# Exploring the Inter-Linkages of Macroeconomic Variables and Stock Performance: The Case of Indian Post Financial Reforms

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## Abstract

*The last wave of financial reforms introduced in the Indian economy in the early 90s was effective and growth-oriented, but the current economic constraints require another wave of reforms. Accordingly, there is a need to undertake impact assessment of financial liberalizations at various levels. The present research fills this gap by examining the relationships between various macroeconomic variables and Indian stock market performance. Secondary data based analysis was conducted to assess the financial impact and volatility consequences on two leading Indian stock indices - Sensex & NIFTY. Seven most used macroeconomic variables - GDP, Interest rate, Inflation rate, Foreign exchange, Gold price, FDI, FIIs were collected for the past two decades to undertake the analysis. ADF unit root, Johnson co-integration, VAR model, Granger casualty, ARCH and GARCH models were utilized. The findings of this study offer clear insights into the relationship between selected variables and stock market performance. Implications of this research for theory and practice are discussed.*

*Keywords: Financial reforms, Stock market, Macroeconomic, FDI, FIIs, Inflation rate.*

## Introduction

Indian economy unfolded with two economic waves – one starting in 1950 and continued for four decades, and another one beginning in early 90s. In the second phase, India recorded fastest growth rates that lasted for more than a decade. This development changed the pace of the economy worldwide, and led India to be recognized as a large market for global investments across the globe. Numerous parameters of growth saw upsurge in this phase including per capita income, life style, industrial development, rapid expansion of service sector, capital market phenomenal growth and intellectual human capital.

When we delve into the lower growth rate issues during the first wave, it is easy to detect that the contributing factors which added immense boost to the economy in the post-financial reforms were missing in those years. Accordingly, the input of only a few variables actually pushed the economy till the 90s. A question to ponder, then, is why the Indian economy is stagnant in the past one decade, despite the presence of all factors which were there in the post-reform era. We delve into this aspect in the present study.

Observing the economy in the present scenario, it is argued that the missing factors are sustainability, inclusive growth and financial inclusion; and these gaps can be filled with the second stage of reforms. What will the second stage of reforms propose is a question of further research? Particularly, the involvement of all compositions calls for critical valuations and a policy design is required accordingly.

Undoubtedly, the Indian economy requires eradicating the sluggishness again to accelerate with a high pace, but there is no single parameter or component which forms the essence base and can lead to substantial contribution. However, researchers are still unclear of the positive and negative effects of the predominant macroeconomic variables.

Studies have been conducted in large numbers to understand the causes of economic development, but little research has been conducted about these inter-linkages in the case of India. Current research attempt is an effort in the same direction where all macroeconomic issues have been considered for exploring and understanding their contributions in the economic growth. Further, in the broader sense, this research has also tried to underlie the contributions of actual inputs behind the unparalleled transformation changes in the growth phase in last two decades.

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**Objectives of the Study**

The present study aims to achieve the following objectives:

1. To examine the contribution of selected macroeconomic factors in Indian development.
2. To understand the inter linkages between these variables.
3. To observe further opportunities for economic development through select macroeconomic variables.

**Review of Literature**

Chen *et al.* (1986) in their research concluded that macroeconomic variables significantly impact economic growth. Further, the authors argued that macroeconomic issues explain stock returns as well. Maysami and Koh (2000) empirically proved that the interplay of several macroeconomic variables including inflation, money supply, growth rate, variation of interest rate and exchange rate effects stock market performance. Gan *et al.* (2006) investigated these relationships using Jhonsohan Cointegration tests and found a significant association between stock market index performances and selected seven macroeconomic variables during 1990 to 2003. Kumar and Padhi (2012) found a strong association between Indian stock market BSE and NSE performance with IPI, WPI, Money supply, T-bills rates and Exchange rate.

Karagedikli *et al.* (2013) revealed exchange rate variation effects profitability of stock market performance in New Zealand economy. Ayyoub *et al.* (2011) argued that the existence of significant inflation rate in the Pakistan economy acts negatively at different levels and damages the economic growth on a consistent level. Barro (1995) studied 100 economies' data for the period of 1960 to 1990, and found negative relationships between inflation rate and economic growth rate. Awojobi (2013) study revealed that the economic development of Greece is the result of financial liberalization process which created a direct relationship between trade openness and GDP. Hye (2012) study based on macro-economic issues in the Chinese economy revealed a sound relationship between economic growth, export, import and interest rate.

Bahmani *et al.* (2014) found positive effects of exchange rates on export and import for Chinese trade with United Kingdom for the period of 1978 to 2010. Richard *et al.* (2014) studied the issues of trade deficits for Southeast Asian Nations (ASEAN)-5 countries and provided linkages between macro-economic variables and trade deficits for the period of 1965 to 2011. Pal and Mittal (2011) also pointed to a sound relationship between Indian stock market performance and interest rates, inflation rate, exchange rates and economic GDP. Adjasi *et al.* (2008) found that exchange rates significantly impact stock market valuations. Their study established direct association of foreign exchange market with stock market performance.

Herzer (2010) suggested positive impact of FDI on economic growth utilizing cross-country data of 50 countries. Metwally (2004) explored the direct relationship between FDI and economic growth at Egypt, Jordan and Oman. The findings revealed that export volumes of these three Middle Eastern countries significantly attracted foreign direct investment from European Union. Kandil (2009) found that GDP growth substantially increased with foreign institutional investment. The economic growth of oil-rich region MENA (Middle East and North Africa) countries considerably altered with stock market recital.

Peng and Wang (2014) found a constructive relationship between foreign institutional investor's capital flows and equity return in Chinese economies between the years 2005 to 2011. The findings also revealed that FIIs flow affects the share price pattern with their trading volume. However, Risso *et al.* (2009) established negative relationship between inflation and economic growth in Mexico for the period 1970 to 2007.

Kyereboah et al. (2008) argued that lending rate and inflation rate changes impact stock market performance. The study also showed that poor stock market performance is the major hitch in business growth at the Ghana economy. Further, Aftab *et al.* (2012) found a negative relationship between export volume and volatile exchange rate. Their study also proved that price levels get influence from foreign income volume. Research was explored at all sectoral level exports in Pakistan for the period of 2003 to 2010. Bleaney and Greenaway (2001) found that low income economies dominatingly based export on primary products. Due

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to volatile exchange rates, export volume and growth rates were not always positively related. Further, it was revealed that exchange rate volatility decreases the investment value. If exchange rate is low, overvalued trade volume would push the growth rate down.

Tenreyro (2007) emphasized considerable importance of exchange rate values in the economic growth. It was found that exchange rate volatility never harmed the trade volume, and that the absence of this volatility does not produce any significant gains. Goujon (2006) studied the development determinants of inflation in Vietnam. A sound positive relationship was found between exchange rate variations and excessive money supplies for inflation rate fluctuations.

Yanikkaya (2003) established a relationship between trade openness and economic growth. It argued that only with trade liberalizations, consistent growth rates can be achieved. Also, while trade share of export and import are important, trade intensity also plays a vital role in the expansion of GDP rate. Chakraborty and Nunnenkamp (2008) revealed that capital inflow of FDI pushed the Indian economic growth further after financial reforms. In this phase, the considerable momentum received by manufacturing sectors compared to that of the service sector contributions. Borensztein *et al.* (1998) ascertained a comparative analysis between domestic investment and FDI for productive economic growth and found FDI to be more attractive. Also, the human capital availability was found to be significantly essential in utilizing FDI investments.

Based on the entire literature review, it appears timely and relevant to undertake a comprehensive study taking into consideration these crucial macroeconomic parameters and explore their implications for Indian economy.

**Research Methodology**

In this study, we explored the linkages between various macroeconomic variables and performance of Indian economy. The yearly closing levels of all the selected variables including GDP, Export, Import, Total trade, Trade openness, Inflation Exchange rate, FDI, FIIs, Sensex (Benchmark of BSE), Government Expenditure and Interest rate were considered for a period between 1990 and 2013. Accordingly, data of a total of 23 years were taken for the purpose of analysis. The analysis was undertaken using various econometric tools as highlighted below.

Since the analysis of econometrics can be performed on a series of stationary nature, it was pertinent to check whether or not the series in our data were stationary. In order to confirm the stationary nature of the series, we prepare line graph for each of the series. Further, we performed the Augmented Dickey-Fuller test under the unit root test to confirm whether or not the series are stationary. All these results confirmed the stationary nature of series, thus allowing us to move further with our analysis. With the stationary log series of all the selected variables, we performed the Granger's causality model in order to observe causality between variables.

The Granger (1969) approach to the question of whether x causes y allows to examine how much of the current y can be explained by past values of y, and then to see whether adding lagged values of x improve the explanation. Here y is said to be Granger-caused by x if x helps in the prediction of y, or equivalently if the coefficients on the lagged x's are statistically significant. It is relevant to note that two-way causation is normally the case; x Granger causes y and y Granger causes x. It has to be noted that "x Granger causes y" does not mean that y is an effect or a result of x. Granger causality measures preferences and information content, but does not by itself indicate causality in the more common use of the term.

We followed the application of Granger's causality with the VAR model. The VAR is used for forecasting systems of time series and for analyzing the impact of random disturbances on the system of variables. VAR approach highlights the need for structural modeling by treating endogenous variables in the system as a function of the lagged values of endogenous variables in the system. Finally, we applied the variance decomposition analysis in order to quantify the extent to which the indices are influenced by each other. The variance decomposition provided us with the information about relative importance of each effect in explaining the variables in the VAR.

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## Results

In this section, we present the findings of Granger's causality tests. We started by computing the basic statistics for all the selected twelve series so as to get an insight into the data. For performing the econometric analysis, it was essential for us to make sure that the series under reference were stationary. In order to make the series stationary, we took log of the twelve series on which the further analysis was performed. Log of the eleven series gave the annual volume of all twelve variables under study. Table 1 presents the descriptive statistics of all variables for the period of 20 years (1993-2013). All the counted indexes were varying due to input volume differences of all selected variables.

### Table 1: Descriptive Statistics of all Selected Variables

| | GDP | EXPORT | IMPORT | TOTAL TRADE | TRADE OPENESS | Inflation Rate | Exchange Rate | FDI | FIIs | SENSEX | GOV. EXPEN | INTEREST RATE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 3019625. | 408818.0 | 597478.5 | 1006297. | 27.23003 | 7.332685 | 41.71090 | 12917.51 | 31423.85 | 7870.279 | 483984.9 | 9.890000 |
| Median | 2234594. | 232077.5 | 271203.0 | 503280.5 | 22.92690 | 6.767125 | 44.60250 | 5553.654 | 9348.000 | 4488.970 | 379747.5 | 9.250000 |
| Maximum | 8276665. | 1465959. | 2345463. | 3811422. | 46.05021 | 13.23084 | 48.39530 | 47138.73 | 146438.0 | 20509.09 | 1288763. | 12.00000 |
| Minimum | 692078.0 | 53688.00 | 63375.00 | 117063.0 | 16.91471 | 3.684807 | 30.64880 | 532.0000 | -45811 | 2615.370 | 125927.0 | 8.000000 |
| Std. Dev. | 2203916. | 395964.0 | 642665.0 | 1038080. | 9.249802 | 3.024264 | 6.138186 | 14220.52 | 48489.48 | 6175.723 | 345503.9 | 1.904261 |
| Skewness | 1.042895 | 1.314647 | 1.351790 | 1.337285 | 0.628776 | 0.320417 | -0.735163 | 1.079093 | 1.196265 | 1.028136 | 1.085465 | 0.138609 |
| Kurtosis | 3.033420 | 3.808951 | 3.872329 | 3.845190 | 1.957144 | 1.882345 | 2.012632 | 2.861733 | 3.866722 | 2.544179 | 3.054607 | 1.134242 |
| Jarque-Bera | 3.626362 | 6.306324 | 6.725251 | 6.556393 | 2.224155 | 1.383184 | 2.613960 | 3.897406 | 5.396172 | 3.696692 | 3.929933 | 2.964918 |
| Probability | 0.163134 | 0.042717 | 0.034644 | 0.037696 | 0.328875 | 0.500778 | 0.270636 | 0.142459 | 0.067334 | 0.157497 | 0.140161 | 0.227079 |
| Observations | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |



**Figure No. 1 to 12**

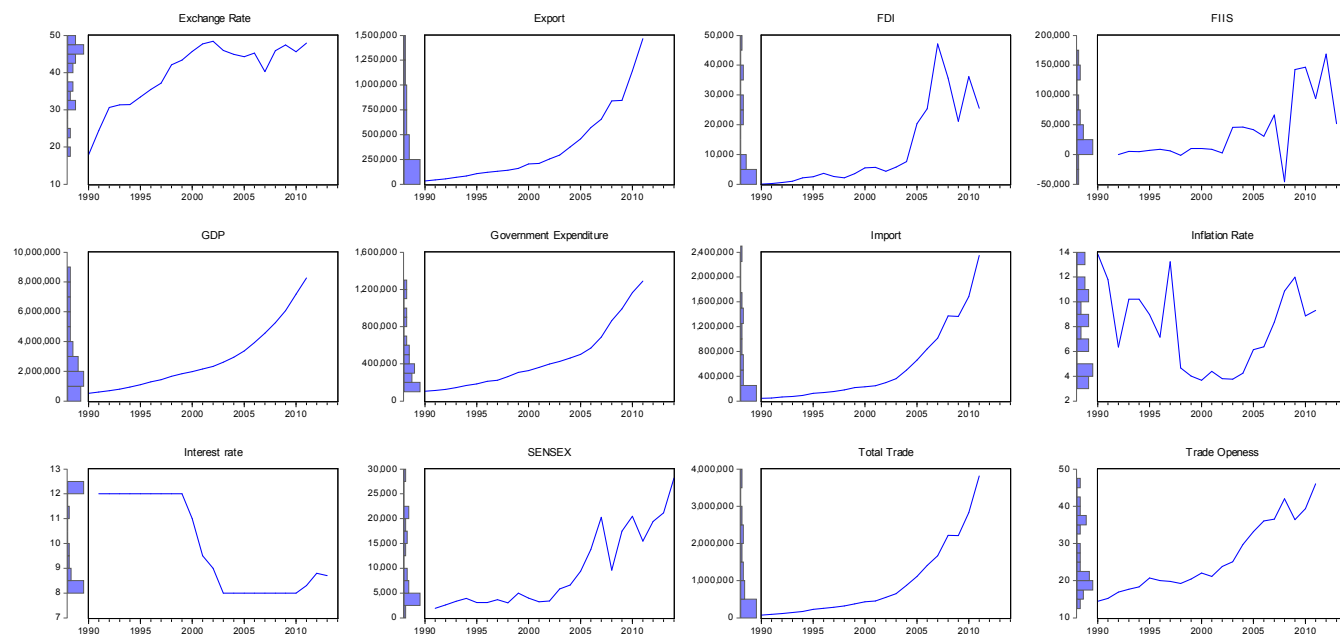| | | | |
|---|---|---|---|
| Figure 1 – Exchange Rate | Figure 4 – FIIs | Figure 7 – Import | Figure 10 – Sensex |
| Figure 2 – Export | Figure 5 – GDP | Figure 8 - Inflation rate | Figure 11 – Total Trade |
| Figure 3 – FDI | Figure 6 – Govt. Exp | Figure 9 – Interest rate | Figure 12 – Trade openess |

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Figures 1-12 show the individual line graphs of the annual volume of all selected variable (GDP, Export, Import, Total trade, Trade openness, Inflation Exchange rate, FDI, FIIs, Sensex, Government Expenditure and Interest rate). Figure 13 shows common line graphs for the twelve variables under study. It is evident from the figures that the series of all twelve variables are stationary in nature.
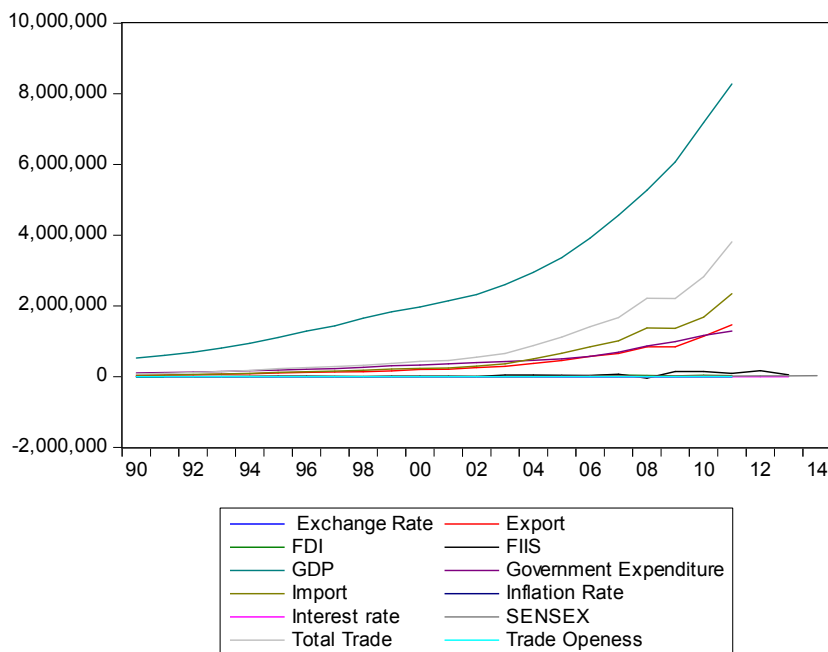


**Figure 13: Common Line Graph for Twelve Varaibles**

In order to further check the stationarity of all series, we performed the correlogram and unit root test analysis. Correlogram analysis was done with twelve legs for all the variables. It was evident that auto correlation values were negative between the 12 lags and the Q statistics were varying all the time. This indicated that none of the series were having serial autocorrelations, and hence were stationary in nature. Accordingly, we accepted the null hypothesis that every individual series is stationary.

Finally, unit-root test was performed on all the series, in order to test the null hypothesis that the series has a unit root. The findings of the unit-root test and the augmented Dickey-Fuller test also confirmed that the series did not have a unit-root, and certified that all series are stationary.

After confirming the stationary nature of the twelve series, we performed the pairwise Granger's causality analysis for all variables. Tables 2, 3, 4, and 5 presented the findings of pairwise Granger's causality for all variables under study with 2 lags. Null hypothesis in the case of Granger's causality model was that "A" does not granger cause "B". On those lines, these tables tested the hypotheses involving the twelve variables in pairs.

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## Table 2: Pair wise Granger Casualty

| Lags: 2 | | | |
|---|---|---|---|
| **Null Hypothesis:** | **Obs** | **F-Statistic** | **Prob.** |
| EXPORT does not Granger Cause EXCHANGE RATE | 20 | 0.23238 | 0.7954 |
| *EXCHANGE RATE does not Granger Cause EXPORT* | | *3.75447* | *0.0476* |
| FDI does not Granger Cause EXCHANGE RATE | 20 | 1.36943 | 0.2843 |
| EXCHANGE RATE does not Granger Cause FDI | | 0.88286 | 0.4340 |
| FIIS does not Granger Cause EXCHANGE RATE | 20 | 0.39265 | 0.6830 |
| *EXCHANGE RATE does not Granger Cause FIIS* | | *6.81773* | *0.0094* |
| GDP does not Granger Cause EXCHANGE RATE | 20 | 0.72441 | 0.5008 |
| EXCHANGE RATE does not Granger Cause GDP | | 2.96814 | 0.0820 |
| GOVERNMENT EXPENDITURE does not Granger Cause EXCHANGE RATE | 20 | 0.79477 | 0.4698 |
| EXCHANGE RATE does not Granger Cause GOVERNMENT EXPENDITURE | | 0.56151 | 0.5819 |
| IMPORT does not Granger Cause EXCHANGE RATE | 20 | 0.27941 | 0.7601 |
| *EXCHANGE RATE does not Granger Cause IMPORT* | | *6.44818* | *0.0095* |
| INFLATION RATE does not Granger Cause EXCHANGE RATE | 20 | 0.35497 | 0.7069 |
| EXCHANGE RATE does not Granger Cause INFLATION RATE | | 0.36739 | 0.6986 |
| INTEREST RATE does not Granger Cause EXCHANGE RATE | 20 | 0.75484 | 0.4883 |
| *EXCHANGE RATE does not Granger Cause INTEREST RATE* | | *4.20723* | *0.0371* |
| SENSEX does not Granger Cause EXCHANGE RATE | 20 | 1.18900 | 0.3335 |
| EXCHANGE RATE does not Granger Cause SENSEX | | 3.46459 | 0.0599 |
| TOTALTRADE does not Granger Cause EXCHANGE RATE | 20 | 0.26765 | 0.7688 |
| *EXCHANGE RATE does not Granger Cause TOTAL TRADE* | | *5.98529* | *0.0123* |
| TRADEOPENESS does not Granger Cause EXCHANGE RATE | 20 | 0.04552 | 0.9556 |
| *EXCHANGE RATE does not Granger Cause TRADE OPENESS* | | *7.18639* | *0.0065* |
| FDI does not Granger Cause EXPORT | 20 | 40.6359 | 9.E-07 |
| EXPORT does not Granger Cause FDI | | 2.27591 | 0.1370 |
| FIIS does not Granger Cause EXPORT | 20 | 97.3497 | 2.E-08 |
| *EXPORT does not Granger Cause FIIS* | | *10.5111* | *0.0019* |
| *GDP does not Granger Cause EXPORT* | *20* | *5.85295* | *0.0132* |
| *EXPORT does not Granger Cause GDP* | | *13.5336* | *0.0004* |
| GOVERNMENTEXPENDITURE does not Granger Cause EXPORT | 20 | 2.42337 | 0.1225 |
| EXPORT does not Granger Cause GOVERNMENT EXPENDITURE | | 24.8759 | 2.E-05 |
| *IMPORT does not Granger Cause EXPORT* | *20* | *9.36982* | *0.0023* |
| *EXPORT does not Granger Cause IMPORT* | | *9.08171* | *0.0026* |
| INFLATION RATE does not Granger Cause EXPORT | 20 | 0.57986 | 0.5720 |
| EXPORT does not Granger Cause INFLATION RATE | | 0.87568 | 0.4368 |
| INTEREST RATE does not Granger Cause EXPORT | 20 | 0.08828 | 0.9160 |

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| | | | |
|---|---|---|---|
| EXPORT does not Granger Cause INTEREST RATE | | 0.00107 | 0.9989 |
| SENSEX does not Granger Cause EXPORT | 20 | 23.0200 | 4.E-05 |
| *EXPORT does not Granger Cause SENSEX* | | *3.77132* | *0.0490* |
| *TOTALTRADE does not Granger Cause EXPORT* | *20* | *9.36982* | *0.0023* |
| *EXPORT does not Granger Cause TOTAL TRADE* | | *8.44787* | *0.0035* |
| TRADE OPENESS does not Granger Cause EXPORT | 20 | 3.67996 | 0.0501 |
| EXPORT does not Granger Cause TRADE OPENESS | | 0.90505 | 0.4255 |
| FIIS does not Granger Cause FDI | 20 | 1.72405 | 0.2167 |
| FDI does not Granger Cause FIIS | | 50.7447 | 7.E-07 |
| GDP does not Granger Cause FDI | 20 | 0.74670 | 0.4907 |
| FDI does not Granger Cause GDP | | 1.50483 | 0.2537 |
| *GOVERNMENTEXPENDITURE does not Granger Cause FDI* | *20* | *7.24057* | *0.0063* |
| *FDI does not Granger Cause GOVERNMENT EXPENDITURE* | | *12.5810* | *0.0006* |
| IMPORT does not Granger Cause FDI | 20 | 1.11930 | 0.3523 |
| FDI does not Granger Cause IMPORT | | 77.6770 | 1.E-08 |
| INFLATION RATE does not Granger Cause FDI | 20 | 0.44383 | 0.6497 |
| FDI does not Granger Cause INFLATION RATE | | 1.87438 | 0.1877 |
| *INTERESTRATE does not Granger Cause FDI* | *20* | *4.47021* | *0.0315* |
| FDI does not Granger Cause INTEREST RATE | | 0.02505 | 0.9753 |
| *SENSEX does not Granger Cause FDI* | *20* | *5.58719* | *0.0165* |
| *FDI does not Granger Cause SENSEX* | | *3.74914* | *0.0497* |
| TOTAL TRADE does not Granger Cause FDI | 20 | 1.51962 | 0.2506 |
| FDI does not Granger Cause TOTAL TRADE | | 81.5039 | 9.E-09 |
| *TRADE OPENESS does not Granger Cause FDI* | *20* | *6.88261* | *0.0076* |
| *FDI does not Granger Cause TRADE OPENESS* | | *13.7178* | *0.0004* |
| *GDP does not Granger Cause FIIS* | *20* | *7.14174* | *0.0081* |
| *FIIS does not Granger Cause GDP* | | *5.13721* | *0.0227* |
| *GOVERNMENT EXPENDITURE does not Granger Cause FIIS* | *20* | *10.9312* | *0.0016* |
| FIIS does not Granger Cause GOVERNMENT EXPENDITURE | | 1.96282 | 0.1799 |
| *IMPORT does not Granger Cause FIIS* | *20* | *7.43945* | *0.0070* |
| FIIS does not Granger Cause IMPORT | | 56.9362 | 4.E-07 |
| INFLATIONRATE does not Granger Cause FIIS | 20 | 0.41332 | 0.6698 |
| FIIS does not Granger Cause INFLATION RATE | | 0.62480 | 0.5507 |
| INTERESTRATE does not Granger Cause FIIS | 20 | 1.80063 | 0.1991 |
| FIIS does not Granger Cause INTEREST RATE | | 0.15974 | 0.8538 |
| *SENSEX does not Granger Cause FIIS* | *20* | *7.96443* | *0.0044* |
| FIIS does not Granger Cause SENSEX | | 0.40697 | 0.6728 |
| *TOTAL TRADE does not Granger Cause FIIS* | *20* | *7.40871* | *0.0071* |

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|---|---|---|---|
| FIIS does not Granger Cause TOTAL TRADE | | 68.4766 | 1.E-07 |
| *TRADE OPENESS does not Granger Cause FIIS* | *20* | *3.85839* | *0.0484* |
| *FIIS does not Granger Cause TRADE OPENESS* | | *12.4621* | *0.0009* |
| GOVERNMENTEXPENDITURE does not Granger Cause GDP | 20 | 0.48033 | 0.6278 |
| *GDP does not Granger Cause GOVERNMENT EXPENDITURE* | | *6.26025* | *0.0106* |
| *IMPORT does not Granger Cause GDP* | *20* | *6.87822* | *0.0076* |
| GDP does not Granger Cause IMPORT | | 18.5595 | 9.E-05 |
| *INFLATIONRATE does not Granger Cause GDP* | *20* | *4.22288* | *0.0351* |
| *GDP does not Granger Cause INFLATION RATE* | | *3.40388* | *0.0604* |
| INTERESTRATE does not Granger Cause GDP | 20 | 2.42978 | 0.1242 |
| *GDP does not Granger Cause INTEREST RATE* | | *9.35719* | *0.0026* |
| SENSEX does not Granger Cause GDP | 20 | 0.95901 | 0.4071 |
| *GDP does not Granger Cause SENSEX* | | *2.30152* | *0.1367* |
| *TOTAL TRADE does not Granger Cause GDP* | *20* | *9.06700* | *0.0026* |
| *GDP does not Granger Cause TOTALTRADE* | | *13.2330* | *0.0005* |
| *TRADE OPENESS does not Granger Cause GDP* | *20* | *4.74573* | *0.0253* |
| GDP does not Granger Cause TRADE OPENESS | | 1.75816 | 0.2061 |
| *IMPORT does not Granger Cause GOVERNMENT EXPENDITURE* | *20* | *7.07612* | *0.0068* |
| GOVERNMENTEXPENDITURE does not Granger Cause IMPORT | | 1.78566 | 0.2015 |
| INFLATIONRATE does not Granger Cause GOVERNMENT EXPENDITURE | 20 | 0.75193 | 0.4884 |
| GOVERNMENTEXPENDITURE does not Granger Cause INFLATION RATE | | 2.53386 | 0.1127 |
| INTERESTRATE does not Granger Cause GOVERNMENT EXPENDITURE | 20 | 0.96142 | 0.4062 |
| GOVERNMENTEXPENDITURE does not Granger Cause INTEREST RATE | | 0.04471 | 0.9564 |
| *SENSEX does not Granger Cause GOVERNMENT EXPENDITURE* | *20* | *8.09179* | *0.0046* |
| GOVERNMENTEXPENDITURE does not Granger Cause SENSEX | | 1.78651 | 0.2037 |
| *TOTAL TRADE does not Granger Cause GOVERNMENT EXPENDITURE* | *20* | *11.1712* | *0.0011* |
| GOVERNMENTEXPENDITURE does not Granger Cause TOTAL TRADE | | 2.12470 | 0.1540 |
| TRADEOPENESS does not Granger Cause GOVERNMENT EXPENDITURE | 20 | 20.7616 | 5.E-05 |
| GOVERNMENTEXPENDITURE does not Granger Cause TRADE OPENESS | | 3.41190 | 0.0601 |
| INFLATIONRATE does not Granger Cause IMPORT | 20 | 0.53287 | 0.5976 |
| IMPORT does not Granger Cause INFLATIONRATE | | 1.43516 | 0.2690 |
| INTERESTRATE does not Granger Cause IMPORT | 20 | 0.11018 | 0.8964 |
| IMPORT does not Granger Cause INTEREST RATE | | 0.00621 | 0.9938 |
| *SENSEX does not Granger Cause IMPORT* | *20* | *9.85129* | *0.0021* |
| *IMPORT does not Granger Cause SENSEX* | | *5.45462* | *0.0177* |
| *TOTAL TRADE does not Granger Cause IMPORT* | *20* | *9.08171* | *0.0026* |
| *IMPORT does not Granger Cause TOTAL TRADE* | | *8.44787* | *0.0035* |
| TRADEOPENESS does not Granger Cause IMPORT | 20 | 0.52591 | 0.6015 |

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|---|---|---|---|
| IMPORT does not Granger Cause TRADE OPENESS | | 0.31082 | 0.7375 |
| INTERESTRATE does not Granger Cause INFLATION RATE | 20 | 0.98014 | 0.3996 |
| INFLATIONRATE does not Granger Cause INTEREST RATE | | 2.85840 | 0.0910 |
| SENSEX does not Granger Cause INFLATION RATE | 20 | 1.00117 | 0.3923 |
| INFLATIONRATE does not Granger Cause SENSEX | | 0.04599 | 0.9552 |
| TOTAL TRADE does not Granger Cause INFLATION RATE | 20 | 1.20737 | 0.3264 |
| INFLATIONRATE does not Granger Cause TOTAL TRADE | | 0.52528 | 0.6019 |
| TRADEOPENESS does not Granger Cause INFLATION RATE | 20 | 1.39470 | 0.2783 |
| INFLATIONRATE does not Granger Cause TRADE OPENESS | | 0.97301 | 0.4006 |
| SENSEX does not Granger Cause INTEREST RATE | 20 | 0.05468 | 0.9470 |
| *INTERESTRATE does not Granger Cause SENSEX* | | *4.85565* | *0.0225* |
| TOTALTRADE does not Granger Cause INTEREST RATE | 20 | 0.00374 | 0.9963 |
| INTERESTRATE does not Granger Cause TOTAL TRADE | | 0.02269 | 0.9776 |
| TRADEOPENESS does not Granger Cause INTEREST RATE | 20 | 0.39009 | 0.6841 |
| INTERESTRATE does not Granger Cause TRADE OPENESS | | 3.35211 | 0.0646 |
| *TOTALTRADE does not Granger Cause SENSEX* | *20* | *3.96350* | *0.0433* |
| *SENSEX does not Granger Cause TOTAL TRADE* | | *16.5417* | *0.0002* |
| *TRADEOPENESS does not Granger Cause SENSEX* | *20* | *13.6682* | *0.0005* |
| *SENSEX does not Granger Cause TRADE OPENESS* | | *11.2210* | *0.0012* |
| TRADEOPENESS does not Granger Cause TOTAL TRADE | 20 | 1.17674 | 0.3352 |
| TOTALTRADE does not Granger Cause TRADE OPENESS | | 0.40719 | 0.6727 |

**(All bold and italic values are having P value less than .05)**

## Table 3: VAR Results of Exchange Rate, Export, FDI, GDP, Govt. Expenses & Import

| Vector Auto Regression Estimates | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Exchange Rate** | **Export** | **FDI** | **FIIS** | **GDP** | **Government Expenditure** | **Import** |
| Exchange Rate (-1) | -0.228642 | -386.4917 | 2650.685 | 5562.009 | 1498.026 | -39.55744 | -16139.16 |
| | (0.53828) | (3900.07) | (1123.07) | (3727.89) | (12378.3) | (3722.19) | (7438.99) |
| | [-0.42476] | *[-0.09910]* | [2.36021] | [1.49200] | [0.12102] | *[-0.01063]* | *[-2.16954]* |
| Export (-1) | -3.27E-05 | 0.821173 | -0.038493 | -0.079618 | -1.058379 | -0.769333 | 1.738341 |
| | (2.7E-05) | (0.19371) | (0.05578) | (0.18516) | (0.61482) | (0.18488) | (0.36949) |
| | *[-1.22237]* | [4.23911] | *[-0.69006]* | [-0.42999] | [-1.72144] | [-4.16130] | [4.70472] |
| FDI (-1) | 0.000109 | 1.487765 | 0.212387 | -4.597984 | -4.054886 | 1.969537 | 2.877877 |
| | (0.00014) | (1.00804) | (0.29028) | (0.96354) | (3.19939) | (0.96206) | (1.92274) |
| | [0.78323] | [1.47590] | [0.73167] | *[-4.77198]* | *[-1.26739]* | [2.04720] | [ 1.49676] |

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| FIIS (-1) | -0.000107 | 1.570684 | 0.294253 | 0.126482 | 1.371073 | 0.195881 | 0.906934 |
| | (5.9E-05) | (0.42536) | (0.12249) | (0.40658) | (1.35005) | (0.40596) | (0.81134) |
| | *[-1.82410]* | [3.69257] | [2.40230] | [0.31108] | [1.01557] | [0.48251] | [1.11783] |
| GDP(-1) | 2.12E-05 | -0.019603 | -0.004218 | -0.092206 | 1.207077 | 0.076441 | 0.242835 |
| | (1.5E-05) | (0.10866) | (0.03129) | (0.10386) | (0.34486) | (0.10370) | (0.20725) |
| | [1.41425] | *[-0.18041]* | *[-0.13480]* | *[-0.88779]* | [3.50018] | [0.73713] | [1.17169] |
| Government Expenditure(-1) | 3.09E-05 | 0.266171 | -0.301388 | -0.149726 | -1.407370 | 0.772461 | 0.064919 |
| | (3.1E-05) | (0.22575) | (0.06501) | (0.21578) | (0.71650) | (0.21545) | (0.43060) |
| | [0.99063] | [1.17905] | *[-4.63622]* | *[-0.69387]* | *[-1.96423]* | [3.58528] | [0.15077] |
| Import (-1) | -6.38E-05 | 0.049377 | 0.195731 | 0.615106 | 1.353018 | 0.364560 | -0.769708 |
| | (3.0E-05) | (0.21807) | (0.06280) | (0.20845) | (0.69214) | (0.20813) | (0.41595) |
| | *[-2.11826]* | [0.22642] | [3.11689] | [2.95090] | [1.95483] | [1.75161] | *[-1.85046]* |
| R-squared | 0.925751 | 0.999196 | 0.948450 | 0.952088 | 0.999734 | 0.999023 | 0.998897 |
| Adj. R-squared | 0.878501 | 0.998684 | 0.915646 | 0.921599 | 0.999564 | 0.998401 | 0.998195 |
| Sum sq. resids | 43.58864 | 2.29E+09 | 1.90E+08 | 2.09E+09 | 2.31E+10 | 2.08E+09 | 8.32E+09 |
| S.E. equation | 1.990629 | 14422.84 | 4153.221 | 13786.09 | 45776.19 | 13765.00 | 27510.10 |
| F-statistic | 19.59282 | 1953.070 | 28.91242 | 31.22698 | 5901.333 | 1606.729 | 1423.038 |
| Log likelihood | -34.84823 | -203.7225 | -180.0688 | -202.8646 | -225.6665 | -202.8355 | -215.9915 |
| Akaike AIC | 4.510340 | 22.28658 | 19.79672 | 22.19627 | 24.59648 | 22.19321 | 23.57806 |
| Schwarz SC | 4.907998 | 22.68423 | 20.19438 | 22.59393 | 24.99414 | 22.59087 | 23.97571 |
| Mean dependent | 42.29312 | 427509.1 | 13569.38 | 33077.05 | 3142127. | 502830.1 | 625589.2 |
| S.D. dependent | 5.710899 | 397646.4 | 14299.89 | 49235.72 | 2193235. | 344249.0 | 647519.5 |
| Determinant resid covariance (dof adj.) | 2.48E+48 | | | | | | |
| Determinant resid covariance | 5.40E+46 | | | | | | |
| Log likelihood | -1210.971 | | | | | | |
| Akaike information criterion | 133.3654 | | | | | | |
| Schwarz criterion | 136.1490 | | | | | | |

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**Table 4: VAR Results of Inflation Rate, Interest Rate, Sensex, Total Trade, Trade Openness**

| Vector Auto Regression Estimates | | Inflation Rate | Interest Rate | Sensex | Total Trade | Trade Openess |
|---|---|---|---|---|---|---|
| Inflation Rate(-1) | | 0.297808 | 0.087857 | 186.2982 | -6639.319 | -0.140132 |
| | | (0.24249) | (0.03763) | (252.724) | (7061.56) | (0.11142) |
| | | [1.22810] | [2.33485] | [0.73716] | [-0.94021] | [-1.25773] |
| Interest Rate(-1) | | 1.060778 | 0.918364 | -264.7682 | -55306.96 | -1.480600 |
| | | (0.78564) | (0.12191) | (818.779) | (22878.2) | (0.36097) |
| | | [1.35021] | [7.53316] | [-0.32337] | [-2.41746] | [-4.10174] |
| Sensex (-1) | | 0.000111 | 1.92e-05 | -0.051821 | 41.20374 | 0.000657 |
| | | (0.00025) | (3.8e-05) | (0.25720) | (7.18653) | (0.00011) |
| | | [ 0.44946] | [ 0.50018] | [-0.20148] | [5.73347] | [5.79443] |
| Total Trade (-1) | | -1.65e-06 | -1.62e-07 | 0.000724 | 1.315025 | 1.19e-06 |
| | | (3.0e-06) | (4.6e-07) | (0.00311) | (0.08699) | (1.4e-06) |
| | | [-0.55369] | [-0.35010] | [ 0.23254] | [15.1161] | [ 0.86481] |
| Trade Openess (-1) | | 0.401625 | -0.002789 | 572.3267 | -44153.67 | 0.242382 |
| | | (0.30619) | (0.04751) | (319.110) | (8916.52) | (0.14068) |
| | | [1.31167] | [-0.05870] | [1.79351] | [-4.95190] | [ 1.72289] |
| R-squared | | 0.409326 | 0.964127 | 0.846149 | 0.995749 | 0.986670 |
| Adj. R-squared | | 0.198371 | 0.951316 | 0.791203 | 0.994230 | 0.981910 |
| Sum sq. resids | | 102.6458 | 2.471557 | 1.11E+08 | 8.70E+10 | 21.66874 |
| S.E. equation | | 2.707737 | 0.420166 | 2821.956 | 78850.60 | 1.244093 |
| F-statistic | | 1.940346 | 75.25381 | 15.39947 | 655.8200 | 207.2597 |
| Log likelihood | | -44.73429 | -7.469929 | -183.7157 | -250.3182 | -29.18016 |
| Akaike AIC | | 5.073429 | 1.346993 | 18.97157 | 25.63182 | 3.518016 |
| Schwarz SC | | 5.372148 | 1.645713 | 19.27029 | 25.93054 | 3.816735 |
| Mean dependent | | 7.332685 | 9.890000 | 7870.279 | 1006297. | 27.23003 |
| S.D. dependent | | 3.024264 | 1.904261 | 6175.723 | 1038080. | 9.249802 |
| Determinant resid covariance (dof adj.) | | 1.68E+16 | | | | |
| Determinant resid covariance | | 2.82E+15 | | | | |
| Log likelihood | | -497.6438 | | | | |
| Akaike information criterion | | 52.76438 | | | | |
| Schwarz criterion | | 54.25798 | | | | |

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**Table 5: Variance Decomposition of all Variables**

| Variance Decomposition of EXCHANGE RATE: | | | | | |
|---|---|---|---|---|---|
| Period | S.E. | Exchange Rate | Export | FDI | FIIS | GDP |
| 1 | 1.015291 | 100.0000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| 2 | 2.152249 | 23.22727 | 70.08646 | 3.974876 | 0.398492 | 2.312900 |
| 3 | 5.595864 | 3.611246 | 76.12410 | 18.17232 | 0.258747 | 1.833588 |
| 4 | 7.086933 | 7.512848 | 60.94904 | 30.18667 | 0.161323 | 1.190118 |
| 5 | 12.56114 | 12.45842 | 44.88122 | 40.81700 | 1.035106 | 0.808257 |
| 6 | 17.30270 | 9.720770 | 41.54119 | 46.26740 | 1.904580 | 0.566057 |
| 7 | 18.06890 | 8.974033 | 38.09283 | 48.29281 | 2.658795 | 1.981534 |
| 8 | 20.13617 | 9.397808 | 37.93899 | 46.03071 | 3.490471 | 3.142020 |
| 9 | 22.24698 | 8.421470 | 43.61719 | 41.88168 | 3.423214 | 2.656454 |
| 10 | 22.41576 | 8.467509 | 43.45970 | 41.26204 | 3.374111 | 3.436638 |

| Variance Decomposition of EXPORT | | | | | |
|---|---|---|---|---|---|
| Period | S.E. | Exchange Rate | Export | FDI | FIIS | GDP |
| 1 | 12205.32 | 7.102277 | 92.89772 | 0.000000 | 0.000000 | 0.000000 |
| 2 | 17322.04 | 43.07754 | 48.90838 | 2.482925 | 1.640603 | 3.890547 |
| 3 | 67733.16 | 20.17531 | 54.35976 | 23.71325 | 0.670493 | 1.081191 |
| 4 | 115737.5 | 7.962908 | 54.82893 | 35.68382 | 1.070822 | 0.453522 |
| 5 | 145213.3 | 11.51054 | 40.87348 | 42.66637 | 1.715038 | 3.234572 |
| 6 | 239581.7 | 9.228607 | 43.28198 | 42.68495 | 2.804884 | 1.999577 |
| 7 | 289016.2 | 6.888892 | 42.77832 | 45.19423 | 3.299826 | 1.838735 |
| 8 | 317583.4 | 6.448395 | 39.35702 | 46.39467 | 3.913038 | 3.886874 |
| 9 | 476648.7 | 6.740561 | 48.18746 | 39.55681 | 3.202428 | 2.312736 |
| 10 | 585662.6 | 4.649252 | 49.67315 | 41.05935 | 2.988004 | 1.630248 |

| Variance Decomposition of FDI | | | | | |
|---|---|---|---|---|---|
| Period | S.E. | Exchange Rate | Export | FDI | FIIS | GDP |
| 1 | 7814.130 | 40.92048 | 22.99985 | 36.07967 | 0.000000 | 0.000000 |
| 2 | 10140.90 | 26.11126 | 22.47110 | 50.29642 | 0.839108 | 0.282110 |
| 3 | 12660.79 | 16.77960 | 45.39388 | 32.66847 | 1.004318 | 4.153728 |
| 4 | 12919.38 | 16.43590 | 44.20824 | 32.97179 | 1.852244 | 4.531829 |
| 5 | 18501.67 | 24.50580 | 31.53916 | 38.87199 | 1.456958 | 3.626093 |
| 6 | 29175.32 | 14.44639 | 38.26229 | 43.56832 | 2.253099 | 1.469903 |
| 7 | 30753.03 | 14.38561 | 41.08871 | 39.64730 | 2.454482 | 2.423901 |
| 8 | 31906.58 | 15.33753 | 38.19314 | 37.23019 | 3.221776 | 6.017363 |
| 9 | 38331.81 | 11.76652 | 51.66325 | 28.67443 | 2.757888 | 5.137907 |
| 10 | 44666.13 | 13.80459 | 51.51982 | 28.17110 | 2.613059 | 3.891434 |

| Variance Decomposition of FIIS | | | | | |
|---|---|---|---|---|---|
| Period | S.E. | Exchange Rate | Export | FDI | FIIS | GDP |
| 1 | 8352.690 | 0.511633 | 69.73692 | 11.18455 | 18.56689 | 0.000000 |
| 2 | 51486.67 | 20.09178 | 51.78934 | 26.78136 | 1.264223 | 0.073284 |
| 3 | 55639.31 | 20.89415 | 46.00332 | 30.70218 | 1.491562 | 0.908793 |
| 4 | 67006.56 | 18.83761 | 50.83597 | 21.27127 | 1.070870 | 7.984281 |
| 5 | 99881.04 | 9.962863 | 61.09426 | 23.07517 | 2.180187 | 3.687522 |
| 6 | 109322.7 | 16.51805 | 56.71146 | 21.61228 | 1.907479 | 3.250732 |
| 7 | 121684.9 | 13.57525 | 57.42520 | 21.82205 | 1.606633 | 5.570865 |

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| 8 | 204978.3 | 8.902725 | 67.27871 | 20.29682 | 1.047678 | 2.474072 |
| 9 | 216223.8 | 14.38435 | 63.51934 | 18.33364 | 1.075857 | 2.686819 |
| 10 | 239348.6 | 21.91836 | 53.79426 | 15.55694 | 0.938438 | 7.792006 |

**Variance Decomposition of GDP**

| Period | S.E. | EXCHANGERATE | EXPORT | FDI | FIIS | GDP |
|---|---|---|---|---|---|---|
| 1 | 45337.17 | 4.647305 | 40.34419 | 16.65503 | 8.887637 | 29.46584 |
| 2 | 53038.19 | 3.764674 | 32.17859 | 12.27965 | 14.73033 | 37.04676 |
| 3 | 93471.41 | 1.890389 | 61.64458 | 15.24307 | 6.919310 | 14.30265 |
| 4 | 163939.9 | 1.893726 | 59.11292 | 27.38430 | 4.348836 | 7.260226 |
| 5 | 379068.2 | 7.980262 | 51.39092 | 35.10509 | 2.603640 | 2.920088 |
| 6 | 649178.7 | 6.155191 | 49.09077 | 40.55928 | 2.581658 | 1.613101 |
| 7 | 911718.6 | 6.837265 | 43.25724 | 44.49858 | 2.987407 | 2.419508 |
| 8 | 1343680. | 6.744775 | 43.30371 | 44.36173 | 3.272878 | 2.316907 |
| 9 | 1808166. | 5.620657 | 44.13570 | 44.72120 | 3.409488 | 2.112949 |
| 10 | 2304482. | 5.397184 | 43.28828 | 45.25319 | 3.533307 | 2.528037 |

**Variance Decomposition of GOVERNMENT EXPENDITURE**

| Period | S.E. | Government Expenditure | Import | Inflationrate | Interestrate |
|---|---|---|---|---|---|
| 1 | 18368.22 | 100.0000 | 0.000000 | 0.000000 | 0.000000 |
| 2 | 28927.76 | 95.23304 | 2.861410 | 0.576584 | 1.328969 |
| 3 | 49475.22 | 75.08412 | 21.59703 | 1.591352 | 1.727497 |
| 4 | 84054.57 | 40.34382 | 57.02187 | 2.025648 | 0.608662 |
| 5 | 126887.8 | 20.15372 | 78.08096 | 0.975252 | 0.790063 |
| 6 | 157341.8 | 13.19241 | 83.82632 | 1.248387 | 1.732890 |
| 7 | 170454.9 | 11.37712 | 82.58798 | 3.850544 | 2.184357 |
| 8 | 179672.3 | 14.38789 | 77.70005 | 5.944657 | 1.967398 |
| 9 | 212656.1 | 25.13829 | 68.62351 | 4.352529 | 1.885667 |
| 10 | 313968.2 | 22.85637 | 73.87445 | 2.329046 | 0.940130 |

**Variance Decomposition of IMPORT**

| Period | S.E. | Government Expenditure | Import | Inflationrate | Interestrate |
|---|---|---|---|---|---|
| 1 | 113142.9 | 16.72596 | 83.27404 | 0.000000 | 0.000000 |
| 2 | 171360.3 | 8.042773 | 91.14082 | 0.055314 | 0.761092 |
| 3 | 236509.7 | 4.237221 | 93.15802 | 0.894050 | 1.710708 |
| 4 | 265671.2 | 3.671006 | 90.32097 | 3.465845 | 2.542183 |
| 5 | 278192.5 | 3.736443 | 86.81408 | 6.995366 | 2.454111 |
| 6 | 301326.6 | 10.41018 | 80.32358 | 6.941110 | 2.325131 |
| 7 | 397886.1 | 17.03493 | 77.35759 | 4.056585 | 1.550899 |
| 8 | 601742.0 | 11.22427 | 86.04525 | 1.966829 | 0.763651 |
| 9 | 824274.4 | 6.147770 | 91.45145 | 1.121862 | 1.278916 |
| 10 | 958861.2 | 4.695256 | 90.69340 | 2.403165 | 2.208176 |

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**Variance Decomposition of INFLATION RATE**

| Period | S.E. | Government Expenditure | Import | Inflationrate | Interestrate |
|---|---|---|---|---|---|
| 1 | 2.462814 | 31.96042 | 29.18803 | 38.85155 | 0.000000 |
| 2 | 2.908365 | 26.20974 | 45.80618 | 27.87641 | 0.107664 |
| 3 | 4.155848 | 13.15100 | 72.91277 | 13.69755 | 0.238686 |
| 4 | 5.660372 | 8.733616 | 82.15210 | 7.673889 | 1.440396 |
| 5 | 6.453409 | 12.99291 | 75.23757 | 8.675516 | 3.094002 |
| 6 | 6.814108 | 15.12635 | 68.10566 | 13.48008 | 3.287909 |
| 7 | 7.312950 | 13.45012 | 69.10809 | 14.17794 | 3.263851 |
| 8 | 7.808736 | 21.70582 | 60.63906 | 12.62179 | 5.033328 |
| 9 | 10.21460 | 20.04523 | 66.55772 | 10.10998 | 3.287075 |
| 10 | 14.90689 | 9.437145 | 82.92889 | 5.426107 | 2.207862 |

**Variance Decomposition of INTEREST RATE**

| Period | S.E. | Government Expenditure | Import | Inflationrate | Interestrate |
|---|---|---|---|---|---|
| 1 | 0.311127 | 0.059785 | 23.49166 | 0.040364 | 76.40819 |
| 2 | 0.568509 | 6.429395 | 48.09541 | 5.386159 | 40.08904 |
| 3 | 0.927433 | 14.69186 | 53.60285 | 12.44125 | 19.26404 |
| 4 | 1.236658 | 14.12962 | 60.59398 | 12.96596 | 12.31045 |
| 5 | 1.560961 | 12.97399 | 66.93673 | 11.51919 | 8.570086 |
| 6 | 1.899873 | 12.25536 | 71.07682 | 10.08303 | 6.584792 |
| 7 | 2.185570 | 13.09553 | 71.10276 | 9.988338 | 5.813367 |
| 8 | 2.362974 | 14.53486 | 68.54922 | 11.35068 | 5.565238 |
| 9 | 2.442175 | 15.06358 | 66.45268 | 13.11641 | 5.367327 |
| 10 | 2.482815 | 14.62117 | 66.39165 | 13.79378 | 5.193403 |

**Variance Decomposition of SENSEX**

| Period | S.E. | Sensex | Total Trade | Trade Openess |
|---|---|---|---|---|
| 1 | 2427.156 | 100.0000 | 0.000000 | 0.000000 |
| 2 | 3001.069 | 92.85435 | 4.669975 | 2.475672 |
| 3 | 3504.835 | 83.62868 | 11.84043 | 4.530891 |
| 4 | 3709.323 | 75.40947 | 20.43777 | 4.152759 |
| 5 | 4441.792 | 69.89919 | 25.21023 | 4.890578 |
| 6 | 5186.771 | 60.15750 | 28.28128 | 11.56122 |
| 7 | 6165.288 | 43.44673 | 27.55321 | 29.00006 |
| 8 | 7761.788 | 28.12292 | 23.66514 | 48.21195 |
| 9 | 10094.52 | 16.63614 | 19.54264 | 63.82122 |
| 10 | 13447.94 | 9.594618 | 16.47541 | 73.92997 |

**Variance Decomposition of TOTAL TRADE**

| Period | S.E. | Sensex | Total Trade | Trade Openess |
|---|---|---|---|---|
| 1 | 65223.08 | 54.35418 | 45.64582 | 0.000000 |
| 2 | 104034.7 | 27.72853 | 66.67846 | 5.593005 |
| 3 | 190193.4 | 32.83417 | 58.26217 | 8.903651 |
| 4 | 301145.7 | 33.46994 | 51.41991 | 15.11016 |
| 5 | 425648.4 | 21.77448 | 46.66045 | 31.56507 |
| 6 | 610172.8 | 14.40582 | 38.19232 | 47.40186 |
| 7 | 865400.1 | 8.626516 | 30.85123 | 60.52225 |
| 8 | 1221487. | 4.499669 | 25.09689 | 70.40344 |

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| | | | |
|---|---|---|---|
| 9 | 1714762. | 2.312987 | 21.42575 | 76.26126 |
| 10 | 2392647. | 1.190861 | 19.55498 | 79.25416 |

**Variance Decomposition of TRADE OPENESS**

| Period | S.e. | Sensex | Total Trade | Trade Openess |
|---|---|---|---|---|
| 1 | 1.724721 | 44.03062 | 16.29707 | 39.67231 |
| 2 | 2.205228 | 26.93341 | 36.59034 | 36.47625 |
| 3 | 3.580697 | 46.03126 | 37.73887 | 16.22987 |
| 4 | 5.006582 | 53.55670 | 38.13768 | 8.305619 |
| 5 | 5.990539 | 47.12614 | 41.66775 | 11.20611 |
| 6 | 7.424574 | 38.07780 | 38.31305 | 23.60916 |
| 7 | 9.415943 | 26.00324 | 31.76089 | 42.23587 |
| 8 | 12.34779 | 15.14017 | 24.19955 | 60.66028 |
| 9 | 16.51172 | 8.554454 | 18.57530 | 72.87025 |
| 10 | 22.17604 | 4.969556 | 15.63775 | 79.39269 |

The results indicate the probability values for total 132 items (for pairs of 12 variables). The results of Granger's model of causality were further confirmed in econometrics by applying the VAR model. In most of the empirical studies, VAR is utilized to support the results of Granger's model; as the application of Granger's causality is not a sufficient exercise. The purpose of the VAR is to examine the dynamic adjustments of all the involved variables to exogenous structural shocks. Accordingly, we applied the VAR models on the series under reference in order to further confirm the results produced by the Granger's causality model. By the application of VAR model, we observed that the integration of individual variables with the others could not be established. The main findings of VAR estimation revealed that the findings were consistent with the results of Granger's causality tests.

Finally, the variance decomposition analysis of the three stock exchanges was studied. The tables decomposed the returns for all twelve variables for a period ranging from 1 to 10. This helped in forecasting for shorter as well as long term duration. The variance decomposition analysis implies that most variables are a result of the fluctuations of own shock, and very occasionally due to the influence or impulse of other variables. For example, export volumes in the short run are created through own shock only and in the long run are influenced with own shock and shocks arising from FDI fluctuations from period 5 onwards. In case of exchange rate, it originates with fluctuations of FDI and export in the long run. FDI throughout impulses with own shocks and shocks from export volume. FII volumes are created mainly with the export volume.

In the short run, till period 2, GDP was influenced through own shocks while export and FDI were influenced with GDP till period 10. Government expenditure in the short run were influenced with own shocks till period 3, but in the long run were dominantly influenced by import volumes. Whereas the import variable was influenced with own shock in the long run and short run both, none of the other variables shocked it. Inflation rate was influenced with own fluctuations and shocks due to government expenditure in short run. Sensex was influenced with own shock flucatations all through, but in the short run, it was also influenced with FIIs volume, inflation and interest rates. Finally, interst rate was always influenced with own shocks throughout.

**Conclusion**

In sum, the present study provided several insights on the contribution of select macroeconomics variables on the Indian economy. The application of unit root test (augmented Dickey-Fuller test) revealed that all Indian macroeconomic variable series are stationary. The findings also lead us to the conclusion that the annual returns of all macroeconomics variables are consistently moving up. A revolutionary growth stage has been recorded in all the variables. Results of Granger's models for all the series indicated the interrelationships between the studied variables.

**IJAR&D**

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