Influence of Foreign Institutional Investments (FIIs) on the Indian stock market

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Abstract

The study examines influence of FIIs on the Indian equity market and its role in integration with US equity market. It provides insight for policy formulation in order to move towards greater liberalized FII's policy regime for regaining FIIs confidence in the Indian equity market. The time line from January 1999 to December 2010 has been partitioned into smaller time frames due to existence of structural breaks in order to capture clear picture of dynamic relationships between variables in the sub - periods. The daily data has been analyzed by Vector Autoregressive framework using different VAR models for determining existence of short term and long run relationships during sub periods and for ascertaining causality between emerging relationships between FIIs, Sensex and other key variables. Despite global recessionary condition both purchase and sales of FIIs have steadily increased due to gradual economic liberalization and it has substantially picked up the pace during the last five years. It was observed for 1/3/1999 to 31/7/2003 period that FII inflows and out flows are significantly influenced by the returns in the domestic equity market. The exchange rate has no effect on the inflows of FIIs; however the outflows are influenced by the change in the exchange rate. SENSEX returns bring change in the exchange rates. Change in the exchange rate affects the outflow of FIIs. The US equity market has no influence on FII's inflows but has marginal influencing role on its outflows.

JEL Classification: C58,C54, G23,G18,G15

Key words: Foreign Intuitional Investments (FIIs), Structural change, VAR

1.0 Introduction

The world economy has gradually started recovering due to buoyant economic activities in the emerging economies. However, the developed economies are still suffering from compounded factors including large fiscal deficits, unemployment, inflation, high debts; all these have resulted in very slow economic growth. The sub-prime crises created an environment of uncertainty and risk. The rising oil & agriculture prices, fueling inflationary pressures have slowed down global economic recovery. However, the Indian growth story post during the period of study is remarkable as its economy has exhibited resilience despite compounded factors including persistent worldwide recessionary conditions, growing current account deficit and inflationary pressures. The other challenges faced by the Indian economy are volatility in FIIs flows, slowdown in exports resulting in widening balance of payment due shrinking global demands, increasing oil & commodities prices and existence of alternative attractive markets.

The Government of India in 1991-92 initiated gradual structural, economic reforms and trade liberalization process in order to bring substantial economic growth, integrate with global economies and provide market access for attracting foreign investments by removing restrictions and regulations. Due to the growing BOP crisis, the high level committee on the Balance of Payments of 1993, headed by Mr. C Rangarajan recommended to shift the composition of external flows to non - debt creating flows. Further by moving away from regulatory regime, Foreign Institutional Investors were allowed to invest in both debt and equity markets and it started in shares and debentures.

Foreign Institutional Investments (FIIs) in the form of Foreign Portfolio Investments helps in enhancing trading volume and market capitalization. Thus it also improves functioning of the secondary market by providing an array of attractive investment opportunities of variety of assets having diversified risk, returns and liquidity profiles. Further FIIs in general may lower cost of capital, provide access to cheap global credits, supplement domestic savings and investments and help in capital market reforms. However FIIs may increase inflation, create asset bubbles; bring financial instability and volatility in the stock market due to sudden reversal of its inflows. According to Dr. Subbarao, former Governor RBI;

'Capital flows aid growth by providing external capital to sustain an excess of investment over domestic savings. By affording the opportunity of using the world market, an open capital account permits both savers and investors to diversify their portfolio to maximize returns and minimize risks'.

The FIIs follow policies and guidelines of the Reserve Bank of India (RBI) and Security Exchange Board of India (SEBI) which has changed from time to time due to dynamic domestic and global environment. The guidelines under SEBI (FII) regulation, 1995 provides its linkage with government policy frame work for investment limits in specific sectors. The policy frame work has evolved since 1992 till today. GOI took steady and cautious approach for gradual liberalization of quantitative restrictions (QRs) by focusing on policy relaxations on investment limits, eligibility criterion for investment and liberalization of investment instruments for FIIs.

Under the Foreign Exchange Regulation Act (FERA); FIIs registered with RBI should obtain permission to buy, sell and realize capital gains on investments which are made by initial corpus remitted to India so as to invest in any recognized stock exchanges through designated bank. The FERA was replaced in 2000 by Foreign Exchange Management Act, (FEMA), 1999 which now controls foreign exchange related transactions for FIIs approved by the RBI.

The two routes for FIIs are (70:30) route; wherein 70% of equity and equity related investments is permissible and balance 30% is for debt. The second route is 100% debt security investment route; however, our focus is on the normal equity FII route. Furthermore to provide flexibility to FII composition, section 15(2) of SEBI FII regulation pertaining to restrictions of 70:30 investments in equity and debt has been removed from October 2008. FIIs are now allowed to invest in all types of securities including government securities. They can invest up to 24% of paid up capital of the company under portfolio investment route.

FPIs comprise GDR/ADR, FIIs and offshore funds & others. The share of FIIs in FPI was 95.97% during 2003-04 and it declined to 46.05% in 2006-07.This significant fall in FIIs is due to meltdown of commodity and equity markets during May-July 2006, fall in Asian markets and tightening of capital control in Thailand.

In 1991-92 the total foreign investments comprising of FDI & FPI was $1.33 billion. FPI increased from mere $4 million touching $ 38.24 billion in 1994-95**(Table 1)**.However there were out flows of - $0.61 in 1998-99; post Asian crisis when Thai Baht was deregulated on 2/7/1997.There was gradual recovery during 1999-2002.The fall in the technology and IT stocks caused bubble burst in April 2001 resulting in the decline of FPIs from $ 20.21 billion in 2001-02 to $ 9.79 billion in 2002 - 03.

The time frame from 2003 to January 2008, known as bull-run period, is characterized by the revival of private foreign capital flows to the emerging market economies due to progressive liberalization process, flexible exchange rate and strong economic growth.Net inflow during 2007-08 was $272.71 billion, an increase of 290% from $ 70.03 billion in 2006-07.

The sub-prime mortgage crisis occurred during 2007-08 resulting in worldwide recessionary conditions consequently due to weak sentiments of investors; the global securities suffered maximum loss during December 08 to early 09 which resulted in net outflows of FPI of -$138.55 billion during 2008-09. Thus there has been out flows of FPI during two years: 1998-99 & 2008-09. However attractive domestic market conditions facilitated net inflow of FIIs $302 billion during 2009-10 (**Table 1**). The gross purchase of debt and equity FIIs increased from $ 1319.71 billion in 2008-09 to $1795.01billion in 2009-10, an increase of 36.02% and combined gross sales increased from $1418.08 billion to $ 1492.48, an increase of 5.26% during same period. The cumulative investment by FIIs (at acquisition cost) increased by 51.02%; from $590.83 billion to $893.36 billion for March 2009 to March 2010.

Net FII inflow in the equity segment was $ 233.74 billion during 2009 -10, a total reversal from outflow of -$102.44 billion during 2008-09 which is an increase of 128.2% preceding year. This remarkable positive inflow in 2009-10 is consistent with the growth in the emerging economy in particular for the growth of BRIC countries. The time frame from 2003 to 2008 was a period of

consistent inflow of FII in equity market with a minor dip in 2006-07. FII stakes in the different sectors of NSE listed companies according to March 2009 statistics indicates that Banking (11.69%), Finance (10.66%), FMCG (10.42%), Information Technology (10.19%) and Media & Entertainment (9.36%) are most attractive sectors for investment.

The number of FII registered with RBI were 12 in 1993, it increased from 2003 onwards but there was sudden jump to 1,319 in 2007- 08 and to 1,626 in 2008- 09 .Although the SENSEX performed better in 2009-10 but the number of new FIIs registered declined to 87.The FIIs continued to invest in Indian market and total number of registered FIIs till March 2010 touched 1,713.The net FII inflows peaked in 2007-08 but there was sudden outflow during 2008-09.The net purchase of equities was $ 233.74 billion against net sales of $102.44billion in the previous year.US ,UK, Mauritius and Hong Kong were major countries for taking FII route to invest in Indian capital market. The large FII inflows appreciated Rupee against $ affecting Indian exports.

The international CAPM by **Frankel (1982)** gives a utility-maximization model for international asset diversification showing that the portfolio risk may be reduced by keeping foreign assets having negative correlation of their returns with home country's assets returns. It was observed that the emerging markets have been growing faster than the advanced economies and are also considered safe & attractive investment destination. The inflows data for the first half of 2010 indicates that the emerging markets are leading economic recovery process and may remain major destination for equity investments. Though the investment pattern for first half of 2010 is uneven but India, Japan , Indonesia and Philippines have shown increase in y-o-y increase in investments; however inflows in Brazil and South Africa have been lower. It was seen by **Poshakwale & Thapa (2010)** that the rapid growth in the flow of foreign equity portfolio investment leads to greater integration of Indian equity markets with global equity markets. FIIs have both positive and negative impact on the domestic economy triggering significant influence on broadly three areas-stock market, exchange rate and foreign exchange reserves. It increases savings of low and middle-income developing countries **(Menkhoff 2003;Modi et al,2001)**,enhances market depth and breadth **(Sumanjeet & Paliwal 2010)**.

The study is organized in six sections. Section 2 reviews related literature and gives testable hypothesis , section 3 provides data, variables, theoretical frame work and methodology, section 4 gives data analysis and empirical findings after the structural breaks, section 5 provides a summary of major findings and section 6 highlights conclusions.

2.0 Literature Review

Chakarbarti R (2001) studied importance of FIIs flow in India and its relationship with other economic variables for May 1993 to June 2001. It was found that even though the flows are highly correlated with the equity returns they are more likely effect than cause of returns; FIIs have no informational disadvantage compared to the local investors and Asian crisis changed determinants of FII inflows resulting domestic equity returns to be the sole drivers of flows. Kohli (2001) investigated trend of capital inflows and their impact on some key macroeconomic

variables. It was observed that inflows appreciates real exchange rate and increases money supply. Mukherjee , Bose & Coondoo(2002) study is an extension of Chakarbarti's (2001) study ; they found that (1) FII flows are caused by returns in the domestic equity market and not conversely (2) Return on equity is single most important factor influencing FII in flows, (3) FII sales and FII net inflows are significantly affected by Indian equity market performance but FII purchase is non - responsive to market performance (4) FII investors are not using Indian equity market for diversification of their investments (5) Return from exchange rate variation and Indian economy fundamentals seem to have influence on FII decision but these are weak. (6) daily FII flows are highly auto- correlated. Batra A (2003) analyzed trading behavior of FIIs and its impact of trading biases upon stock market stability. FIIs have been positive feedback investors and trend chasers at aggregate level on daily data were found. But no evidence of positive feedback trading on monthly basis was found. There was no joint dynamics between long horizon return and net equity purchase. The foreign investors were found to have tendency to herd on equity market even though it may not happen the same day. There is an excessive sell side herding during financial crisis. Although on average the extent of herding [1] on the either side of market during crisis was lower than during immediate preceding period. Batra A (2004) while studying stock return volatility patterns on monthly data used asymmetric GARCH model augmented by structural change analysis. This helped in the identification of sudden shift in stock price volatility and nature of events which caused shift in volatility. It was concluded that the period around BOP crisis and subsequent reforms was the most volatile phase. Major policy changes resulted in sudden shift in stock return volatility which is a consequence of domestic political and economic events rather than global happening. Bose & Coondoo (2004) examined quantitative impact of FII regulatory policy reforms on its investment flow using intervention analysis technique based on multivariate GARCH regression model. Ten policy interventions during 1999-2004 were examined for their possible significant influence on FII flows and their sensitivity to the stock returns. It was found that liberalization of policies have desired expansionary effect in increasing mean level of FII flows , however some restrictive measures to control FII flows do not have significant negative impact on net inflows. Badani & Tripathi (2009) employed ARIMA model to examine relationship between FII investments and the Indian stock market. It was found that the past FII investments have significant impact on the current SENSEX & NSE Index, but not much impact of current FII investment on the current indices was observed. A significant finding of the study is that the FII investment in India needs well calibrated policy response whereas the daily movement of stock market can be better explained by the factors other than FIIs. Bhaduri SN and Samuel A (2009) employed logistic smooth transition method to estimate correlation and pace of integration in international equity market .It was found that pace of integration between Indian and world market is insignificant. Sehgal S & Tripathi N (2009) in their study on investment strategies of FIIs in the Indian equity market examined whether FIIs adopt positive feedback[2] & herding strategy; found that FII's exhibit return chasing behavior while using monthly data and are using this strategy for daily data as they do not react instantaneously but wait for market information to crystallize . Further FII's display a strong herding behavior which is much stronger at the aggregate level than at individual stock level this may be because FIIs are more cognizant of corporate fundamentals at

the individual stock. Mishra, Das & Pradhan (2010) in their study focusing on foreign investments and real economic growth in India used VAR framework observed that bi-directional causality runs from net FII flows to real economic growth. Economic growth is determined and influenced by the volume of portfolio investments. Mukherjee P and Roy M (2011) identify determinants of investment decision of mutual funds and compare it with that of FIIs. It was found that mutual funds influence the decision of FIIs in case of investment in equity and FIIs does opposite of mutual funds. Both track international interest rates. Lakshman, Basu and Vaidyanathan R (2013) observed presence of market - wide herding and examined whether intuitional investors are responsible for herding. They studied impact of index return & volatility as well impact of FIIs inflows & mutual funds on herding.

The study is motivated due to lack of research using high frequency daily data which is divided into sub-periods due to structural breaks. For the first time VAR models comprising of different endogenous variables are employed to comprehensively understand emerging statistical and economic relationships and causation between them and related policy implications.

2.1 Objectives

1. To study the influence of FIIs on SENSEX returns and its role in integration with US equity market.
2. To examine macroeconomic determinants influencing relationship between SENSEX and FIIs.

2.2 Research Questions

1. Are there short term and long run relationships between SENSEX and FIIs? Does there exist a robust VAR to explain it?
2. What is the causal relationship of purchase, sales and net FII flows with SENSEX?
3. What is the impact of structural change on the relationship between SENSEX and FIIs and other indices?
4. Do FIIs help in the integration of SENSEX with the US equity market?
5. What is the relationship between SENSEX, S&P 500 and exchange rate?

3.0 Data Selection, Variables and Methodology

The daily data relating to variables SENSEX, Purchase and sales of FIIs, S&P500 and Exchange rate has been taken from www.bseindia.com, www.sebi.com, Business Beacon and uk.finance.com.

3.1 Data Series

FIIN =FII net inflow which is the difference between daily FII purchase (FIIP) and FII sales (FIIS) in the equity market.

FIIP= Daily purchase of FIIs

FIIS= Daily sales of FIIs

FIIR is ratio of FIIP and FIIS;

FIIR= $\frac{FIIP}{FIIS}$ if FIIR> 1; indicates inflow of FII's and

FIIR<1; indicates outflow of FII's

EXR = Daily Rs $ exchange rate.

SENSEX = Daily closing price of BSE 30

S&P 500 = Daily closing price of US bench mark market index

The following variables giving daily returns have been derived from the above time series:

glSensex=log(Sensex/Sensex(-1)),glSP500=log(SP500/SP500(-1)),glexr=log(exr/exr(-1)), glfiip=log(fiip/fiip(-1)) , glfiis =log(fiis/fiis(-1)) and glfiir=log(fiir/fiir(-1)).

3.2 Methodology

We evaluate by different VAR models existence of possible relationship between net capital flow, Sensex return, S & P return and change of exchange rate. This is done starting with simple VAR models with few variables in the identified sub-periods and bringing in more variables into the system which helps in identification of a robust VAR model. The descriptive statistics is first discussed followed by the usage of statistical tests for confirming presence of structural breaks. Tests for non - stationarity is followed by discussion about existence of cointegration, Granger causality test, generalized impulse response analysis and variance decomposition analysis.

3.2.1 Test for Stationarity

Non-stationarity of time series is tested to avoid the presence of 'spurious regression' **(Granger & Newbold, 1974)**.The classical regression model assumes that both dependent and independent variables in the regression model should be stationary. The presence of unit root or non stationarity are tested using different tests including Augmented Dickey - Fuller (ADF) test (1979, 1981),Phillips Perron (PP) test (1988) & KPSS test(1992). Subsequently DFGLS, E-R-S test and Ng-Perron test are also used in order to confirm stationarity of time series.

3.2.2 Vector Autoregressive Model (VAR)

In order to examine the relationship between macroeconomic variables; the Vector Autoregressive Model (VAR) popularized by **Sims (1980)** has been used. The VAR model includes all variables in the system and tries to determine its variation due to its past values as well as lagged values of other variables.

An unrestricted VAR assumes that the variables are related to both their own lagged values as well as lagged values of other variables. In this study estimated VAR are of reduced form since they only use lagged values of variables on the right hand side indicating non - existence of simultaneity in the system. Numbers of variables included in the system depend upon theoretical considerations and decision about lag length is based upon statistical tests. For an unrestricted VAR it is necessary that the same numbers of lags of all of the variables are used in all equations. The optimal lag length is for minimum value of multivariate information criteria

based on AIC, SC and HQ. It is essential that all variables included in the VAR should be stationary so as to conduct joint significance test on the lags of identified variables. The significance of all lags of each variable within the VAR framework is examined jointly by F-tests which will establish the joint significance of all lags of the individual variables. **(Brooks & Tsolacos, 1999)**

3.2.3 Generalized Impulse Response Analysis

The impulse response function captures and measures the time profile of effect of a onetime shock to one of the innovations to both future & current values of endogenous variables of a dynamic system.

The conventional method of Impulse response function **Sim (1980,81)** is sensitive to the sequence of the variables of the VAR**(Lutkhepohl,1991)** . Inverse of Cholesky factor of the residual covariance matrix was used by **Cholesky** to orthogonalize these impulses. This imposes an ordering of variables in the VAR and it attributes all effects to the variable which is first in the VAR system. The responses change significantly in case of reversing the order which is its limitation. In order to overcome this problem for linear multivariate model, **Pesaran & Shin (1998)** developed Generalized Impulses which are orthogonal set of innovations that are independent of VAR ordering. The impulse responses can be uniquely estimated; secondly they do not change due to the ordering of the variables in the VAR and lastly they take into consideration the past patterns of correlation between different shocks.

3.2.4 Variance Decomposition

The impulse response function helps to find the effect of a shock to one endogenous variable imparted on other variables in the VAR whereas the variance decomposition breaks the endogenous variable's variations into shocks component to the VAR. We have decomposed the forecast error variance so as to determine the proportion of the movement in the different time series that are consequence of its own shock rather than shocks to other variables.

4.0 Data Analysis and Empirical Findings

4.1 Descriptive Statistics for Sub Timeframes

The timeframe from 1st January 1999 to 31st December 2010 has been divided into four sub periods T_1, T_2, T_3 and T_4 on the basis of global events influencing Sensex and FIIs flows. These sub divisions are based on statistical analysis.

The four mutually exclusive time frames are T_1, T_2, T_3 and T_4 (**Table 2)**

1. The Asian crisis triggered after 2/7/1997 when the Bank of Thailand announced managed float of Baht which amounted to spreading of recession. However the process of slow economy recovery started post - Asian currency crisis during 1/1/1999 to 31/7/2003.This period recovery , on the contrary, also had dotcom bubble burst which resulted in the meltdown of technology and IT stocks after April 2001.The Sensex touched highest of

5933.56 on 11/2/2000 and lowest of 2600.12 on 21/9/2001(**Table 3**).Maximum purchase of FII was $286.39 million and maximum outflow was $192.98 million.

The descriptive statistics of time series variables indicates that Sensex, SP500,FIIP and FIIS are positively skewed whereas SP500 and Exchange rate are marginally negatively skwed.SENSEX,SP500,EXR are platykurtic where as FIIP,FIIS and NETFII are leptokurtic. The JB statistics indicates that all time series are not normally distributed.

2. The second time frame 1/08/2003 to 15/01/2008 focus on gradual reform process which helped to come out from the recession caused by dotcom bubble burst. The recession was followed by the process of consolidation and economic growth due to gradual reform process in regulatory environment resulting into revival of private capital flows. Though in the latter period it also started giving indications of global subprime crisis causing sudden out flows of FIIs. The descriptive statistics of the second subsample from 1/08/2003 to 15/01/2008 indicates that Sensex touched all time high at 20,873 and minimum 3,741.This period witnessed high volatility of FIIs. The inflow of FIIs touched its peak of $2,323 million due to attractiveness of the Indian economy but it had record outflow of $ 2515.63 million. All time series besides EXR are positively skewed. SENSEX and SP500 are platykurtic whereas all other time series are leptokurtic. The Jarque-Bera statistics indicates non - normality of all time series.
3. The period 16/01/2008 to 9/03/2009 relates to subprime mortgage crisis and failure of global banking system. The global securities suffered maximum loss during this period which consequently affected our economy. The SENSEX showed high volatility by dropping from maximum of 19,868 and touching minimum of 8,160 indicating bear phase .FIIs outflow touched maximum of $ 2,520 and net inflow moved in the band of $967 million to -$861 million. Sensex and SP500 are negatively skewed and remaining time series are positively skewed. Sensex, SP500 and EXR are platykurtic whereas FIIs are leptokurtic. The Jarque-Bera test confirms that all time series are not normally distributed.

4. The post subprime crisis period from 10/03/2009 to 31/12/2010 shows robustness of Indian banking regulatory system and resilience of the emerging economy .The SENSEX touched highest peak of 21,029 points. FIIs inflows reached maximum of $ 2,664 million .The maximum outflow in a day was $1,610 million. All variables are positively skewed excepting SENSEX and SP500. The distributions time series are leptokurtic for all but for SP500 which is almost normally distributed. The JB statistics indicates non - normality of distributions of all time series.

It was observed from equality of mean test by using Levene's test, Post Hoc Tukey HSD test & ANOVA that for the four subsamples of NetFII and SENSEX returns for T_1, T_2, T_3, and T_4 have distinct distributions. Thus each sub period has statistically different distribution of these variables characterized by distinct set of population parameters.

4.2 Structural Breaks

The break point **Chow test (1960)** independently fits equation for each subsample and checks existence of any significant difference in the estimated equations. The presence of significant difference in these estimated equations indicate structural change in the relationship. The Chow breakpoint test checks existence of structural break in all parameters of the equation, however, in case of a linear equation, testing structural break in the subset of parameters will be sufficient.

Why structural break study is necessary? According to **Katarina Juselius (2006)**[3],

> "Since the inferences from the VAR model are valid provided the parameters are constant, it is frequently the case that one has to split the sample period into subsamples representing constant parameter regimes."

The structural breaks are tested for the complete data from 1/1/1999 to 31/12/2010 having 2984 observations for the data series NetFII, BSER, GEXR, SP500R or testing for its subset by running regression of NetFII on SENSEXR.

The stability of two parameters is tested by CHOW test.

The null hypothesis & alternative hypothesis are:

H_0 : The parameters are constant or stable across four samples

H_1: The parameters do not remain constant across four samples.

Thus from the first version of Chow break test (**Table 4**); it is seen that H_0 is rejected as p-value is less than α at 1%. Similarly the p - value for the second & third version of test based on χ^2 test rejects the null hypothesis indicating existence of structural breaks at observations 1147, 2266 and 2544 or it is also an evidence of instability of parameters. Thus the parameters do not remain constant over the whole range. Determination of reliable relationships between parameters is possible by conducting independent analysis for these four mutually exclusive partitions.
The Chow test for confirmation of break points for complete set of variables- net inflow of FIIs , Sensex return , S&P 500 return and growth in exchange rate is conducted below.

The regression equation of the variable and its output is:

$$NETFII = \alpha + \beta_1 * SENSEXR + \beta_2 * SP500R + \beta_3 * GEXR$$

Interpretation
As R^2 < d ⇨ that it is a non-spurious regression (0.101<1.323). **(Table 5)**
SENSEXR and GEXR are significant at 5% but S&P500 is insignificant.
Secondly ,Adj R^2=0.10 which means the model can hardly explain 10% of variation in the dependent variable net FII by joint variation of the three independent variables SENSEXR , SP500 and GEXR .
The p - value of F statistics = 0.0<0.5, it means the model has joint explanatory power of

3 independent variables. This indicates goodness of fit. The DW statistics =1.32361< D_L, as for n=200, number of explanatory variables k=3,α=5%,D_L = 1.643 but for n=2298 the value of D_L will be much higher than 1.643.This implies reject H_0: ρ=0⇨ existence of autocorrelation.
As value of Variance Inflation Factor (VIF) is less than 10; it indicates absence of Multicollinearity thus the estimate of βs will be precise.
Further values of coefficients (β's) of parameters are not providing true picture of state of affairs. This may be due to structural breaks occurring during the long period of observations.
The Chow- test **Table 6** confirms instability of parameters over the complete time line as p-values for three statistics are 0.0 < α =1%.Thus the test strongly indicates existence of structural breaks in the time series data of FII flows(in similar way for the SENSEX data)

4.3 Test for Stationarity

The non-stationarity at level is tested for LSENSSEX, LSP500, LEXR, NETFII, LFIIP, LFIIS and LFIIR for 1/1/1999 to 31/07/2003 using variety of test. It was observed that most of the time series are non - stationary excluding LFIIR which gave mixed signals.

The stationarity for first difference of variables LSENSEX, LSP500,LEXR,LFIIP ,LFIIS and LFIIR by different unit root tests confirms that all variables are integrated of order 1 .

The following VAR models comprising of different variables are considered for analysis:

VAR I : GLFIIP & GLSENSEX

VAR II: GLFIIP, GLSENSEX, GLSP500 & GLEXR

VAR III: NETFII & SENSEXR

VAR IV: GLSENSEX, GLFIIS, GLEXR and GLSP500

4.4 VAR Model I

4.4.1 VAR lag order Selection

The VAR model 1 comprises of two endogenous variables GLFIIP and GLSENSEX. The lag order of unrestricted VAR is calculated for different information criteria [**Sim (1980),Lukepohl (1991)**]. It is seen that the lag length for 4 gives minimum value for all three information criterion- Akaike information criterion (AIC), Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ).Thus **VAR(4)** is suitable for further analysis.

The VAR estimate is given by:

GLFIIP = - 0.713482971793*GLFIIP(-1) - 0.45304718571*GLFIIP(-2) - 0.342581139703*GLFIIP(-3) - 0.292258954201*GLFIIP(-4) + 3.58908503342*GLSENSEX(-1) - 0.467850251669*GLSENSEX(-2) - 2.18844429875*GLSENSEX(-3) - 0.481869425643*GLSENSEX(-4) + 0.0056547268182

Interpretation

37.53% variation in the growth of FII inflows (purchase) is explained by the model whereas hardly 2.4% growth SENSEX can be explained by growth in FIIs purchase. Thus in short term the growth of SENSEX has higher influence on the growth of inflows of FIIs than otherwise. The F- value indicates that the regression coefficients are significant for FIIP.

4.4.2 Impulse Response

Figure 1 gives the impulse response associated with unit standard deviation shock in each of the two explanatory variables.

Impact on FII inflows

Innovation in FII inflows

Considering signs of responses, unexpected FII inflows have mixed impact on itself and the effect of shock dies down after 10 days. On the first day it is positive second day negative and it recovers to positive on the third day dipping on 5^{th} and 6^{th} but peaks up on the 6^{th} day.

Innovation in Sensex returns

Return of Sensex has positive impact on FIIs inflow on the first day but from 2^{nd} to 5^{th} day has negative impact on FIIs inflows remains positive from 6^{th} to 7^{th} day and it has subsequently no effect on FII inflows.

Impact on SENSEX return

Innovation in FII inflows

Increase in FIIs inflow has positive impact on Sensex return till 5 days ahead and has marginal dip on 6^{th} day but has positive dying impact after 7^{th} day.

Innovation in Sensex returns

Innovation in SENSEX return has significantly positive impact one day ahead but it suddenly falls on 2^{nd} day and has marginal positive impact till 6^{th}day and has no impact on Sensex returns further.

As the impulse response dies out to zero in all four cases; therefore the VAR model is stationary.

4.4.3 Variance Decomposition

Variance Decomposition of GLFIIP

The first day's decomposition of growth FIIP (FII inflows) is due to its own innovation. Even after 10^{th} day, shock to the FIIP account for 98.45% variation in growth of FII inflows or 98.45% variation in growth FII inflow is explained by its own shock where as SENSEX return shocks account for 1.55 % of variance of FII inflows .It implies that FII inflows are dependent on itself rather than SENSEX returns.

Variance Decomposition of GLSENSEX

98.51% growth in Sensex return is explained by itself on the 1^{st} day where as 1.48% of growth in Sensex return is explained contemporaneously by inflow of FIIS.96.83% variation in SENSEX return is explained by shock 10 days ahead whereas 3.16% variation in Sensex return is explained by FII purchase.

4.4.4 Granger Causality

Correlation does not imply causation in a meaningful way; it only provides strength of relationship between the two random variables. The correlation coefficient between the endogenous variables: growth in Sensex return (GLSENSEX) and growth in FII inflows (GLFIIP) is 0.0578.

The short term dynamics are examined using the Granger causality for lag 4 between GLSENSEX and GLFIIP. As p - values are 0.0005 and 0.0007 which are significant at 1%,therefore reject the null both hypothesis: (1) GLSENSEX does not Granger Cause GLFIIP & (2) GLFIIP does not Granger Cause GLSENSEX ,indicating there exist a bi-directional causality running between growth of SENSEX return and growth of FIIs inflows.

However it is seen that Granger causality is sensitive to the selection of order of lag. GLSENSEX granger causes GLFIIP but GLFIIP does not Granger cause GLSENSEX. Thus two way causation does not exist between two variables for 2 lag length.

4.5 VAR Model II

Let us include more endogenous variables in the model and find its appropriateness in terms goodness of fit and improvement over the previous model. The lag order selection criteria for VAR for endogenous variables GLFIIP, GLSENSEX, GLSP500, GLEXR confirms minimum value for lag 1 Schwartz information criterion.

VAR estimate is given by **Table 7**

Interpretation

AdjR^2 for regression of FIIP is 23% which implies 23% variation in growth of inflow of FIIs is explained by the model and remaining 77% remains unexplained. Further as $F_{k-1,n-k}$ =89.999,k=4,n-k=1,145-4=1,141,H_0:β_1= β_2 =β_3 =β_4=0,α=5%,$F_{3,1141}$ =2.08.F-statistics for overall significance of OLS for GLFIIP rejects the null hypothesis ,as $F_{cal}>F_{tab}$ implying β_i's are significant. Thus the model is correctly specified in jointly explaining variation in growth of FII inflows on the basis of explanatory variables. To Test H_0:β_1= β_2 =β_3 =β_4=0 by F - test ,which is measure of overall significance of parameters is similar to test significance of R^2 =0 [as F= $\frac{\frac{R^2}{k-1}}{\frac{(1-R^2)}{n-k}}$].Thus OLS for GLFIIP gives good fit. Similarly F_{cal} for GLSENSEX and GLEXR is 6.7206 and 5.2406 respectively, thus regression coefficients for GLSENSEX and GLEXR are significant ; however the null hypothesis for GLSP500 is accepted implying no relationship of growth in SP500 with the growth of explanatory variables - FII inflows, SENSEX and exchange rate.R^2 for VAR II is less than VARI but it was observed that '*R^2 is an inappropriate measure when variables are trending*' (page 59, The Co- integrated VAR model by **Katarina Juselius**) .The F- statistics which tests H_o that all of the slope variables are jointly zero indicates that the regression coefficients are jointly significant confirming that there is significant relationship between GLFIIP and other explanatory variables .

Granger Causality

Chakarbarti (2001) also examined causality between net FII and SENSEX for monthly returns; however Granger causality focuses to detect statistically significant short term lead lag relationship in the pair of data sets of two variables. As SENSEX responses spontaneously; examination of monthly data will fail to capture inherent exact causality **(Mukherjee, Bose & Coondoo,2002)** which is limitation of Chakarbarti's study. The Granger causality relations are provided in **Table 8**

Interpretation

GLSENSEX Granger causes GLFIIP ➡ past value for growth of Sensex returns causes growth in FIIs inflows but the causation does not run the other way at 1% level of significance. This confirms that FII flows in India during post - Asian crisis are mostly due to contemporaneous return of SENSEX which is similar to research by **Mukherjee , Bose & Coondoo(2002), Panda(2005)** done for a limited data set .The other way causation that FII inflow being cause of return of SENSEX does not exists , which was also confirmed **by Badani & Tripathi (2009)**.

Another significant feature is non - existence of causation between growth of US market returns and growth of inflows of FIIs. Although S & P 500 has significant influence on Sensex returns but other way causation does not exist which reflects the true state of affairs.

A fall in the exchange rate of Rupee against $ represents depreciation of Rupee (more Rs for a $) whereas rise in exchange rate represents an appreciation of Rupee. By the **Table 11** it is evident that no definite conclusions can be drawn about Granger causality between exchange rate and inflow of FIIs for T1 which conforms to the study of **Bhattacharya & Mukherjee (2002)** who suggested that there is no causal linkage between FII inflows and exchange rate but **Kohli (2001)** found that inflows of FIIs appreciates real exchange rate. **Badani(2005)** found , for the monthly data from April 1993 to March 2004, existence of long term relationship between FIIs inflows and exchange rate. However the period of the study prior to 1999 has somewhat regulated policy frame work for FIIs and usage of monthly data cannot provide true picture. From the table it is evident that the change in the exchange rate does not granger cause Sensex returns however Sensex returns Granger causes change in exchange rate (which contradicts **Badani 2005**'s study where it was seen that short term causality runs from change in exchange rate to stock returns and not vice versa for monthly data. **Bhattacharya & Mukherjee (2002**) also found unidirectional causality from change in exchange rate to stock returns at 10% for monthly data implying that the exchange rate movements leads the BSE sensitive index .Thus the absence of causal relationship between exchange rate and inflow of FII indicates that the causality between exchange rate and Sensex return is not due to FII purchases but due to other factors. Thus stock market volatility may be stabilized by focusing on domestic economic policies. Furthermore stock market returns can neither capture changes in inflows of FIIs nor change in exchange rate thus a suitable profit making tactical strategy may be formulated on the basis of this information. It is also seen non- existence of any causation between S&P 500 and change in exchange rate.

Variance decomposition analysis almost confirms the above analysis; on the first day 100% variation in FII inflows is explained by variation in itself and hardly 0.47% is explained by

SENSEX returns 10 days ahead and change in exchange rate and US equity market has no influence on FIIs inflows.99.6% variation in Sensex return is explained by itself on the first day whereas 0.37% variation Sensex return is explained FIIs inflows 10 days ahead.1.8% variation in Sensex return is explained by S& P returns 10 days ahead. Variance decomposition of change in exchange rate confirms unidirectional causality from Sensex return to change in exchange rate.1.94% variation in change in exchange rate is due to Sensex return on the first day and it increase to 3.15% 2 days ahead and maintains the same even 10 days ahead.

4.6 VAR III

It is seen that NETFII & SENSEXR are both stationary I(0) for the time period T_1.Var lag order selection has minimum value 1 for SC though it is 3 for HQ and 5 for AIC.R^2 value in the OLS of VAR(1) of NETFII & SENSEXR is very small signifying that the model is not a good fit. More variables need to be included. But the model is able to jointly explain variations as by F-statistics; β coefficients are significant. There exists unidirectional causality in Granger sense from Sensex returns to net FIIs at α=1% when lag is 1 and bi-directional at α=5%. Bidirectional causality exists in case lag is 3 (for HQ) at α=5%.However for lag 5 (for AIC) bidirectional causality exits at α=1% **(Table 9)**

The Granger Causality test has been used to study market information efficiency. The information efficiency exists in case unidirectional lagged causal relationship from an economic variable to Sensex return or bi-directional between Sensex return and economic variables could not be found. It implies that market is efficient as economic variables cannot influence or be influenced by Sensex volatility. Sensex and variables movements are statistically independent of each other. The above analysis indicates bi-directional causality exists between SENSEX return and net FIIs at 5% level of significance. *This means market information efficiency hypothesis may be rejected for Sensex return and net FIIs*. But the result is consistent with the **base-broadening hypothesis** which assumes positive and long term impact of FIIs on stock price due to reduction of risk premium on account of international diversification. There is expansion of investor base to include foreign investors which results in increased diversification this is followed by reduced risk which lowers the required risk premium**. [Merton (1987), Clark & Berko(1997) and Warther (1999)]**

4.7 VAR IV

The VAR for stationary endogenous variables GLSENSEX, GLFIIS, GLEXR and GLSP500 has minimum value of lag 1 by SC criterion and lag 4 by AIC and HQ criterion. The VAR for lag 4 is considered. The estimated VAR(4) has low R^2 value signifying poor fit but as the $F_{k-1,n-k} = F_{16-1,1147-16} = F_{15,1131}$ =1.67 F-statistics is significant for OLS in the VAR of GLSENSEX(3.224094) ,GLFIIS(38.69679), GLEXR(2.267202) but insignificant for SP500(0.773234);where values within ( ) are F - calculated . Further simple linear regression between daily FII sales and BSES return is found to be negative and significant on the same day whereas FII purchase has positive and significant relationship with BSE return at α=10%.

It is seen that the pair wise granger causality exists from GLSENSEX to GLFIIS, GLSENSEX to GLEXR & GLEXR to GLFIIS. This mean that decline in returns of SENSEX results in the sales of FIIs ,SENSEX returns brings change in the exchange rates and change in the exchange rates affects outflow of FIIs.

- The variance decomposition of SENSEX return shows that 100% variation in it is due to itself but returns of SP500 affects 1 day ahead and 2.8% variation in SP500 return affects SENSEX return 10 days ahead other variables have no influence on SENSEX.
- The variance decomposition of sales of FIIs indicates that 99.81% variation is due to itself a day ahead. More that 3% variation in outflow in FIIs is due to change in the exchange rate , return of both Sensex and S& P 500 10 days ahead.
- The variance decomposition of change in exchange rate confirms that 97.7% variation is due to itself and remaining 2.05% due to SENSEX return 1 day ahead. Variation in Sensex return has persistent influence on change in exchange rate.

Similar analysis could be conducted for other three sub periods.

5.0 Summary of Major Findings

1. It is evident from **VAR I** between Sensex return and FII inflows that in short terms; Sensex return is responsible for the growth of inflows of FIIs for post Asian crisis period. This is also confirmed by the innovation of Sensex and FII inflows. The variance decomposition indicates that FII inflows are dependent on itself rather than on SENSEX returns. Significant variation in SENSEX return is explained by itself whereas small variation in Sensex return is explained by FII purchase. Growth of SENSEX return and growth of FIIs inflows have bidirectional causality.

2. **VAR II** includes more endogenous variables GLFIIP, GLSENSEX, GLSP500, GLEXR. Past value of growth of Sensex returns causes growth of FIIs inflows but the causation does not run the other way. FII flows in India during post Asian crisis are mostly due to contemporaneous return of SENSEX. The other way causation that FII inflow being cause of return of SENSEX does not exists, which was also confirmed **by Badani & Tripathi (2009).** Non - existence of causation between growth of US market returns and growth of inflows of FIIs. However S& P 500 has significant influence on Sensex returns but other way causation does not exist. No definite conclusions can be drawn about granger causality between exchange rate and inflow of FIIs for T_1 which conforms to the study of **Bhattacharya & Mukherjee (2002).** It was observed that the change in the exchange rate does not granger cause Sensex returns; however Sensex returns Granger causes change in exchange rate. The absence of causal relationship between exchange rate and inflow of FII indicates that the causality between exchange rate and Sensex return is not due to FII purchases but due to other underlying factors. Thus stock market volatility may be stabilized by focusing on domestic economic policies. Variance decomposition confirms that inflows of FIIs are explained mostly by itself and Sensex returns also contribute marginally. US equity market has no influence on FIIs inflows. Variance decomposition of change in exchange rate confirms unidirectional causality from Sensex return to change in the exchange rate.

3. **VAR III** comprises of two variables - net inflows (NETFII) & Sensex return (SENSEXR). There exists unidirectional causality in granger sense from Sensex returns to net FIIs at α=1% when lag is 1 and bi-directional α=5%. The bi-directional causality means market information efficiency hypothesis may be rejected for Sensex return and net FIIs. This leads to strong evidence consistent with the previous research work conducted confirming with base-broadening hypothesis.

4. **VAR IV** includes variables GLSENSEX GLFIIS GLEXR GLSP500 and it examines role of FIIs sales or outflows.FII sales/ purchase has corresponding negative/ positive relation with Sensex returns. It was observed that the decline in the return of SENSEX results in the sales of FIIs, SENSEX returns brings about change in the exchange rates and change in the exchange rates affects outflow of FIIs. The variance decomposition of SENSEX return shows that 100% variation in it is due to itself but returns of S&P500 affects 1 day ahead. 99.81% variation in FII sales is due to itself a day ahead. More that 3% variation in outflow in FIIs is due to change in the exchange rate, return of both Sensex and S& P 500. Variation in Sensex return has persistent influence on change in exchange rate.

6.0 Conclusions

The large time frame was subdivided in sub periods due to existence of structural breaks confirmed by the usage of different statistical tests as inferences drawn from VAR model is valid for the constant parameter regime. Different VAR models for derived sub - periods provided interesting results indicating statistically significant relationships. It was observed that FIIs inflows and out flows are significantly influenced by the returns in the domestic equity market.Net inflows dependence on equity market returns indicates daily return chasing behavior on the short term by the Foreign Institutional Investors. The existence of bi-directional causality for Sensex return and net FIIs means market information efficiency hypothesis may be rejected; at the same time it confirms base-broadening hypothesis. By the usage of Generalized Impulse Function, Variance Decomposition and Granger causality test; it was found that the change in the exchange rate has no affect on the inflows of FIIs; however out flows are influenced by the change in the exchange rate. SENSEX returns bring about change in the exchange rates and change in the exchange rates affects outflow of FIIs. The US equity market has no influence on FIIs inflows but it has marginal influencing role in its outflows. The policy implication of these findings motivates to move towards more liberalized regime so as to regain investor's confidence in Indian equity market ensuring greater value to all stake holders.

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8.0 Tables:

Table 1: FDI & FPI investments from 1991 to 2011

Year	FDI	FPI	Total
	b$	b$	b$
1991-92	1.29	0.04	1.33
1992-93	3.15	2.44	5.59
1993-94	5.86	35.67	41.53
1994-95	13.14	38.24	51.38
1995-96	21.44	27.48	48.92
1996-97	28.21	33.12	61.33
1997-98	35.57	18.28	53.85
1998-99	24.62	-0.61	24.01
1999-00	21.55	30.26	51.81
2000-01	40.29	27.6	67.89
2001-02	61.3	20.21	81.51
2002-03	50.35	9.79	60.14
2003-04	43.22	113.77	156.99
2004-05	60.51	93.15	153.66
2005-06	89.61	124.92	214.53
2006-07	228.26	70.03	298.29
2007-08	348.35	272.71	621.06
2008-09	351.8	-138.55	213.25
2009-10	371.82	323.75	695.57

Source RBI, table 31 page 53

Table 2 : Four sub periods for analysis

	Events	From	To	Sample points	Number of observations
1	Post Asian Crisis & Dot com bubble burst,T_1	1-1-1999	31-7-2003	1147	1147
2	Period of consolidation & reforms,T_2	1-08-03	15-01-08	2266	1119
3	Subprime crisis,T_3	16-01-08	09-03-09	2544	278
4	Post subprime crisis,T_4	10-3-09	31-12-10	2984	440

Table 3: Descriptive Statistics of variable for T1 (1/1/1999 to 31/07/2003)

	SENSEX	SP500	EXR	FIIP	FIIS	NETFII
Mean	3801.140	1194.396	46.12230	47.06899	39.74816	7.350283
Median	3560.320	1234.450	46.74000	39.42208	34.86133	5.265621
Maximum	5933.560	1527.460	49.06000	286.3935	192.9812	261.8516
Minimum	2600.120	776.7600	42.39100	0.682835	0.309853	-111.5368
Std. Dev.	707.8888	201.3728	2.140593	30.65335	23.90271	25.84790
Skewness	0.811084	-0.317788	-0.377228	2.035447	1.762453	1.430576
Kurtosis	2.756780	1.878516	1.666916	10.80060	8.185358	16.43959
Jarque-Bera	128.5876	79.41459	112.1344	3700.103	1878.829	9023.491
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Observations	1147	1147	1147	1147	1147	1147

Table4: Chow Breakpoint Test

Chow Breakpoint Test 1147,2266,2544			
Null Hypothesis :No Breaks at specified breakpoints			
Equation Sample :2 2984			
Statistics	**Value**	**Prob. of Statistics**	**p-value**
F-statistic	62.22455	Prob. F(6,2975)	0.00000
Log likelihood ratio	352.65870	Prob. Chi-Square(6)	0.00000
Wald Statistic	373.34730	Prob. Chi-Square(6)	0.00000

Table 5: Multiple Regression model

Dependent Variable: NETFII						
Method: Least Squares						
Date: 05/18/11 Time: 21:40						
Sample (adjusted): 2 2984						
Included observations: 2983 after adjustments					**Collinearity Statistics**	
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**	**Tolerance**	**VIF**
C	30.23948	2.476039	12.21284	0.0000		
SENSEXR	1754.847	149.5067	11.73758	0.0000	.905	1.105
SP500R	-190.1358	187.3934	-1.014634	0.3104	.958	1.044
GEXR	-75.35857	7.072709	-10.65484	0.0000	.933	1.071
R-squared	0.101531	Mean dependent var		**31.42062**		
Adjusted R-squared	0.100627	S.D. dependent var		142.4261		
S.E. of regression	135.0702	Akaike info criterion		12.65081		
Sum squared resid	54348790	Schwarz criterion		12.65885		
Log likelihood	-18864.68	Hannan-Quinn criterion		12.65370		
F-statistic	112.2140	Durbin-Watson stat		1.323616		
Prob(F-statistic)	0.000000					

Table 6: Chow Breakpoint Test for Multiple Variables

Chow Breakpoint Test: 1147 2266 2544			
Null Hypothesis: No breaks at specified breakpoints			
Varying regressors: All equation variables			
Equation Sample: 2 2984			
F-statistic	32.06337	Prob. F(12,2967)	0.00000
Log likelihood ratio	363.73020	Prob. Chi-Square(12)	0.00000
Wald Statistic	384.76040	Prob. Chi-Square(12)	0.00000

Figure 1: Generalized Innovation

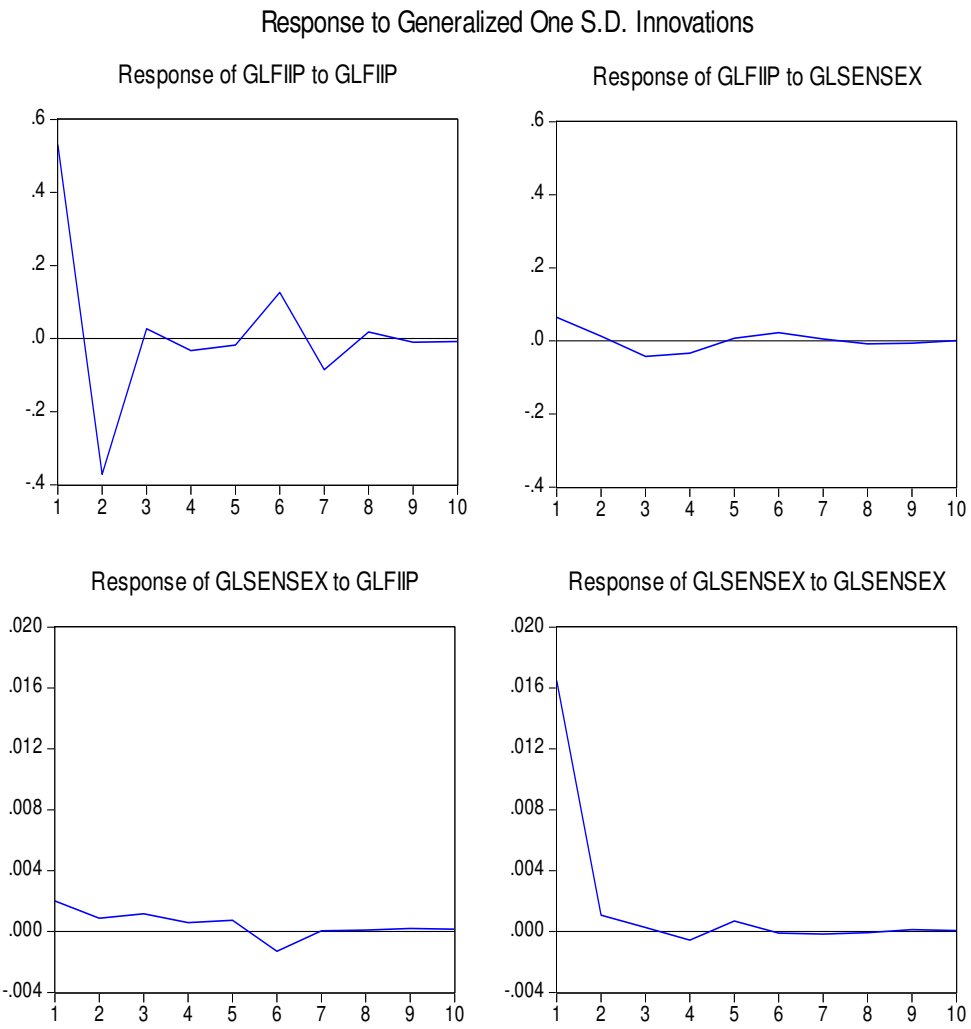

Table 7 :VAR II estimate

Vector Autoregression Estimates				
Sample (adjusted): 3 1147				
Included observations: 1145 after adjustments				
Standard errors in ( ) & t-statistics in [ ]				
	GLFIIP	**GLSENSEX**	**GLSP500**	**GLEXR**
GLFIIP(-1)	-0.488994	5.97E-05	0.000273	-3.45E-05
	(0.02590)	(0.00073)	(0.00060)	(5.3E-05)
	[-18.8810]	[0.08235]	[0.45716]	[-0.65682]
GLSENSEX(-1)	2.572146	0.062471	0.005448	-0.008706
	(1.05934)	(0.02965)	(0.02440)	(0.00215)
	[2.42806]	[2.10660]	[0.22323]	[-4.05113]
GLSP500(-1)	1.878052	0.165163	0.006088	-0.002661
	(1.28712)	(0.03603)	(0.02965)	(0.00261)
	[1.45912]	[4.58390]	[0.20533]	[-1.01912]
GLEXR(-1)	15.10960	-0.123246	0.039660	-0.062585
	(14.6258)	(0.40943)	(0.33693)	(0.02967)
	[1.03307]	[-0.30102]	[0.11771]	[-2.10944]
C	0.004952	0.000199	-0.000192	7.73E-05
	(0.01743)	(0.00049)	(0.00040)	(3.5E-05)
	[0.28404]	[0.40700]	[-0.47721]	[2.18559]
R-squared	0.239999	0.023038	0.000289	0.018056
Adj. R-squared	**0.237332**	0.019610	-0.003219	0.014611
Sum sq. resids	395.0995	0.309619	0.209675	0.001626
S.E. equation	0.588709	0.016480	0.013562	0.001194
F-statistic	**89.99941**	**6.720620**	0.082285	**5.240646**
Log likelihood	-1015.532	3078.731	3301.882	6083.972
Akaike AIC	1.782588	-5.368963	-5.758745	-10.61829
Schwarz SC	1.804611	-5.346941	-5.736723	-10.59627
Mean dependent	0.004338	0.000170	-0.000188	7.16E-05
S.D. dependent	0.674114	0.016644	0.013540	0.001203
Determinant resid covariance (dof adj.)		2.41E-14		
Determinant resid covariance		2.36E-14		
Log likelihood		11464.08		
Akaike information criterion		-19.98967		
Schwarz criterion		-19.90158		

Table 8: Pairwise Granger Causality

	Pair wise Granger Causality					
	p-value					
Lags	1	2	3	4	5	6
Null Hypothesis						
GLSENSEX does not Granger Cause GLFIIP	0.0181*	0.0077*	0.0004*	0.0005*	0.0011*	0.0041*
GLFIIP does not Granger Cause GLSENSEX	0.8699	0.2579	0.2652	0.0007*	0.0037*	0.0126*
GLSP500 does not Granger Cause GLFIIP	0.1219	0.1640	0.1575	0.3650	0.3281	0.2646
GLFIIP does not Granger Cause GLSP500	0.6374	0.8887	0.9819	0.9886	0.9926	0.9946
GLEXR does not Granger Cause GLFIIP	0.5121	0.7578	0.3151	0.5729	0.0149*	0.0336**
GLFIIP does not Granger Cause GLEXR	0.3621	0.6138	0.4506	0.0274	0.0430**	0.0713
GLSP500 does not Granger Cause GLSENSEX	5.E-06	1.E-05	1.E-06	4.E-06	9.E-06	3.E-05
GLSENSEX does not Granger Cause GLSP500	0.8144	0.8327	0.9700	0.9948	0.9592	0.9865
GLEXR does not Granger Cause GLSENSEX	0.7301	0.3609	0.1952	0.1926	0.1856	0.3196
GLSENSEX does not Granger Cause GLEXR	4.E-05*	0.0002*	0.0006*	0.0024*	0.0018*	0.0016*
GLEXR does not Granger Cause GLSP500	0.9303	0.2004	0.3786	0.5358	0.5970	0.7155
GLSP500 does not Granger Cause GLEXR	0.2298	0.3349	0.5337	0.6389	0.7318	0.7471

* indicates significance at 1% and ** indicate significance at 5%

Table 9 : Pair wise granger causality

	Pair wise Granger Causality					
	p-value					
Lags	1	2	3	4	5	6
Null Hypothesis						
SENSEXR does not Granger Cause NETFII	7.E-08	6.E-07	2.E-09	9.E-09	1.E-09	2.E-09
NETFII does not Granger Cause SENSEXR	0.0332	0.0532	0.0322	0.0610	0.0105	0.0433

[1] Herding is to buy or sell stocks together in a group. Short term trading strategies are positive feedback trading and herding

[2] Positive feedback traders rush to buy when the market is booming and are selling when the market is declining .They are eager to copy each other's behavior.

[3] The Co - integrated VAR Model Methodology and Applications" by Katarina Juselius, page 26