty share price index has a significant positive long-run relationship with money supply, interest rate, index of industrial production, and the US stock market index but significant negative relationship exists between the NSE-Nifty share price index and exchange rate in the long run. The multivariate VECM reveals that there is a strong unidirectional causation running from interest rate and the US stock market return to NSE stock market return in India.

An empirical analysis conducted by Sampath (2011) on the relation between BSE-Sensex and macroeconomic variables like index of industrial production, real effective exchange rate and

wholesale price index was conducted based on a time series data ranging from April 1993 to March 2010. The study revealed that the selected macroeconomic variables are co-integrated with the BSE stock index in India and they have statistically significant long-run effect on stock prices.

The exchange rates' influence on the stock market was investigated in a research work where data pertaining to eight years period starting from 2004 to 2012 was collected. The variables selected for the study are USD/INR exchange rate and SENSEX and Nifty 50 as independent and dependent variables respectively. The granger causality test revealed that over the course of 8 years there exists no relationship between exchange rates and stock market. However, Correlation result shows that there is very low degree of positive relationship between the two (Gulati & Kakhani, 2012).

Ray and Sarkar (2014) in their paper attempted to investigate the dynamic relation between the stock market and the select macroeconomic variables at log-levels, in India, for the period January 1991 to April 2008. Findings of the study show that the long-run stock market behavior is positively related to output and exchange rate, and negatively related to short- and long-term interests, money supply and inflation. The results of the causality and innovation analysis suggest that the stock market influences the economic activities, more specifically the industrial activities and the market is expected to be more sensitive to the shocks of itself over the projected period of the study.

Mohanamani and Sivagnanasithi (2012)analysed the nature and extent of foreign institutional investment in India to study the relationship between foreign institutional investment and stock indices. The data collected pertains to the period of 2000-2010 and was collected from official sources of BSE, NSE and the SEBI. The dependent and independent variables of the study were market indices (SENSEX and NIFTY) and FIIs respectively. A simple linear relationship wasshown between these variables with the help of correlation and regression as the data analysis tools. In the study, the researchers found out that, FIIs tend to buy and sell stocks in bulk and tend to create major withdrawal effects when they leave. It was also found that Foreign Institutional Investment and movement of SENSEX and Nifty are closely correlated in India. The Movement of FII has significant influence on the movement of stock market indices.

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Several other researchers have also carried out studies which try to find out the relation between macroeconomic variables and stock market indices in India and abroad and have come out with contradictory outcomes in the previous years. Hsing (2011) in his research came to the conclusion that selected macroeconomic variables either positively or negatively influence the stock market indices of South Africa.Likewise, Ozcan (2012) came out with the conclusion that there exists high relationship between the Istanbul Stock Exchange index and the macroeconomic variables. At the same time Balint (2010) came with the results of her research that the correlation between macroeconomic variables and thirty stocks listed in Bucharest Stock Exchange were weak and insignificant. This result was substantiated by a research by Lupu and Calin (2014)in which they came to a conclusion that except for the stock indices of the country of Slovenia, all other nations in Europe taken for the study indicated very low dependency between macroeconomic variables and stock indices.

## Problem of the study

An empirical analysis on the relation between BSE-Sensex and macroeconomic variables like index of industrial production, real effective exchange rate and wholesale price index was conducted based on a time series data ranging from April 1993 to March 2010. The study revealed that the selected macroeconomic variables are co-integrated with the BSE stock index in India and they have statistically significant long-run effect on stock prices (Sampath, 2011)

Studies concerning macroeconomic variables and stock market movements have been carried out in various countries. India as an emerging economy and also an economy which is looked forward as a future financial super power by all the other nations needs to get updated in this respect. Several fruitful studies have been carried out taking Bombay Stock Exchange index, SENSEX and National Stock Exchange index, Nifty 50 into consideration. This study thus focuses on this aspect and tries to enlighten the relationship between a few selected macroeconomic variables and Nifty 50.

## Objectives of the study

The study was undertaken with the following objectives:

1) To identify thelevel of correlation between all selected macroeconomic variables with all the industry stock indices.
2) To identify relation between the selected macroeconomic variables and the stock market.

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3) To identify a fitting model for the prediction of Nifty 50.

## Significance of the study

Stock market investments are being done by different classes of people from many walks of life. Researches in this area have followed different dimensions and established new theories and models which have facilitated the investment decisions of all kinds of investors. Academicians from finance and economics have been fascinated with the developments in the stock markets and the dynamics they have showcased over the years.

The growth of Indian financial markets has been phenomenal in the post liberalization period. As per the reports of SEBI, the number of registered corporate brokers increased from 3316 in 2000-01 to 4917 in 2013-14 and the number of registered sub-brokers increased from 5675 in 2000-01 to 51885 in 2013-14, which counts to 48 percentage and an unbelievable 814 percentage increase respectively (SEBI, 2010; 2014). The market capitalization of NSE has increased from Rs. 6,578,470 million in 2000-01 to Rs. 72,777,200 million in 2013-14(National Stock Exchange, 2008; 2010; 2014). There have been ups and downs in this journey which is well complemented by the growth of market participation. The average daily turnover over these years has increased from Rs. 53,367 million to Rs. 111,892 million (National Stock Exchange, 2008; 2010; 2014). NSE also witnessed a 134 percentage (720 in 2000-01 to 1688 in 2013-14) rise in the number of listed companies within this time frame. The introduction of internet stock trading in Capital Market Segment at NSE in February, 2000 led to an increasingly rising pattern in average turnover of NSE till 2005-06. With the introduction of NSE InfoTech Services Ltd., the average turnover almost doubled when compared to preceding years (Singh & Kaur, 2011). This shows that the establishment of online platforms has increased the participation of retail investors as well.

A majority of the retail investors are not quite familiar with any of the analysis of stock market prices. Rather, they are moved by the sudden fluctuations in the indices and also by the rumours. Hence, when the market prices fall, they come across heavy losses which ultimately will make them recede from the market. The long term impact of this on the economy is lack of sufficient capital investment. One of the most important factors that fundamentally affect the stock market prices is the movements in the macroeconomic variables. The study is aimed at providing a new insight into the investment decisions of the retail investors as well as the portfolio managers by

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observing and analyzing macroeconomic variable movements. The study undertaken, therefore, has a significance in the modern financial era.

**Research methodology**

**Design**

As the current research is aimed at giving an insight into the relationship between the stock prices and macroeconomic variables and lays a strong foundation and a platform for further study in the discipline, the study has an exploratory design.

**Data and Methodology**

The study is focused on the past movements of the stock market and other macroeconomic variables in India. The information required for analysis, thus, is historically available. Hence, rather than primary data, secondary data is used in the study.

Monthly closing price of each index was taken as the data for analysis. The data used was for time period from April, 2000 to March, 2015. Index of the National Stock Exchange, Nifty 50 and the sector based indices of the exchange, namely, Nifty Bank, Nifty IT, Nifty Pharma, Nifty Media, Nifty Metals, Nifty Finance, Nifty Energy, Nifty FMCG, Nifty Auto and Nifty Realty, are used in the study as NSE is the stock exchange that has the highest volume of trade in India. The entire eleven indices are taken into consideration for the analysis. There are sector indices which had its inception after the initial years of the period of study. Hence, data available from the date of their inception only is considered for such analysis. The data relating to the indices were collected from the official website of the National Stock Exchange. The index of IT sector Nifty IT was initially introduced with a base value of 1000. However, on 1$^{st}$ May 2004 this was reconstructed into 100. So, for the purpose of the study, the initial years' index values are converted from base 1000 to base 100.

Selection of macroeconomic variables was done in two stages. From the works of Maysami, Howe and Hamzah (2004), Ang and Piazzesi (2003), Zarnowitz (1992) and Bhatia and Jain (2013), a list of macroeconomic variables were selected in the first stage. The correlation of these macroeconomic variables with Nifty 50 was calculated and those variables which had the highest correlation with Nifty 50 were selected for the final study in the second stage. The finally selected macroeconomic variables are Gross Domestic Product (GDP), Consumer Price Index

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(CPI) as inflation rate, Broad Money Supply (M3), Exchange Rate of U S Dollar (USD), International Oil Prices (OP) and International Gold Prices (GP). In the data collection process, it was found that some variables like CPI and GDP had different base periods for their calculations. To attain uniformity in the values, the values of each variables were brought under one base year. In the case of Consumer Price Index (CPI), the values obtained were converted to conform with base year 1999, and in the case of GDP, quarterly values were obtained for base years 1999-2000 and 2004-2005. As monthly values were not available, the quarterly values were equally divided into three for the three months pertaining to the quarter. Along with that, the data for all fifteen years were brought under the base year 1999-2000.The statistics related to these variables are collected from the official websites of Reserve Bank of India, Ministry of Statistics and Programme Implementation, Securities and Exchange Board of India, www.indexmundi.com, www.inflation.eu (Worldwide Inflation Data) and World Gold Council.

**Analysis tools**

For selecting the variables, that is, finalizing the six macroeconomic variables, simple correlation was carried out between all the macroeconomic variables and Nifty 50. The six variables which depicted highest correlation were selected to be put to further analysis. For accomplishing the objective of identifying relation between the selected macroeconomic variables and the stock market, both simple and multiple regression was carried out at 95% level of confidence.

**Analysis and interpretation**

The study looks into the correlation of all the macroeconomic variables with all the industry stock indices individually. This gives us a holistic view into the relation between these variables when taken individually. Table 1 provides these values and also gives the results as to whether the relation is adequate, moderately adequate or inadequate. The classification is made as mentioned below.

- Highly adequate – those values which are greater than or equal to 0.75
- Moderately adequate – those values which are more than or equal to 0.50 and below 0.75.
- Inadequate – All values below 0.50

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# Table 1

## Correlation between all selected macroeconomic variables and the industry indices

| Variables | | GDP – At Factor Cost (Rs Crs) [adjusted] | CPI | M3 (In Crs) | USD vs INR | OIL PRICES | Gold Prices (Rs. Per troy ounce) |
|---|---|---|---|---|---|---|---|
| NIFTY 50 | Correlation | 0.937 | 0.905 | 0.925 | 0.517 | 0.848 | 0.860 |
| NIFTY 50 | Result | Adequate Model | Adequate Model | Adequate Model | Moderately Adequate Model | Adequate Model | Adequate Model |
| NIFTY Auto | Correlation | 0.879 | 0.924 | 0.924 | 0.795 | 0.672 | 0.789 |
| NIFTY Auto | Result | Adequate Model | Adequate Model | Adequate Model | Adequate Model | Moderately Adequate Model | Adequate Model |
| NIFTY Bank | Correlation | 0.941 | 0.930 | 0.942 | 0.568 | 0.814 | 0.877 |
| NIFTY Bank | Result | Adequate Model | Adequate Model | Adequate Model | Moderately Adequate Model | Adequate Model | Adequate Model |
| NIFTY Energy | Correlation | 0.846 | 0.743 | 0.781 | 0.236 | 0.786 | 0.757 |
| NIFTY Energy | Result | Adequate Model | Adequate Model | Adequate Model | Inadequate Model | Adequate Model | Adequate Model |
| NIFTY Finance | Correlation | 0.904 | 0.902 | 0.915 | 0.657 | 0.697 | 0.812 |
| NIFTY Finance | Result | Adequate Model | Adequate Model | Adequate Model | Moderately Adequate Model | Moderately Adequate Model | Adequate Model |
| NIFTY FMCG | Correlation | 0.917 | 0.977 | 0.971 | 0.812 | 0.852 | 0.906 |
| NIFTY FMCG | Result | Adequate Model | Adequate Model | Adequate Model | Adequate Model | Adequate Model | Adequate Model |
| NIFTY IT | Correlation | 0.879 | 0.904 | 0.906 | 0.660 | 0.790 | 0.811 |
| NIFTY IT | Result | Adequate Model | Adequate Model | Adequate Model | Moderately Adequate Model | Adequate Model | Adequate Model |
| NIFTY Media | Correlation | 0.160 | 0.190 | 0.192 | 0.025 | 0.075 | -0.031 |

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| NIFTY Media | Result | Inadequate Model | Inadequate Model | Inadequate Model | Inadequate Model | Inadequate Model | Inadequate Model |
|---|---|---|---|---|---|---|---|
| NIFTY Metal | Correlation | 0.453 | 0.322 | 0.362 | -0.105 | 0.396 | 0.387 |
| NIFTY Metal | Result | Inadequate Model | Inadequate Model | Inadequate Model | Inadequate Model | Inadequate Model | Inadequate Model |
| NIFTY Pharma | Correlation | 0.895 | 0.947 | 0.945 | 0.769 | 0.777 | 0.834 |
| NIFTY Pharma | Result | Adequate Model | Adequate Model | Adequate Model | Adequate Model | Adequate Model | Adequate Model |
| NIFTY Realty | Correlation | -0.722 | -0.730 | -0.729 | -0.731 | -0.476 | -0.764 |
| NIFTY Realty | Result | Adequate Model | Adequate Model | Adequate Model | Adequate Model | Inadequate Model | Adequate Model |

Source: Calculated by the researcher

From the above table it is observed that some of the relations are highly significant but there are a few indices which do not have any relation with the macroeconomic variables. Those indices which do not reflect even simple correlation with the macroeconomic variablesare not investigated in detail in the process of analysis which will be explained in the coming sections.

While analysing the table, it is found that Nifty Media and Nifty Metals do not have simple correlation with any of the macroeconomic variables under study. This may be due to the reason that, the indices are not being considered as an attractive investment avenue by the investors as they consider the banking and IT sector companies. Along with these indices inadequate relation could be found when USD is correlated with Nifty Energy and the oil prices with Nifty Realty. These relations are of least significance that their causality and prediction capability has limited value when considered individually.

**Relation between the selected macroeconomic variables and the stock market.**

The analysis gives an insight as to those variables having a collective impact on the movements of Nifty 50. The R-squared ($R^2$) is a statistic that measures the explanatory or predictive power of a regression model. It is commonly known as coefficient of determination. It is a goodness-of-fit measure, indicating how well the linear regression equation fits the data. The higher the value

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of $R^2$, the more dependent is the variable on the independent variables. The variables are considered to be influencing each other only if the $R^2$ value exceeds 0.50.

The research tried to analyse if the selected macroeconomic variables are collectively leading to the movements in Nifty 50. To investigate this, multiple regression (backward) was adopted so as to provide an equation that will help in the prediction of the index.

**Table 2**

**Table Showing Result of Multiple Regression Analysis by Keeping Nifty 50 as Dependent**

| | Model | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | R | $R^2$ | Adjusted $R^2$ |
|---|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | | | |
| 1 | (Constant) | 7116.144 | 958.540 | | 7.424 | 0.000 | 0.978 | 0.957 | 0.955 |
| | GDP | 0.003 | 0.002 | 0.122 | 1.371 | 0.172 | | | |
| | CPI | -7.785 | 9.963 | -0.188 | -0.781 | 0.436 | | | |
| | M3 | 0.001 | 0.000 | 1.863 | 7.267 | 0.000 | | | |
| | USD | -151.004 | 12.620 | -0.422 | -11.965 | 0.000 | | | |
| | Oil Prices | 0.064 | 0.049 | 0.052 | 1.290 | 0.199 | | | |
| | Gold Prices | -0.049 | 0.005 | -0.624 | -9.752 | 0.000 | | | |
| 2 | (Constant) | 6612.234 | 708.351 | | 9.335 | 0.000 | 0.978 | 0.957 | 0.955 |
| | GDP | 0.003 | 0.002 | 0.136 | 1.560 | 0.121 | | | |
| | M3 | 0.001 | 0.000 | 1.683 | 15.034 | 0.000 | | | |
| | USD | -155.367 | 11.305 | -0.434 | -13.743 | 0.000 | | | |
| | Oil Prices | 0.063 | 0.049 | 0.051 | 1.274 | 0.205 | | | |
| | Gold Prices | -0.050 | 0.005 | -0.636 | -10.196 | 0.000 | | | |
| 3 | (Constant) | 6849.286 | 684.671 | | 10.004 | 0.000 | 0.978 | 0.956 | 0.955 |
| | GDP | 0.003 | 0.002 | 0.126 | 1.455 | 0.148 | | | |
| | M3 | 0.001 | 0.000 | 1.716 | 15.758 | 0.000 | | | |
| | USD | -159.148 | 10.927 | -0.445 | -14.564 | 0.000 | | | |
| | Gold Prices | -0.048 | 0.005 | -0.605 | -10.480 | 0.000 | | | |
| 4 | (Constant) | 7685.000 | 373.536 | | 20.574 | 0.000 | 0.978 | 0.956 | 0.955 |

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|---|---|---|---|---|---|---|---|---|
| M3 | 0.001 | 0.000 | 1.845 | 28.863 | 0.000 | | | |
| USD | -168.489 | 8.869 | -0.471 | -18.997 | 0.000 | | | |
| Gold Prices | -0.047 | 0.004 | -0.591 | -10.351 | 0.000 | | | |

Dependent Variable: Nifty 50

Source: Calculated by the researcher

In the multiple regression analysis Nifty 50 was taken as the dependent variable and all the selected macroeconomic variables were taken as independent variables. This produced several models which can be understood from table 2. The table shows four models which eliminates each variable moving from the first to the fourth model.

Model 1 includes all the independent variables under study where we can see that the $R^2$ value is 0.957 which is considerably higher than 0.50. This can be said to be a fit model, but while observing the t values and the p values (mentioned in column named "sig"), we can understand that there are certain variables which do not significantly contribute to the model. Variables with high t value and p values which is lesser than 0.05 are the variables that explains model significantly. In model 1, three variables namely GDP, CPI and oil prices are found to be insignificant as the p values are far greater than 0.05. However, after eliminating CPI that is the variable having the highest p value the other two were retained to see whether these two variables, namely GDP and oil prices have any collective impact on Nifty 50. The second model analyses the impact of the five variables on Nifty 50.

Model 2 is created by eliminating CPI. However, this model does not make any difference in $R^2$, but the t value of the variables other than that of oil prices go up. However, the variables GDP and oil prices are still insignificant. The p value of oil prices is the highest and this variable is eliminated to formulate the next model.

Model 3 is drawn after the elimination of Oil prices. This model also gives a high $R^2$ value of 0.956 but we can find GDP as a variable which does not contribute significantly to the model. The p value of GDP in this model is higher than 0.05 at 0.148. However, the values of all the other variables have gone up in the results.

Model 4 the final model is formulated by eliminating GDP as it does not significantly contribute to the model. The model gives a high $R^2$ value of 0.956 and all the remainingvariables contribute

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quite significantly to the model as all p values are lesser than 0.05. Thus, we can conclude that the prediction of Nifty 50 is best done with the help of Model 4 and the model is drawn as under.

$$Nifty\ 50 = 7685 + 0.001\ M3 - 168.5\ USD - 0.047\ GP$$

Thus multiple regression confirms the collective impact of M3, USD and GP only in the prediction of Nifty 50.

**Findings**

From the analysis done in this study, we can summarise the findings as below.

- In the case of correlation between Nifty 50 and all selected macroeconomic variables, except for US Dollar which indicates only moderate correlation, all other variables indicated high correlation and chance of predictability. The correlation values indicate that there exists high relationship between Nifty industry indices and all selected macroeconomic variables when taken individually except in the case of Nifty Metals and Nifty Media. These indices do not indicate even moderate correlation with any of the macroeconomic variables. The correlation of Nifty Energy and Nifty Realty with US Dollar and oil prices also indicated inadequate relation as in the case of Nifty Media and Nifty Metals.

- The regression analysis indicate that only three macroeconomic variables confirm collective impact on Nifty 50 movement, namely US Dollar, Gold Prices and broad money supply. The model developed with this regression analysis has high $R^2$ value which states that 95.6 percent of the variations in Nifty 50 can be explained with these variables.

**Conclusion**

Some of the cited studies, both national and international, have tried to examine the impact of macroeconomic variables on the stock prices. A few other studies have tried to examine the other reasons for the movement of stock prices. In the present study, it is found that in Indian conditions the prime movers of Nifty 50 are variations in the strength of US Dollar in relation to Indian Rupee, gold prices and broad money supply. Variations in these variables lead to fluctuations in Indian stock market indices.

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