THE IMPACT OF SELECTED MACROECONOMIC VARIABLES ON INDIAN STOCK EXCHANGE

Tank Hetal
Research Scholar
Saurashtra University, Rajkot, India
Email: hetaltank677@gmail.com

ABSTRACT
The objective of this paper is to examine the relationship between various macroeconomic variables and stock market and to find the impact of selected 11 macroeconomic variables on SENSEX. The selected macroeconomic variables for the purpose of this study are Repo rate, Reverse repo rate, SLR, CRR, GDP growth rate, Inflation rate, IIP, CPI, Exchange rate, Gold rate and Oil rate. For this purpose, the statistical tools like multiple correlation and regression is used by researcher.

Keywords: Macroeconomic variables, SENSEX, Stock Exchange

INTRODUCTION
The history has demonstrated that the prices of shares and other financial instruments are a vital part of the economic activity, playing out a pivotal part in the economy of any country. Further, numerous researchers have demonstrated that money markets assume an essential part in monetary success, cultivating capital arrangement and supporting the financial development of the economy. Money markets is a standout amongst the most fundamental segments of a free-showcase economy, as it masterminds capital for the organizations from investors in return for partakes in proprietorship to the financial specialists. Stock trade gives organizations the office to raise capital by pitching offers to the speculator. Stock prices can be considered as a pointer of a nation's monetary status and social mindset and are viewed as a main marker of the genuine financial action. Offer costs likewise influence the abundance of families and their utilization; reserve funds and speculation choices. In this way, one might say that, money markets are a necessary piece of the monetary arrangement of any economy, as it assumes a huge part in channelizing stores, interfacing savers and financial specialists, which prompted financial development of the economy. Further, it is trusted that there exist many components to which the share trading system responds, factors like the monetary, political and socio-social conduct of any nation. Thus, speculators deliberately watch the execution of the securities exchanges by watching the composite market file, before contributing assets. The market list goes about as the measuring stick to look at the execution of individual portfolios and furthermore gives speculators to estimating future patterns in the market. Particularly the securities exchanges of developing economies are probably going to be delicate to crucial changes in macroeconomic structure and arrangements, which assumes a vital part in accomplishing money related steadiness. Being a standout amongst the most vital mainstays of the nation's economy, the share trading system is painstakingly seen by administrative bodies, organizations and speculators. Hence, monetary arrangement creators and analysts watch out for the conduct of money markets, as it's smooth and hazard free operation is fundamental for financial and budgetary strength.
OBJECTIVE

The objective of this research is to find the answer to questions through the application of scientific procedures. The purpose of this research study is to test hypothesis of a causal relationship between variables. Each and every research has its own scientific purposes; the main objective of this study is described as under.

1. To analyze the relationship of Macroeconomic variables like Repo rate, Reverse Repo rate, SLR, CRR, GDP growth rate, Inflation rate, IIP, CPI, Exchange rate, Gold rate, Oil price.
2. To analyze the impact of most significant macroeconomic variables on the stock market indices.
3. To develop a model that helps in showing the relationship between dependent and independent variables.

RESEARCH DESIGN

Sources of the data

The data required for this study be obtained from various secondary sources.

Universe and sampling plan

In order to find out the relationship between Indian stock market indices with the selected macroeconomic variables, research data and information were collected. All of the research data and information were secondary data. It was collected from various data sources which covered between the duration of January 2008 to December 2016. S&P BSE SENSEX, stock market index will be the dependent variable and the selected macroeconomic variables would be the independent variables. In this study, 11 macroeconomic variables like Repo Rate, Reverse Repo Rate, Statutory Liquidity Ratio, Cash Reserve Ratio, GDP Growth Rate, Inflation Rate, Index of Industrial Production, Consumer Price Index, Exchange Rate, Gold Rate and Oil Rate have been selected.

Period of the study

The yearly data of various selected macroeconomic variables were collected for the period starting from January 2008 to December 2016.

Tools and techniques of the study

First of all, the researcher has classified the data and the same is analyzed by using appropriate statistical techniques. In this research study, researcher has used the following tools and techniques.

1. Correlation is used to analyze the relationship of different Macroeconomic Variables,
2. Regression is used to analyze the impact of most significant Macroeconomic Variables on the stock market indices and helps in showing the relationship between dependent and independent variables.

ANALYSIS AND INTERPRETATION

The following table shows the last 9-years data of selected macroeconomic variables and SENSEX.
Here, we have 11 macroeconomic variables like; repo rate, reverse repo rate, SLR, CRR, GDP growth rate, inflation rate, CPI, IIP, exchange rate, oil rate, gold rate. One of the objectives of this study is to analyze the correlation between these macroeconomic variables and to analyze the relation between macroeconomic variables and SENSEX.

With the help of multiple correlation, how each and every macroeconomic variable is correlated with other macroeconomic variables and with SENSEX and in which direction they are correlated, is analyzed.

The following table shows the correlation between different Macroeconomic variables and SENSEX.

**S&P BSE SENSEX**

1. SENSEX has high positive correlation with CPI and Exchange Rate; while it has partial correlation with Repo Rate, Reverse Repo Rate, GDP and IIP.

2. On the other hand, it has negative correlation with CRR, SLR and Inflation Rate.

3. While it has very little or no correlation with Oil Rate.

This is shown in following graph
ANALYSIS USING REGRESSION

Macroeconomic variables which have significant relationship with SENSEX and also significant relationship with each other are used for developing different model to check the impact of most significant macroeconomic variables on the Stock Market Indices and also help in showing the relationship between dependent and independent variables. Multiple Regression is used to develop the models that can be used to forecast the dependent variable.

There are chances that if the correlated variables become the part of regression and they all are affect each other so there is a need to check the model fit between the variables for the multiple regression.

The first model includes CRR, SLR, Inflation Rate, CPI and Exchange Rate. These five macroeconomic variables have significant correlation with SENSEX.

The second model includes CRR, SLR and Inflation Rate. These three macroeconomic variables have significant negative correlation with SENSEX.

The third model includes Gold Rate, Exchange Rate and CPI. These three macroeconomic variables have significant positive correlation with SENSEX.

The forth model includes Oil Rate, IIP, GDP, Reverse Repo Rate and Repo Rate. These five macroeconomic variables have partial correlation with SENSEX.

TEST OF SIGNIFICANCE OF REGRESSION MODELS

The ANOVA tests the acceptability of the model from a statistical perspective. ANOVA is a useful test for checking the model’s ability to explain any variation in the dependent variable. Here, for testing that whether the regression models are significant or not, ANOVA is used by the researcher. The researcher has framed 4 regression models. Out of these 4 models which one is significant can be known by using ANOVA.

The p-value for each term tests the null hypothesis that the coefficient is equal to zero (no effect). A low p-value (<0.05) indicates that you can reject the null hypothesis. In other words, a predictor that has a low p-value is likely to be a meaningful addition to your model because changes in the independent variable are related to changes in the dependent variable.

Conversely, a larger (insignificant) p-value suggests that changes in the independent variables are not associated with changes in the dependent variable.
The following table shows the results of ANOVA test for different models.

<table>
<thead>
<tr>
<th>Model</th>
<th>Particulars</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>Significance F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>Regression</td>
<td>5</td>
<td>3977363801.46</td>
<td>795472760.29</td>
<td>59.91</td>
<td>0.0033</td>
</tr>
<tr>
<td></td>
<td>Residual</td>
<td>4</td>
<td>53110823.15</td>
<td>13277705.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>9</td>
<td>4030474624.61</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 2</td>
<td>Regression</td>
<td>3</td>
<td>3911237938.44</td>
<td>1303745979.48</td>
<td>65.60</td>
<td>0.0002</td>
</tr>
<tr>
<td></td>
<td>Residual</td>
<td>6</td>
<td>119236686.17</td>
<td>19872781.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>9</td>
<td>4030474624.61</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 3</td>
<td>Regression</td>
<td>3</td>
<td>3913819975.09</td>
<td>1304606658.36</td>
<td>67.10</td>
<td>0.0002</td>
</tr>
<tr>
<td></td>
<td>Residual</td>
<td>6</td>
<td>116654649.53</td>
<td>19442441.59</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>9</td>
<td>4030474624.61</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 4</td>
<td>Regression</td>
<td>5</td>
<td>3876880466.64</td>
<td>775376093.33</td>
<td>20.19</td>
<td>0.0162</td>
</tr>
<tr>
<td></td>
<td>Residual</td>
<td>4</td>
<td>153594157.97</td>
<td>38398539.49</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>9</td>
<td>4030474624.61</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Here, we can see that for first model, the value of significance is 0.0033, which is less than 0.05. It suggests that the model is significant. It means that changes in the independent variables are associated with changes in the dependent variable.

2. In second model, the significance value is very little (0.0002). That’s why we can say that the model is significant to explain the variations in the dependent variable.

3. In third model, also the value of significance is 0.0002 which is less than 0.05. It indicates that the table is able to explain the changes in the dependent variable.

4. In forth model, the significance value is 0.0162, which is less than 0.05. So, we can say that this model is significant to explain the probable variations in dependent variable due to changes in independent variables.

5. As the above table in indicates that all four models are significant because the significance value for all these models is less than 0.05. But the model-2 and model-3 is better than the remaining two models. Because their significance value is very near to zero or we can say that it is almost zero.
6. The second model includes CRR, SLR and Inflation Rate. These three macroeconomic variables have significant negative correlation with SENSEX. So, the changes in these 3 independent variables cause a significant change in SENSEX (dependent variable).

The third model includes Gold Rate, Exchange Rate and CPI. These three macroeconomic variables have significant positive correlation with SENSEX. So, we can say that these 3 macroeconomic variables are significant to explain the probable changes in SENSEX.

**ANALYSIS OF REGRESSION STATISTICS**

The following table shows the regression statistics of different models.

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple R</td>
<td>0.9934</td>
<td>0.9851</td>
<td>0.9854</td>
<td>0.9808</td>
</tr>
<tr>
<td>R Square</td>
<td>0.9868</td>
<td>0.9704</td>
<td>0.9711</td>
<td>0.9619</td>
</tr>
<tr>
<td>Adjusted R Square</td>
<td>0.7236</td>
<td>0.7939</td>
<td>0.7947</td>
<td>0.6738</td>
</tr>
<tr>
<td>Standard Error</td>
<td>3643.8586</td>
<td>4457.8898</td>
<td>4409.3584</td>
<td>6196.6555</td>
</tr>
</tbody>
</table>

1. In first model, the Adjusted R-square is 0.7236. It suggests that 72.36% of the variance in the dependent variable or outcome variable explained by the independent or predictor variable. In our first model, we have 5 independent variables like CRR, SLR, Inflation Rate, CPI and Exchange Rate. It means in first model, 72.36% of the variance in the SENSEX explained by the CRR, SLR, Inflation Rate, CPI and Exchange Rate.

2. In second model, the Adjusted R-square is 0.7939. It suggests that 79.39% of the variance in the dependent variable or outcome variable explained by the independent or predictor variable. In our first model, we have 3 independent variables like CRR, SLR and Inflation Rate. It means in second model, 79.39% of the variance in the SENSEX explained by the CRR, SLR and Inflation Rate.

3. In third model, the Adjusted R-square is 0.7947. It suggests that 79.47% of the variance in the dependent variable or outcome variable explained by the independent or predictor variable. In our first model, we have 3 independent variables like Gold Rate, Exchange Rate, CPI. It means in first model, 79.47% of the variance in the SENSEX explained by the Gold Rate, Exchange Rate and CPI.

4. In forth model, the Adjusted R-square is 0.6738. It suggests that 67.38% of the variance in the dependent variable or outcome variable explained by the independent or predictor variable. In our first model, we have 5 independent variables like Oil Rate, IIP, GDP, Reverse Repo Rate and Repo Rate. It means in first model, 67.38% of the variance in the SENSEX explained by the Oil Rate, IIP, GDP, Reverse Repo Rate, Repo Rate.

From the above table: 4.4, we can see that the Adjusted R-Square of Model-3 is 0.7947, which is more than that of remaining three. So it suggests that Model-3 is better than the remaining three. Because in Model-3, 79.47% of the variance in the SENSEX explained by the Gold Rate, Exchange Rate and CPI.

**FINDINGS OF THE STUDY**

From the above study, the researcher can conclude the following points:

**Multiple correlation analysis**

1. The correlation study says that SENSEX has high positive correlation with CPI and Exchange Rate. It means if the CPI and Exchange Rate increases at that time the SENSEX will also increase and vice-a-versa.
2. While, it has partial correlation with Repo Rate, Reverse Repo Rate, GDP and IIP. It means if there is any change in all these macroeconomic variables then it has the less impact on SENSEX.

3. On the other hand, it has negative correlation with CRR, SLR and Inflation Rate. It means if the CRR, SLR and Inflation Rate increases at that time the SENSEX will decrease and vice-a-versa.

4. While it has very little or no correlation with Oil Rate. It suggests that the changes in oil rate made little or no impact on SENSEX.

Regression analysis

1. The ANOVA test indicates that all four models are significant because the significance value for all these models is less than 0.05. But the model-2 and model-3 is better than the remaining two models. Because their significance value is very near to zero or we can say that it is almost zero.

2. The second model includes CRR, SLR and Inflation Rate. These three macroeconomic variables have significant negative correlation with SENSEX. So, the changes in these 3 independent variables cause a significant change in SENSEX (dependent variable).

3. The third model includes Gold Rate, Exchange Rate and CPI. These three macroeconomic variables have significant positive correlation with SENSEX. So, we can say that these 3 macroeconomic variables are significant to explain the probable changes in SENSEX.

From the analysis of regression statistics, we can see that the Adjusted R-Square of Model-3 is 0.7947, which is more than that of remaining three. So, it suggests that Model-3 is better than the remaining three. Because in Model-3, 79.47% of the variance in the SENSEX explained by the Gold Rate, Exchange Rate and CPI.

CONCLUSION

The study reveals that SENSEX has high positive correlation with CPI and Exchange Rate. On the other hand, it has negative correlation with CRR, SLR and Inflation Rate. Regression analysis reveals that Model-3 is better than the remaining three. Because in Model-3, 79.47% of the variance in the SENSEX explained by the Gold Rate, Exchange Rate and CPI.

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