

# Effect of Macroeconomic Variables on Stock Market

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*Abstract: The paper aims to study the effect of macroeconomic factors on the performance of the Indian Stock market Index (BSE: 500) using monthly and yearly data over the time frame of June 2003 to June 2016. The macroeconomic variables are; Inflation, exchange rate, Oil Prices, Gold Prices, Aggregated monsoon. The study also found the correlation between different macroeconomic variables using which they were fitted in the VAR regression model. The long term relation of the Indian stock market was studied with these macroeconomic parameters. The paper also looks at which variables are more significantly related to the Stock market in the long run the domestic macroeconomic variables or global. One of the most significant macroeconomic factor is Gold. Gold prices have an inverse relationship with the price of the dollar. Given the importance of Gold in the global economy, we have analyzed the close correlation between the gold prices and the stock market prices and the factors that have created such relations between gold and stock market.*

## 1. Introduction

The corporate sector is greatly influenced by macroeconomic variables which may be real or financial. This directly impacts the economy's stock market. However, owing to the high degree of interdependence of macroeconomic variables, it is difficult to explain the variation in stock market using independent variables. Extensive literature is available on the effect of macroeconomic variables on the stock market. Our study aims to add to this existing pool of literature by incorporating macroeconomic parameters relevant to the Indian setting. We have studied the effect of several important parameters which include - Exchange Rate, Gold prices, Crude oil prices, Average Rainfall during Monsoon and Inflation on Sensex.

### 1.1. Exchange Rate

If there is an appreciation of domestic currency, imports will be cheaper which indicates a negative relationship between exchange rate and stock return but on the other hand, appreciation of domestic currency means less export which indicates a

negative relationship with the stock return. This makes it necessary to understand the impact of Exchange Rate on Stock Prices.

### 1.2. Inflation

Inflation refers to the sustained increase in price level of goods and services in the country. Increase in Inflation leads to an increase in the company's future cash flow and an increase in dividend, which consequently raises stock prices. This makes it necessary to study the effect of Inflation on Stock Market.

### 1.3. Gold Prices

Gold is an important investment avenue. When gold prices increase, investors are attracted towards the commodity market and away from the equity market. One would thus expect a negative correlation to exist between gold prices and stock market returns. Gold prices are majorly regulated by the supply and demand, and fluctuate periodically on the basis of the market response to the above supply demand variables.

Factors that affect the short term gold prices are majorly dependent on the central bankers' policy who lease out bullion loans and charge an interest rate that is also repayable in gold. Thus the short term gold prices are positively related to the lagged gold price and negatively related to the gold lease rate decided by the central bankers.

The factors that affect the gold prices in the long run period is the inflation rate; gold prices are known to rise proportionally with the inflation rate.

### 1.4. Oil Prices

Since India imports most of its oil from the international market, higher oil prices will lead to an increase in cost of production of firms, resulting in decreasing profit margins and hence lower stock prices. The relationship between oil prices and stock prices is thus negative.

### 3. Results

#### 1.5. Average Rainfall in Monsoon

Given that India is still primarily an agrarian economy, monsoon has significant impact on the stock market. Poor monsoon results in increase in cost of production and consequently decrease in profits which adversely affect stock prices. Thus there exists a positive correlation between the average rainfall during the monsoon and the stock market.

## 2. Methodology

The monthly Sensex values are hypothesized to be dependent on certain macro-economic parameters and to test the claim, we ran polynomial regression model; fitting the data of Sensex with various other parameters and checking for relative error magnitude which is indicated by Adjusted R-squared value. The value ranges from 0 to 1 with former indicating no correlation while the latter indicating that there is a complete fit.

Monthly data from 2003 to June 2016 is used in each of the parameters to run a regressive model in R using the inbuilt function and the results analyzed from there were used to develop best overall multinomial polynomial regression model, i.e. the one with best fit and prediction ability without suffering from multicollinearity. Also individual variation of Sensex with all parameters were plotted to visualize the kind of relation existing between them.

### 2.1. Software

R is a free open source software environment for statistical computing and graphics. It works on a variety of platforms and works greatly in the field of data manipulation, calculation and graphical display. It has been used to run the multivariate regression models and make sense out of the large data to understand the exact correlations between the various macroeconomic variables and Stock market prices.

### 2.2. VAR Modeling

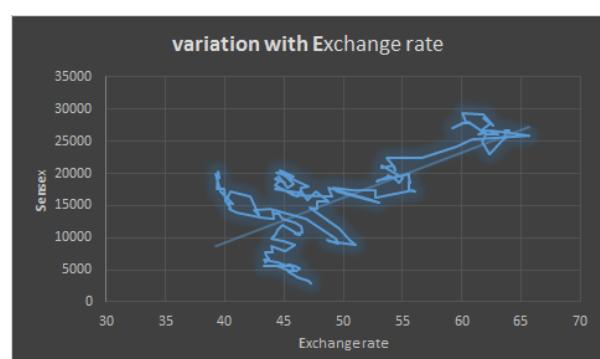
Vector auto regression (VAR) is an econometric model used to assess the linear interdependencies among multiple time series. All variables in a VAR are analyzed symmetrically in a structural sense each variable has an equation explaining its evolution based on its own lags and the lags of the other model variables.

Coefficients	Estimated Std.	Error t	value	Pr (> t )
Intercept	22355.2043	3283.4804	6.808	3.29e-10
Exchange Price	-395.2249	72.7588	-5.432	2.65e-07
Oil prices	-0.7943	0.2484	-3.198	0.00174
inflation	354.8716	109.0058	3.256	0.00144
Gold price	6.2533	0.5218	11.984	2e-16

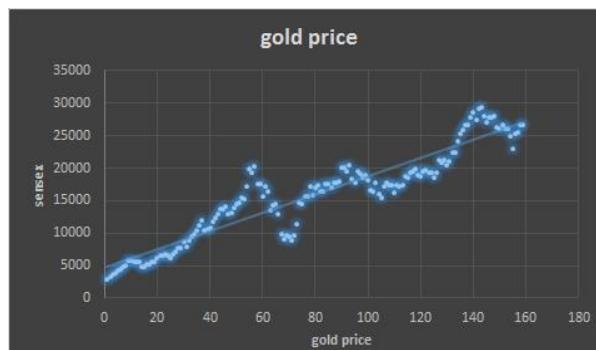
**Multiple R-squared: 0.7577, Adjusted R-squared: 0.7502**

The above table shows the output of our multinomial regression model having exchange rate, and gold price as most significant variables statistically while oil prices and inflation are also very significant variables which supports our hypothesis that Sensex does have a correlation with macro-economic parameters. The adjusted  $R^2$  value is highest in these set of predictor variables as incorporating Avg. rainfall does not improve the model even though it is statistically significant. The reason being existence of multicollinearity between rainfall and inflation. Also, .75 is quite good  $R^2$  value indicating good fit and prediction abilities of our variables.

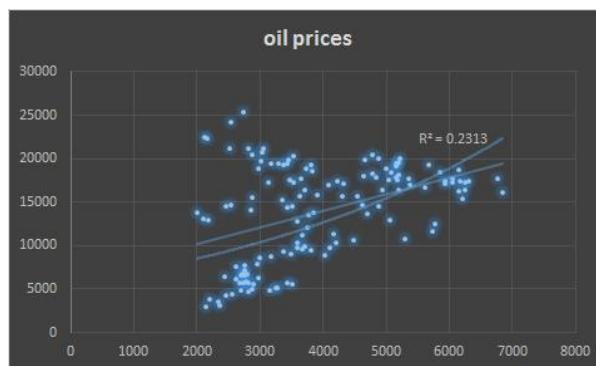
The graphs of Sensex vs individual parameters also show a correlation exists between Sensex and all the predictor variables confirming with the output of our regression model as shown in the table. Even though the  $R^2$  value is not good enough for oil prices and others, still it is a significant variable as the p-value is low. This can be explained due to the fact that Sensex value is very dynamic and shows oscillating behavior, so accuracy in prediction induces a lot of errors, but its averaged value over longer periods of time show correlation with our parameters which can be visualized with the trend lines as well.



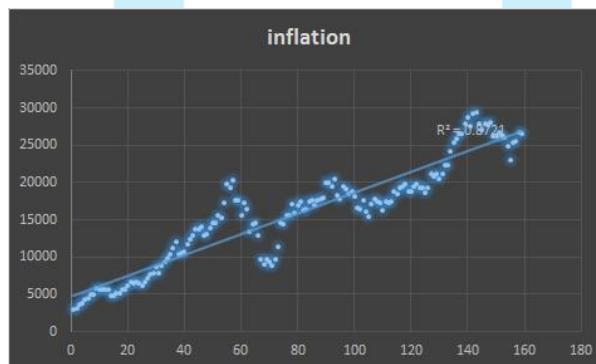
**Figure 1: Variation of Index with Exchange Rate**



**Figure 2: Variation of Index with Gold Prices**



**Figure 3: Variation of Index with Oil Prices**



**Figure 4: Variation of Index with Inflation Rate**

It has been proved that Exchange rate has some serious relation with Stock market prices and has clear relation in its forecasting, thus as a policy implication the RBI should be maintaining suitable exchange rate to keep the Stock market prices in accordance.

Gold prices are closely linked globally and domestically, thus variations in the international market will affect the prices in the domestic market thus having large effects on the Stock prices. The reason why Gold prices and stock prices have a co-movement is because many Indians have started to use gold as an investment option and therefore the co-movement.

#### 4. Acknowledgements

This work was supported from the data from the data obtained from the Bombay Stock Exchange, International data center, Indian Open Data forum.

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