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# An Analysis into Interrelationship between Foreign Institutional Investments, Stock Market Returns and Exchange Rate Movement

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**ABSTRACT**

Indian Capital markets have seen a surge of Capital inflow post 1992 after Securities Exchange Board of India was incorporated. One of the major economic reforms in the capital market was to allow Foreign Portfolio Investments to invest in Indian Companies.This paper attempts to understand the inter-relationship between FII and select macro-economic variables which include Stock Market Returns and Exchange rate Movement. BSE-Sensex is chosen to compute the stock market returns and INR-UDR spot rate is assumed for calculating the exchange rate movement. The period of study is chosen from 1st January 2004 to 31st December 2015 which includes a total period of 11 years. The study was done using the Correlation Test, Johansen's Co-integration Test and the Vector Auto Regression Model (VAR). FII, Return on SENSEX and Return on exchange rate seem to be very strong as reflected in the correlation test. However between Sensex movement and exchange rate movement it was found that Sensex has a very strong positive correlation with the movement of FII. The co-integration test indicated a long run movement between the three variables. VAR model proved that return on FII is influenced by time lag 1 and 2 of returns on FII and is also influenced by time lag 1 of Sensex. Return on SENSEX is influenced by time lag 1 and 2 of returns on Sensex and time lag 1 of return on FII. INR-US$ exchange rate is influenced by only time lag 1 and 2 of INR-US$ exchange rate itself.

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**KEYWORDS:** ***FII, Stock market Returns, Exchange Rate Movement, Correlation, Co-integration, VAR model.***

## Introduction

India liberalized the capital markets in the year 1991 due to depleting foreign exchange reserves in the country. Indian Capital markets have seen a surge of Capital inflow post 1992 after Securities Exchange Board of India was incorporated. Indian



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Corporates started approaching the capital markets more and more to mobilize resources. One of the major economic reforms was to allow Foreign Portfolio Investments to invest in Indian Companies. Over the years Indian Corporates has seen a massive flow of foreign capital. Foreign Institutional investments are often referred to as Hot Money .While the inflow of foreign capital leads to surge in the economic activity their withdrawal could lead to a depletion of foreign exchange currency playing a havoc in the economy. There are various determinants of foreign capital flow .They include Stock market returns, Inflation rate, exchange rate movements etc. This paper attempts to understand the inter-relationship between FII and select macro-economic variables which include Stock Market Returns and Exchange rate Movement. BSE-Sensex is chosen to compute the stock market returns and INR-USD spot rate is assumed for calculating the exchange rate movement. The period of study is chosen from 1st January 2004 to 31st December 2015 which includes a total period of 11 years. The study was done using the Correlation Test and the Vector Auto Regression Model (VAR).

**Review of Literature**

Rai and Bhanumurthy (2006) examined the determinants of foreign institutional investments in India with the help of monthly data from January 1994 – November 2002.The study established a positive relationship between FII and returns on the stock market and inflation in the United States.However there was a negative relationship between FII and Inflation in India, Return on S&P 500, Ex-ante Risk on the BSE, and Ex-Ante Risk on S & P 500.Bodla and Ashish Kumar (2009) conducted a study a causal relationship between Foreign Institutional Investors and Macroeconomic Variables in India for a period of 15 years from January 1993 to December 2007. The macro-economic variables selected for the study included Stock market capitalization and tradingvolume. The study concluded that the net investment made by FIIS were a causal force of market capitalization. However FII investment were an effect of trading Volumes. Suganthi and Darshana (2013) explored causal relationship between FII and selected Macro economic variables which included Wholesale Price Index, Index of Industrial Production and Exchange Rate. The results showed a bidirectional relationship between FII and Sensex, FII and Exchange Rate and a unidirectional relationship between Sensex and IIP, Sensex and WPI, FII and IIP and FII and exchange rate. The study however pointed out that no relationship existed between FII and WPI. Shrivastav (2013) examined whether market movement in terms of stock prices could be explained by foreign investors, and also examined the relationship between FII and Indian stock market.The study found that FII is thus an important macroeconomic indicator which can help us analyze a particular stock and the whole stock market in a better manner.Bhatnagar,V (2011) indicated that Market size, Political Scenario, Labour Cost and productivity, Liberalized Trade Policy, Infrastructure, Incentives and Operating conditions, Disinvestment Policy were the causes of FII investments in India.Arya &Purohit (2012) found that FII has gained a significant role in Indian stock markets. The beginning of 21st century has revealed the real dynamics of Indian stock market and its various benchmarking indices. The study was mainly focused to check the volatility of stock market & returns due to the existence of FIIs in India.

**Objectives**

While FII leads to an unprecedented inflow of foreign capital and thus gives a boost to the economy in general, their withdrawal could lead to a major blow to the economy in general and capital market in particular. Thus the first



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objective of the paper would be to study the relationship between the three variables i.e. FII, Sensex movement and INR-USD exchange rate movement.

The three variables selected in the study could impact itself as well as the other variables. Thus the second objective of this study is to understand the inter-linkages between FII, Stock Market Returns and INR-USD Exchange Rate movement using the VAR model

**Hypotheses**

**H0a:** There is no correlation between FII, Stock Market movement (Sensex) and Exchange Rate movement (INR-USD)

**H1a:** There is correlation between FII, Stock Market movement (Sensex) and Exchange Rate movement (INR-USD)

**H0b:** There is no cointegration between FII, Stock Market movement (Sensex) and Exchange Rate movement (INR-USD)

**H1b:** There is co-integration between FII, Stock Market movement (Sensex) and Exchange Rate movement (INR-USD)

**Research Methodology**

The secondary data considered for the study consists of daily closing data of Foreign Institutional Investments, Sensex and INR-USD exchange rate from 1st January, 2004 to 31st December 2015. Sensex data is used as representative of the Indian Stock Market. FII data was extracted from the SEBI, NSDL website, Sensex data was taken from BSE website and INR US$ Exchange rate- spot rate was taken from the RBI reference rate archives. After cleaning the data, 2853 data sets were used for the research.. Excel function Lookup was used to clean the data. Statistical Analysis was done using EViews software.

To perform statistical analysis log difference series was calculated using the formula:

FIIrt (FII Return) = LN (FII t) – LN (FII t-1)

Sensexrt (Sensex Return) = LN (St) – LN (St-1)

USDrt (Indian Rupee- US $ Exchange Rate) = LN (Et) – LN (Et-1)

Descriptive Statistics was used initially to give a quantitative summary of the above mentioned variables. To perform data analysis on time series data, unit root test was administered on the data as a pre-requisite.To understand the relationship between FII, Sensex movement and INR US$ exchange rate movement, correlation test and co-integration test were applied. Vector auto regression (VAR) model was deployed to capture the interdependencies between the variables. This model explains a variable based on its own lag as well as lag of other variables.

**Data Analysis and Interpretation**

To check the normality of the series of data, Descriptive statistics was deployed on the data

**Table 1:** Descriptive Statistics of Log difference Series

| | FIIRT | SENSEXRT | USDRT |
|---|---|---|---|
| Mean | 0.0011 | 0.0005 | 0.0001 |
| Maximum | 0.0812 | 0.1599 | 0.4694 |
| Minimum | -0.0256 | -0.1180 | -0.5163 |
| Std. Dev. | 0.0042 | 0.0157 | 0.1065 |
| Skewness | 3.5860 | -0.0300 | -0.8307 |
| Kurtosis | 56.48853 | 11.3599 | 7.8991 |
| Jarque-Bera | 346218.8 | 8308.426 | 3181.380 |
| Probability | 0.0000 | 0.0000 | 0.0000 |
| Observations | 2853 | 2853 | 2853 |

The mean returns for all the three variables is almost 0%. Standard deviation of INRUS$ exchange rate indicates that the variability of returns in exchange rate is more than that of FII returns and Sensex returns. Also variability of Sensex returns is more than that of FII return series. The log differentiated series are not normally distributed as can be verified from Skewness, Kurtosis and Jarque- Bera Test.

To run any statistical analysis on time series data,



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data needs to be tested for its stationarity

**Table 2:** ADF Unit Root Test Statistics

| At Level series Lag length 1 based on SIC | ADF Unit Root Test Statistics | | |
|---|---|---|---|
| | None | With Intercpt | With Trend and Intercept |
| FII 1% Level | -2.56 | -3.43 | -3.96 |
| T Statistic | -25.06 | -26.56 | -27.03 |
| Probability | 0.00 | 0.00 | 0.00 |
| SENSEX 1% Level | -2.56 | -3.43 | -3.96 |
| T Statistic | -38.66 | -38.71 | -38.71 |
| Probability | 0.00 | 0.00 | 0.00 |
| Exchange rate 1% Level | -2.56 | -3.43 | -3.96 |
| T Statistic | -57.34 | -57.33 | -57.32 |
| Probability | 0.00 | 0.00 | 0.00 |
| At Level series- Lag length 1 based on SIC | ADF Unit Root Test Statistics | | |
| | None | With Intercept | With Trend and Intercept |
| FII 1% Level | -2.56 | -3.43 | -3.96 |
| T Statistic | -25.06 | -26.56 | -27.03 |
| Probability | 0.00 | 0.00 | 0.00 |
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| T Statistic | -57.34 | -57.33 | -57.32 |
| Probability | 0.00 | 0.00 | 0.00 |
| At Level series Lag length 1 based on SIC | ADF Unit Root Test Statistics | | |
| | None | With Intercept | With Trend and Intercept |
| FII 1% Level | -2.56 | -3.43 | -3.96 |
| T Statistic | -25.06 | -26.56 | -27.03 |
| Probability | 0.00 | 0.00 | 0.00 |
| SENSEX 1% Level | -2.56 | -3.43 | -3.96 |
| T Statistic | -38.66 | -38.71 | -38.71 |
| Probability | 0.00 | 0.00 | 0.00 |
| Exchange rate 1% Level | -2.56 | -3.43 | -3.96 |
| T Statistic | -57.34 | -57.33 | -57.32 |
| Probability | 0.00 | 0.00 | 0.00 |
| At Level series- Lag length 1 based on SIC | ADF Unit Root Test Statistics | | |
| | None | With Intercept | With Trend and Intercept |
| FII 1% Level | -2.56 | -3.43 | -3.96 |
| T Statistic | -25.06 | -26.56 | -27.03 |
| Probability | 0.00 | 0.00 | 0.00 |
| SENSEX 1% Level | -2.56 | -3.43 | -3.96 |
| T Statistic | -38.66 | -38.71 | -38.71 |
| Probability | 0.00 | 0.00 | 0.00 |
| Exchange rate 1% Level | -2.56 | -3.43 | -3.96 |
| T Statistic | -57.34 | -57.33 | -57.32 |
| Probability | 0.00 | 0.00 | 0.00 |

Since P values are less than 5% in all the three cases i.e. with trend, trend and intercept and with none and the T- Statistic is more than the critical values at 1 % it means that data is stationary at



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level series. This data can used for further statistical analysis.

**Table 3:** Correlation Test

| | FII | SENSEX | USD |
|---|---|---|---|
| FII | 1 | 0.91 | 0.61 |
| SENSEX | 0.919 | 1 | 0.576 |
| USD | 0.61 | 0.576 | 1 |

It can be concluded from above that FII and Sensex have a very strong positive correlation at 0.91. FII and INR US$ exchange rate is positively correlated at 0.61 while FII and INR UD$ exchange rate is also positively correlated at 0.58.

**Table 4:** Co-integration Test

Date: 11/14/16 Time: 13:33
Sample (adjusted): 3 2854
Included observations: 2852 after adjustments
Trend assumption: Linear deterministic trend
Series: FII SENSEX USD
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

| Hypothesized No. of CE(s) | Eigenvalue | Trace Statistic | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|
| None * | 0.158156 | 509.5534 | 29.79707 | 0.0001 |
| At most 1 * | 0.005800 | 18.55183 | 15.49471 | 0.0168 |
| At most 2 | 0.000687 | 1.960795 | 3.841466 | 0.1614 |

Trace test indicates 2 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

| Hypothesized No. of CE(s) | Eigen value | Max-Eigen Statistic | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|
| None * | 0.158156 | 491.0016 | 21.13162 | 0.0001 |
| At most 1 * | 0.005800 | 16.59104 | 14.26460 | 0.0211 |
| At most 2 | 0.000687 | 1.960795 | 3.841466 | 0.1614 |

Max-eigenvalue test indicates 2 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values


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Co-integration test is based on two test methods i.e. trace test and maximum Eigene value test. The results of the test indicate that P values are less than 5% which mean there is a cointegration between the three variables with lag 1. P Value for Maximum Eigen Value Statistic is less than 5%. This means that in the long run they move together. Therefore we reject the null hypotheses and accept the alternate hypotheses.

To map the interdependencies between the different variables VAR model was used. This model explains whether a variable evolves based on its own lag or based on the lag of other variables. In the VAR model, Return on FII (FIIRT), Return on Sensex ( SENSEXRT)and Exchange rate movements ( USDRT) are the dependent variables while the independent variables include l lag and 2 lags of FIIRT, SENSEXRT and USDRT. This means that FIIRT can be influenced by its own lag (1 and 2) as well as lag of SENSEXRT and USDRT (1 and 2).

**Table 5:** VAR

Vector Autoregression Estimates
Date: 11/14/16 Time: 14:16
Sample (adjusted): 4 2854
Included observations: 2851 after adjustments
Standard errors in ( ) & t-statistics in [ ]

| | FIIRT | SENSEXRT | USDRT |
|---|---|---|---|
| FIIRT(-1) | 0.235958 | 0.190577 | -0.140163 |
| | (0.01928) | (0.07741) | (0.48820) |
| | [ 12.2389] | [ 2.46193] | [-0.28710] |
| FIIRT(-2) | 0.156826 | 0.047074 | 0.391507 |
| | (0.01867) | (0.07496) | (0.47275) |
| | [ 8.40023] | [ 0.62799] | [ 0.82815] |
| SENSEXRT(-1) | 0.047826 | 0.057398 | -0.184312 |
| | (0.00485) | (0.01948) | (0.12282) |
| | [ 9.86013] | [ 2.94727] | [-1.50064] |
| SENSEXRT(-2) | -0.001771 | -0.075972 | -0.033635 |
| | (0.00492) | (0.01975) | (0.12455) |
| | [-0.36003] | [-3.84674] | [-0.27004] |
| USDRT(-1) | -0.000782 | -0.001914 | -0.287716 |
| | (0.00070) | (0.00283) | (0.01783) |
| | [-1.10986] | [-0.67689] | [-16.1344] |
| USDRT(-2) | 0.000818 | 0.003671 | -0.309435 |
| | (0.00070) | (0.00283) | (0.01784) |
| | [ 1.16087] | [ 1.29821] | [-17.3491] |
| C | 0.000644 | 0.000261 | 3.73E-05 |
| | (7.7E-05) | (0.00031) | (0.00195) |
| | [ 8.36819] | [ 0.84329] | [ 0.01915] |

VAR is a linear regression model which is given by the following equation:

$$FIIRT = C(1)*FIIRT(-1) + C(2)*FIIRT(-2) + C(3)*SENSEXRT(-1) + C(4)*SENSEXRT(-2) + C(5)*USDRT(-1) + C(6)*USDRT(-2) + C(7)$$


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SENSEXRT = C(8)*FIIRT(-1) + C(9)*FIIRT(-2) + C(10)*SENSEXRT(-1) + C(11)*SENSEXRT(-2) + C(12)*USDRT(-1) + C(13)*USDRT(-2) + C(14)

USDRT = C(15)*FIIRT(-1) + C(16)*FIIRT(-2) + C(17)*SENSEXRT(-1) + C(18)*SENSEXRT(-2) + C(19)*USDRT(-1) + C(20)*USDRT(-2) + C(21)

Using the least square method, the probability of each constant is derived which is given in table

**Table 6**: Least Square Method

System: UNTITLED
Estimation Method: Least Squares
Date: 11/14/16 Time: 14:55
Sample: 4 2854
Included observations: 2851
Total system (balanced) observations 8553

| | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C(1) | 0.235958 | 0.019279 | 12.23888 | 0.0000 |
| C(2) | 0.156826 | 0.018669 | 8.400233 | 0.0000 |
| C(3) | 0.047826 | 0.004850 | 9.860130 | 0.0000 |
| C(4) | -0.001771 | 0.004919 | -0.360030 | 0.7188 |
| C(5) | -0.000782 | 0.000704 | -1.109864 | 0.2671 |
| C(6) | 0.000818 | 0.000704 | 1.160874 | 0.2457 |
| C(7) | 0.000644 | 7.70E-05 | 8.368190 | 0.0000 |
| C(8) | 0.190577 | 0.077410 | 2.461935 | 0.0138 |
| C(9) | 0.047074 | 0.074960 | 0.627987 | 0.5300 |
| C(10) | 0.057398 | 0.019475 | 2.947267 | 0.0032 |
| C(11) | -0.075972 | 0.019750 | -3.846745 | 0.0001 |
| C(12) | -0.001914 | 0.002828 | -0.676893 | 0.4985 |
| C(13) | 0.003671 | 0.002828 | 1.298211 | 0.1942 |
| C(14) | 0.000261 | 0.000309 | 0.843294 | 0.3991 |
| C(15) | -0.140163 | 0.488195 | -0.287104 | 0.7740 |
| C(16) | 0.391507 | 0.472747 | 0.828154 | 0.4076 |
| C(17) | -0.184312 | 0.122822 | -1.500641 | 0.1335 |
| C(18) | -0.033635 | 0.124554 | -0.270044 | 0.7871 |
| C(19) | -0.287716 | 0.017832 | -16.13439 | 0.0000 |
| C(20) | -0.309435 | 0.017836 | -17.34906 | 0.0000 |
| C(21) | 3.73E-05 | 0.001950 | 0.019151 | 0.9847 |
| Determinant residual covariance | | 3.36E-11 | | |

**Conclusion and Suggestion**

The linkages between return on FII, return on SENSEX and return on exchange rate seem to be very strong as reflected in the correlation test. However between Sensex movement and exchange rate movement it was found that Sensex has a very strong positive correlation with the movement of FII. The cointegration test indicated



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a long run movement between the three variables. VAR model proved that return on FII is influenced by time lag 1 and 2 of returns on FII and is also influenced by time lag 1 of Sensex. Return on SENSEX is influenced by time lag 1 and 2 of returns on Sensex and time lag 1 of return on FII. INR-US$ exchange rate is influenced by only time lag 1 and 2 of INR-US$ exchange rate itself.

The above analysis shows that FII can be incentivized by strong and stable stock market as FII and the Stock market returns are not only strongly correlated but also are influenced by each other. While FII and Exchange rate are positively correlated but they do not influence each other.

The result of the analysis thus would help policy makers in designing strategies to attract foreign institutional investments. It would also help portfolio managers to design their products based on the above analysis. Finally the study can be used to predict the FII movements and thus protect retail domestic investors from incurring losses.

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