

Interrelationship between FII and Stock Market and their Causal Relationship with Selected Macroeconomic Variables in India

P. Suganthi and C. Dharshanaa

Abstract

This paper tries to explore the causal relationship between Foreign Institutional Investment (FII) and Indian Stock Market. Further, the paper examines whether they individually create impact on certain selected macroeconomic variable sand vice versa. Sensex is taken as a representative of Indian Stock Market. Inflation as measured by Wholesale Price Index (WPI), national output as represented by Index of Industrial Production (IIP) and Exchange Rate are the three macroeconomic variables considered for the study. The monthly data of the selected variables for the period from April 2005 to March 2013 is taken for the study. Correlation and Granger causality test have been used to study the causal relationship between FII & Sensex and their causal relationship with the macroeconomic variables. Our results show that a) there is a bidirectional relationship between FII and Sensex, FII and Exchange Rate b) there is unidirectional relationship between Sensex and IIP, Sensex and WPI, FII and IIP & FII and Exchange Rate and c) there is no relationship between FII and WPI.

Key Words: FII, Sensex, WPI, IIP, Exchange rate and Granger causality test.

1. Introduction

Indian capital market has witnessed tremendous developments since 1991, when the government had adopted liberalization and globalization policies. Financial liberalisation resulted in the opportunity of foreign investors investing in domestic securities and domestic investors transacting in foreign securities. Capital inflows to emerging economies exceeded their developed counterparts. According to HSBC, in 2009-12, emerging economies of Asia have received capital flows worth \$1trillion which is 484% more than inflows in the preceding four years (Nguyen, 2014). During this period, India received US \$93 billion as inflows which is over two times her inflows of US \$40 billion received in 2005-08. Positive fundamentals combined with fast growing markets made

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India an attractive destination for Foreign Institutional Investors (FII) (Prasanna, 2008). Progressive liberalisation process coupled with strong economic growth made India a favoured destination for foreign investors.

Table 1: FII investment during the period 2004 to 2013 (In Rs. crores)

FII Investment (Financial Year)			
Financial Year	Equity	Debt	Total
2004-05	44,123	1,759	45,881
2005-06	48,801	-7,334	41,467
2006-07	25,236	5,605	30,840
2007-08	53,404	12,775	66,179
2008-09	-47,706	1,895	-45,811
2009-10	110,221	32,438	142,658
2010-11	110,121	36,317	146,438
2011-12	43,738	49,988	93,726
2012-13	140,033	28,334	168,367

Source: www.sebi.gov.in

Table 1 shows the FII inflows from Equity, Debt and Net Inflows from 2005-05 to 2012-13. However, the fact that volatility in FII inflows and its significant impact on the Indian stock market cannot be ignored. Throughout 2008, many times, the Sensex lost around 600-1500 points on intraday trading owing to unabated selling by FII amid the fears of US recession. The sub-prime mortgage crisis in 2007-08 created a dip in the FII flows as a result of foreign investors fearing about impending recession. Later post-crisis, FII flows improved hoping to exploit favourable domestic situations. Many empirical studies conducted during different periods have revealed that FII flows cause significant impact on the stock market movements (Bhatia & Kishor, 2013; Pal, 2005; Rao, Murthy & Ranganathan, 2005; Thiripalraju & Rajesh, 2011). They have examined and found empirical relationship between FII flows and capital markets. This paper attempts to confirm the causal relationship between FII and the stock market for a more recent period.

FII and stock markets are also influenced by behavioural pattern of various macro-economic variables. Sangmi & Hassan (2013) stated that the macroeconomic variables have an important role in bringing investments to India and cause significant impact on the stock price. Various studies have been made analysing the relationship between equity market returns and movements with a specific or a set of macroeconomic variables. For example, the monthly results of IIP and stock prices (BSE and NSE) share a bidirectional causal relationship (Paramati & Gupta 2011). Many studies have tried to explore the relationship between stock markets and Inflation (Boyd, Levin & Smith, 2001; Gultekin, (1983), stock markets and exchange rate (Abdalla & Murinde, 1997; Mishra, 2004). FII and interrelationship with stock market and different

macroeconomic variables has been widely researched in the context of India and other emerging economies (Kumar, 2009; Singh, 2005; Srikanth & Kishore, 2012).

2. Theoretical Framework

FII is very important for any economy as it reflects economic health and brings in financial resources and liquidity to the economy. FII exerts a larger impact on the domestic financial markets in the short run and a real impact in the long run (Kumar & Malyadri, 2013). Changes in the portfolio of global investors can be influenced by their perceptions of country solvency than stipulated by strong fundamentals (Mukherjee, Bose & Coondoo, 2002). Emerging markets like India, being capital scarce want to woo foreign investors and retain them in the economy. Many factors had caused unexpected reversals in the pattern of FII flows to the country hitting the panic button in the economy. Therefore, it is imperative to comprehend the significant impact and crucial determinants of FII in the economy.

Stock markets assume a pivotal important role in channelizing the funds from surplus to deficit, from non-profitable to profitable sectors and in the price discovery of assets. Many empirical studies confirm their two-way causal relationship between FII and stock markets and some studies also reveal that FII not only improves liquidity, but also reduces volatility in the stock market (Kumar, 2000). Researchers, however, also believe that the movements in stock market prices are deviated from fundamental reasons and to a significant extent influenced by mobile foreign capital. Uncertainty in the stock market breeds volatility. The influence of uncertain behaviour of macroeconomic variables on the stock market is found to be significant in various studies. This also has an implication on the risk to FIIs and domestic stock market investors.

In understanding the impact of macroeconomic variables on FII and stock market, usually the researchers take one, two or a set of variables for the purpose of study. In this paper, it was intended to focus on a limited number of easily comprehensible variables. Among the widely researched macroeconomic variables like, Interest rates, National output indicated by GDP, IIP, etc., different measures of money supply, Inflation, measured by WPI or CPI, Exchange rate, Gold price, therefore, WPI and IIP representing Inflation and National output and Exchange rate are selected for the study.

3. Objectives

- To comprehend the interrelationship between Foreign Institutional Investment and Indian stock market.
- To identify the inter-relationship between stock market and macroeconomic variables
- To examine the inter-relationship between Foreign Institutional Investment and macroeconomic variables

4. Literature Review

Empirical study is conducted to examine the effect of stock price and foreign investment on macroeconomic variables or vice-versa and the results of all those studies have provided different conclusions according to the combination of variables, time period, methodologies and tests used. Here, we have discussed some previous research works/papers and their empirical conclusions that are related to the topic of research. Bhatt (2011) in his paper highlighted that India has been hit by the global meltdown and it is clearly due to India's rapid and growing integration into the global economy.

Bansal & Pasricha (2009) studied the impact of market opening to FIIs on Indian stock market behaviour. They empirically analyzed the change of market return and volatility after the entry of FIIs to Indian capital market. They concluded that while FII and stock market average returns were not related, volatility had been certainly reduced because of FII. Vardhan & Sinha (2014) examined the influence of FII on the Indian Equity Market and its role in integration with US equity market. The existence of structural breaks during the study period was recognised. By using different Vector Autoregressive Models (VAR), the study showed that despite global recessionary trends, FII purchases and sales have steadily increased on account of gradual economic liberalisation and gained momentum in the last five years. FII inflows found to be significantly related to equity market returns. Although inflows were not affected by Exchange rates, outflows and affected by exchange rates. Again, US equity market created no influence on FII inflows and a marginal influence on the FII outflows. Richards (2005) analysed the aggregate daily trading of all foreign investors in six Asian emerging equity markets and found that behavioural pattern of investors extracting information from recent times. The other finding was that relevant foreign investors and external conditions could have a larger effect on emerging markets than implied by previous works.

Kumar (2011), attempted to examine the determinants of FII. Taking data for a period of 17 years from Jan 1993 to Dec 2009 and using Granger Causality test, the study concluded that while stock market return, IIP and Exchange rate caused FII flows, Wholesale price index, money supply and interest rate did not have causal relation with FII. Bai & Green (2011) explored the determinants of cross sectional stock return variations in emerging markets and pointed out that exchange rate and inflation together can explain 55% of pure country effects. Dasgupta (2012) has attempted to explore the long-run and short-run relationships between BSE Sensex and four key macroeconomic variables of Indian economy by using descriptive statistics, ADF tests, Johansen and Juselius's cointegration test and Granger causality test. Results showed that all the variables has contained a unit root and are integrated. Johansen and Juselius's cointegration test pointed out at least one cointegration vector and long-run relationships. The Granger causality test has found no short-run unilateral or bilateral causal relationships between BSE Sensex with the macroeconomic variables. Therefore, it is concluded that, Indian stock markets had no informational efficiency. Pethe & Karnik (2000) studied the interrelationships between

stock markets and important macroeconomic variables. Cointegration and Granger Causality tests are performed and the tests revealed that relationships between macroeconomic variables and stock indices are not very conclusive. Another study on macroeconomic variables and the performance of Indian stock markets by Naka, Mukherjee & Tufta (1998) employed co integration tests and identified domestic inflation to be the most severe deterrent to Indian stock market performance and domestic output growth to be the predominant driving force.

Many studies have analysed the relationship between Sensex, FII and a set of macroeconomic variables with data taken during different periods. Chittedi (2009) analyzed the performance of Sensex Vs.FIIs and found that FII s investments in BSE Sensex reveal that FIIs are significant factor determining the liquidity and volatility in the stock market prices. Makan, Ahuja & Chauhan, (2012) studied whether the identified macroeconomic factors could influence movements in BSE Sensex. On the basis of overall analysis and sectoral analysis it was concluded that out of seven variables, exchange rate, FII and call rate were relatively more significant and likely to influence Indian stock market. There was a positive relation between FII and Sensex. Gordon & Gupta(2003)in their paper evaluated the determinants of FII inflows into India and observed that though FII inflows into India are small compared to other emerging markets, they are less volatile. The econometric results indicated that a combination of domestic, regional and global variables are important in determining equity flows to India. The performance of emerging market stocks positively influenced FII flows into India. Lagged domestic stock market returns, and other events such as credit rating downgrades or a depreciation of the exchange rate affected FII flow negatively. Another paper by Bindu(2004)also conducted an intensive study to find out the determinants responsible for the flow of FIIs and their degree of impact created by FII flows and they found out that FII inflow depends on stock market returns, inflation rates (both domestic and foreign), and ex-ante risk. In terms of magnitude, the impact of stock market returns and the ex-ante risk turned out to be the major determinants of FII inflow. The study did not find any causative link running from FII inflow to stock returns. Bohra & Dutt (2011) attempted to examine the behavioural pattern of FII and how different groups of shares in Sensex respond to FII inflows. They concluded that FII and Sensex are positively correlated and Sensex follows FII, except in 2005 and 2008. Considering, individual group of securities, FII shared a positive correlation with those securities that are less regulated and highly capitalised expecting high equity yield.

5. Methodology

Methodology is the science of dealing with principles of procedure in research and study.

Data

For the purpose of the study secondary data has been used.

Period of the study

The study covers 8 financial years starting from April 2005 to March 2013 and monthly data is taken for the study of the variables. The date of study included pre-crisis, crisis and post crisis period.

Variables considered for the study and sources of data

The values of all the variables have been enclosed as annexure 1. Monthly data for Net FII investments for the mentioned period published in the website of SEBI have been used. S&P BSE Sensex (referred as Sensex), known as the benchmark index, is taken to represent Indian stock market. Monthly closing values of Sensex are taken from the website of BSE India. WPI Inflation and IIP are considered as the indicators of inflation and national output respectively. The third macroeconomic variable used is the Exchange rate. The monthly values of these macroeconomic variables are collected from the website of RBI, India. There are 96 monthly observations for each variable and a total of 480 observations have been used for this study. The statistical tools and tests such as Correlation, Augmented Dickey Fuller (ADF) Test and Granger causality test are being performed using Gretl software, version 1.9.8 and functions of MATLAB, version 7.8.0 (R2009a) to study correlation and the causal relationship between FII & Sensex and their impact and determinants.

In statistics and econometrics, an Augmented Dickey–Fuller test (ADF) is a test for a unit root in a time series sample. It is an augmented version of the Dickey–Fuller test for a larger and more complicated set of time series models. This test will help to describe whether a time series is stationary or not. Rejection of the null hypothesis denotes that there is no unit root and the series is stationary. Accepting of the null hypothesis denotes that there is the presence of unit root and the series is not stationary.

H_0 – Presence of Unit root, hence non stationary and it has to be difference to make it stationary,

H_1 – No Unit root and hence the series is stationary.

The following ADF model with trend has been used;

$$\Delta Y_t = b_0 + \delta Y_{t-1} + \beta_t + \alpha_1 \Delta Y_{t-1} + \alpha_2 \Delta Y_{t-2} + \dots + \alpha_p \Delta Y_{t-p} + \varepsilon_t \quad (1)$$

Where b_0 is the constant, t denotes time, β is the corresponding coefficient and p is the lag order of the autoregressive process.

H_0 - No causal relationship

H_1 - X Granger Causes Y

The Granger Causality tests help in detecting causality between two variables when both influence each other. If X and Y are two time series and if X Granger causes Y, then X should help to predict Y. To elaborate, in a regression Y against past values of Y, taking

past values of X as independent variables should contribute significantly to the explanatory power of the regression. Further, Y should not be able to predict X. Otherwise, if X helps to predict Y and Y helps to predict X, then there is a possibility of variables other than X and Y are causing both X and Y. The test is based on the following regression equations:

$$Y_t = C_{1t} + \sum_{i=1}^p \alpha_i Y_{t-i} + \sum_{i=1}^p \beta_i X_{t-i} + u_{1t} \quad (2)$$

$$X_t = C_{2t} + \sum_{i=1}^p \phi_i Y_{t-i} + \sum_{i=1}^p \varphi_i X_{t-i} + u_{2t} \quad (3)$$

Where p denotes the number of optimum lag length and μ_{1t} and μ_{2t} are residuals in the regression equations and not correlated to each other. Granger causality test is known to be sensitive to the choice of lag length. To choose the optimum lag length, the Schwarz' Bayesian Information Criterion (BIC) are used.

5.4 Hypotheses

As the focus of research is to understand the inter relationship between FII, Stock market and macroeconomic variables, test of causality is intended to be employed. In this connection, the hypotheses of causal relationships between FII and stock market and with the three variables selected for the study are detailed in Table 2 as below:

Table 2: Hypothesis statements of the study

No.	Null hypothesis	Alternate hypothesis
1.	H ₀ : No causality between FII & Sensex	H ₁ : Causal relationship between FII & Sensex
2.	H ₀ : No causality between Sensex&FII	H ₂ : Causal relationship between Sensex&FII
3.	H ₀ : No causality between IIP & Sensex	H ₃ : Causal relationship between IIP & Sensex
4.	H ₀ : No causality betweenSensex & IIP	H ₄ : Causal relationship between Sensex & IIP
5.	H ₀ : No causality between Exchange Rate & Sensex	H ₅ : Causal relationship between Exchange Rate & Sensex
6.	H ₀ : No causality between Sensex & Exchange Rate	H ₆ : Causal relationship between Sensex & Exchange Rate
7.	H ₀ : No causality between WPI & Sensex	H ₇ : Causal relationship between WPI & Sensex
8.	H ₀ : No causality betweenSensex&WPI	H ₈ : Causal relationship between Sensex & WPI
9.	H ₀ : No causality between IIP & FII	H ₉ : Causal relationship between IIP & FII
10.	H ₀ : No causality between FII & IIP	H ₁₀ : Causal relationship between FII & IIP
11.	H ₀ : No causality between WPI & FII	H ₁₁ : Causal relationship between WPI & FII
12.	H ₀ : No causality betweenFII & WPI	H ₁₂ : Causal relationship between FII & WPI
13.	H ₀ : No causality between Exchange Rate & FII	H ₁₃ : Causal relationship between Exchange Rate & FII
14.	H ₀ : No causality between FII & Exchange Rate	H ₁₄ : Causal relationship between FII & Exchange Rate

6. Analysis and Interpretation

With a view to accomplish the predetermined set of objectives of our research, different set of techniques and tests have been adopted. Correlation matrix analysis finds the strength of association between Sensex, FII and selected macroeconomic variables. To explore the causality between two variables, Granger Causality test is commonly performed between the two variables. Taking two variables or time series X and Y, if X Granger Causes Y, then it can be concluded that X has significant unidirectional relationship with Y and X can lend support to predict Y. ADF test is used to find the stationary or non-stationary nature of time series.

Table 3: Summary statistics using the observation April 2005 –Mar 2013

Variable	Mean	Median	Minimum	Maximum	Std. Dev.	Skewness	Ex. kurtosis	J- Q test	P value
Sensex	14991.60	16171.00	6154.44	20509.10	3803.84	-0.62	-0.75	8.42	0.01
FII	6729.35	5078.25	-17205.40	35227.90	10622.90	0.58	-0.07	5.35	0.07
WPI	6.70	7.13	-0.39	11.15	2.77	-0.49	-0.34	4.32	0.12
Exchange Rate	46.30	45.49	39.27	55.94	4.19	0.54	-0.20	4.80	0.09
IIP	147.38	148.95	99.08	194.20	23.24	-0.33	-0.66	3.49	0.17

Source: Gretl Output

Table 3 shows the descriptive statistics of the variables taken for the study. The minimum and maximum values for all variables exhibits a wide range of values during the study period indicating that the values of the selected variables have reached opposite extremes in the study period. The table also shows that Exchange Rate and FII is positively skewed whereas Sensex, WPI and IIP are negatively skewed. While performing the Jarque-Bera test, in Sensex the time series is not normally distributed and other variables are normally distributed. All the variables are platykurtic.

Fig.1: Monthly values of FII & Sensex from Apr 2005 – Mar 2013

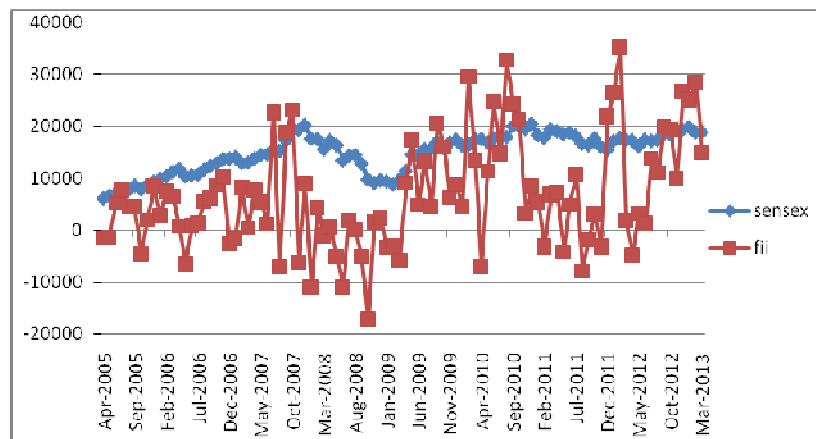


Fig 2: Monthly values of IIP, WPI and exchange rate from Apr 2005 – Mar 2013

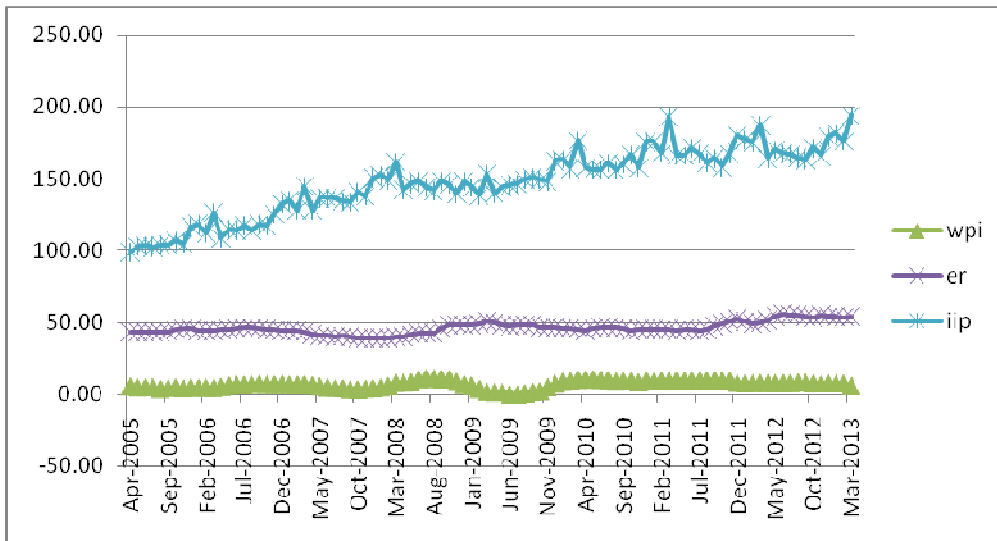


Fig. 1 & Fig. 2 give a graphical representation of the monthly data of the variables selected for the study. A glance at Fig. 1s gives an indication about how the values of Sensex and FII move together. Fig. 2 indicates how WPI, IIP and Exchange rate move together for the time period selected.

To perform Granger Causality test, it is a pre requisite that the variables are stationary; else, the results may be distorted by spurious regressions. So, before performing Granger Causality tests, ADF tests are done to determine whether the variables are stationary at their levels or at their first differences.

The variables considered in this paper are the monthly data of Sensex, FII and three macroeconomic variables namely WPI, IIP and Exchange rate. ADF test is carried out to understand whether all the series are stationary or non-stationary. The results of ADF test statistics are given in the table below.

Table 4: ADF Test for the selected variables

Variable name	Level		1st difference	
	T statistic	P value	T statistic	P value
Sensex	-1.907	0.642	-6.878	0*
FII	-5.195	0.000232*	-10.492	0*
WPI	-3.431	0.053	-4.298	0.00499*
Exchange Rate	-4.461	0.00302*	-2.381	0.0386*
IIP	-1.613	0.779	-6.782	0.000001*

*Significant level at 5%

Source: Gretl output

From Table 4 it can be concluded that the FII and Exchange Rate are stationary at level and the p- value of the three variables are less than 0.05 (0.000232, 0.00302). Null hypothesis holding that the variables are non-stationary is rejected for these variables.

In case of Sensex, WPI and IIP, the p-values are greater than 0.05. Null hypothesis holding that the variables are non-stationary is accepted for these variables. Now in order to do test for causality, it is important to make these variables stationary. Thus we have calculated the first difference of all the variables and ADF tests are carried out. The p-values are less than 0.05 in their first difference for Sensex, WPI and IIP (0, 0.00499, 0.000001). All the series are stationary in their first difference and the integrated of order 1 or I(1). The optimum lag order was calculated in the software using BIC.

Correlation refers to any of a broad class of statistical relationships involving dependence. Perfect positive correlation (a correlation co-efficient of +1) implies that as one security moves, either up or down, the other security will move in lockstep, in the same direction. Alternatively, perfect negative correlation means that if one security moves in either direction the security that is perfectly negatively correlated will move in the opposite direction. If the correlation is 0, the movements of the securities are said to have no correlation; they are completely random.

Table 5: Correlation matrix of selected variables

Variables	Sensex	FII	WPI	Exchange Rate	IIP
SENSEX	1	.411**	.349**	0.152	.811**
p-value		0	0	0.139	0
FII	.411**	1	-0.047	.297**	.317**
p-value	0		0.652	0.003	0.002
WPI	.349**	-0.047	1	0.087	.447**
p-value	0	0.652		0.397	0
EXCHANGE RATE	0.152	.297**	0.087	1	.476**
p-value	0.139	0.003	0.397		0
IIP	.811**	.317**	.447**	.476**	1
p-value	0	0.002	0	0	

**Correlation is significant at the 0.01 level (2-tailed).

Source: Gretl Output

From Table 5, it is very precise that the Sensex is strongly correlated with IIP (with the correlation value of 0.811). Sensex is moderately correlated with FII and WPI (with the correlation value of 0.411, 0.349 respectively), FII is correlated with Exchange rate with

correlation coefficient being 0.297, WPI is correlated with IIP with the value 0.447 and Exchange rate is also medially correlated with IIP with coefficient being 0.476. The Correlation coefficients are significant at 0.05 and 0.01 level.

There is very low degree of correlation between Sensex and Exchange Rate, FII and WPI, Exchange rate and WPI (with the correlation value of 0.152, -0.047 and 0.087 respectively).

Granger causality test is a technique for determining whether one time series is significant in forecasting another or not. The Granger causality test depicts the direction of causality between two variables when both influence each other.

A time series X is said to Grange-cause Y if it can be shown, usually through a series of t-tests and F-tests on lagged values of X (and with lagged values of Y also included), that those X values provide statistically significant information about future values of Y .

Table 6: Granger causality test of FII and sensex & other variables

Variables		Result of granger causality test			
X	Y	F statistic	Critical value	Null Hypothesis	Result
FII	SENSEX	17.3111	3.0954	Rejected	FII Granger Causes SENSEX
SENSEX	FII	11.5755	3.9445	Rejected	SENSEX Granger Causes FII
IIP	SENSEX	9.8733	3.9434	Rejected	IIP Granger Causes SENSEX
SENSEX	IIP	0.2914	3.9457	Accepted	Sensex does not Granger Cause IIP
Exchange Rate	SENSEX	7.9226	2.7047	Rejected	Exchange Rate Granger Causes SENSEX
SENSEX	Exchange Rate	8.508	2.316	Rejected	SENSEX Granger Causes Exchange Rate
WPI	SENSEX	15.1311	3.9434	Rejected	WPI Granger Causes
SENSEX	WPI	0.1984	3.9457	Accepted	SENSEX does not Granger Cause WPI
IIP	FII	5.7235	3.9445	Rejected	IIP Granger Causes FII
FII	IIP	3.3935	3.9457	Accepted	FII does not Granger Cause IIP
Exchange Rate	FII	1.242	3.9445	Accepted	Exchange Rate does not Granger Cause FII
FII	Exchange Rate	25.2309	3.9457	Rejected	FII Granger Causes Exchange Rate
WPI	FII	1.2424	3.9445	Accepted	WPI does not Granger
FII	WPI	1.6069	3.9457	Accepted	FII does not Granger Cause

Source: MATLAB Output

Granger-causality test has been conducted to study the causal relationship between FII and Sensex, between FII & WPI, FII & IIP, FII & Exchange rate, Sensex & WPI, Sensex & IIP, Sensex & Exchange rate. By examining causal relationship, it will be helpful to understand whether the FII and Sensex have bidirectional relationship, FII and Sensex individually has any impact on the macro economic variables and whether FII & Sensex individually are determined by the macro economic variables. The appropriate lag length is chosen using the Schwarz Bayesian information criterion. Any particular lagged value of one of the variables is retained in the regression if (1) it is significant according to a t-test, and (2) it and the other lagged values of the variable jointly add explanatory power to the model according to an F-test.

Table 6 shows the granger causality relationship between FII and Indian Stock Market and the selected variables. It is found from the table that there is a bidirectional relationship between FII & Sensex. The F-statistic for both is greater than its critical values (17.3111, 11.5755) hence alternate hypotheses H_1 and H_2 are accepted. So, any changes in the Indian stock market or any changes in FII will impact each other in the long run.

There is a unidirectional relationship between IIP & Sensex and IIP Granger causes Sensex. The F-statistic 9.8733, greater than its critical value confirms it. This indicates that an economy with healthy national output has a bearing on the stock market. Alternate hypothesis H_3 is accepted. However, our results do not confirm the causal relationship from Sensex to IIP and H_4 is rejected. The movements in the stock market do not help to predict national output.

F-statistic values of 7.922 and 8.508 greater than their critical values for Granger causality tests between exchange rate and sensex and vice versa confirm that there is a bidirectional causal relationship between sensex and exchange rate. Alternate hypotheses H_5 and H_6 are accepted. Stronger rupee enhances investors' confidence in the stock market as it creates a very conducive environment for business and a booming stock market backed by profitable business operations results in creation of foreign exchange reserves.

There is a unidirectional relationship between WPI and Sensex (F-value 15.1311 > Critical Value (CV) 3.9434) and WPI Granger causes sensex. Alternate hypothesis H_7 is accepted. While results show that Sensex does not Granger cause WPI and alternate hypothesis H_8 is rejected. Inflationary trends have causal impact on the stock market movements, whereas vice versa is not true from this study. Change in inflation is observed to exert influence on the stock market prices from the study.

There is a unidirectional relationship between IIP and FII, FII does not Granger Cause IIP (F-statistic 3.3935 < CV 3.9457) while IIP Granger causes FII (F-value 5.7325 > CV 3.9445). Alternate hypothesis H_9 is accepted. It makes clear that FIIs are attracted by the strength of fundamentals of the economy and increases in national output causes an

increase in FII flows. As FII are only short term portfolio investments, FII do not have a causal impact on IIP. H_{10} stands to be rejected from the study.

There is a unidirectional relationship between FII and exchange rate, FII Granger causes exchange rate. As FII inflows enter the market, they bring in foreign exchange reserves and FII outflows deplete foreign exchange reserves causing movements in rupee value against foreign currency. Alternate hypothesis H_{12} is accepted. However exchange rate does not Granger Cause FII, alternate hypothesis H_{11} is rejected and it has to be understood that Exchange rate is affected by FII and does not cause FII.

There does not exist any causal relationship between FII and WPI. The F- statistics of both these tests are lesser than the CV ($1.2424 < 3.9445$, $1.6069 < 3.9457$) and alternate hypotheses H_{13} and H_{14} are rejected. Inflation and FII do not have any causal relationship between them.

7. Conclusion

In this study necessary analyses are performed to understand whether there is an inter-relationship between FII & Indian Stock Market, their individual inter-relationship with selected macroeconomic variables. The selected macroeconomic variables are Index of Industrial production, Exchange Rate and Wholesale Price Index. Indian stock market is represented by BSE Sensex. Monthly data of the variables for a time span of 8 years was considered. The paper employed Granger Causality test and correlation analysis to examine the relationships.

On the basis of overall analysis it can be concluded that all the three selected variables are likely to influence the Indian Stock market. There is a bidirectional relationship between FII & Stock market. Many of the previous literature available confirm the existence of bidirectional causal relationship between FII and stock markets. Hence, volatility in stock market can be significantly forecasted by FII and volatility in FII can be significantly explained by stock market movements in India in the long run. In addition to that, certain other variables also lend explanatory power in significantly determining the movements in FII and stock market. This analysis helps domestic and foreign investors in understanding the changing patterns of these two variables vis-à-vis changing macroeconomic environment, while making investment decisions. Policy makers and regulatory bodies would make use of these inter-relations in deciding about policy issues and responding to economic situations.

It can be mentioned that this research can be extended in its scope in the future. The framework for understanding causal relationship between the variables can be made more reliable by incorporating structural breaks appearing in the study period into the model so that forecasting errors could be minimised. To develop a more precise understanding of the relationship between FII and Stock markets, an enhanced list of macroeconomic variables can be included so that the model can be made more robust.

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ANNEXURE**Table A1: Monthly data of FII and sensex & the macro-economic variables**

MONTH-YEAR	SENSEX	FII	WPI	EXCHANGE RATE	IIP
Apr-2005	6154.44	-1,476	5.33	43.6419	99.1
May-2005	6715.11	-1,386	4.59	43.4095	103.1
Jun-2005	7193.85	5,258	4.68	43.5245	104.0
Jul-2005	7635.42	7,760	4.84	43.4340	102.4
Aug-2005	7805.43	4,621	3.48	43.5500	104.1
Sep-2005	8634.48	4,458	4.38	43.8462	104.4
Oct-2005	7892.32	-4,627	4.67	44.7575	107.3
Nov-2005	8788.81	1,874	3.94	45.6315	104.6
Dec-2005	9397.93	8,361	4.38	45.5633	116.8
Jan-2006	9919.89	2,756	4.36	44.2010	118.5
Feb-2006	10370.24	7,436	4.45	44.2300	112.4
Mar-2006	11279.96	6,430	4.24	44.3378	126.7
Apr-2006	11851.93	770	4.97	44.8245	108.8
May-2006	10398.61	-6,647	6.05	45.1959	114.8
Jun-2006	10609.25	875	6.80	45.8886	114.2
Jul-2006	10743.88	1,297	6.54	46.3675	117.6
Aug-2006	11699.05	5,448	7.11	46.4461	114.3
Sep-2006	12454.42	6,133	6.96	46.0105	118.2
Oct-2006	12961.9	8,670	6.93	45.3552	117.7
Nov-2006	13696.31	10,187	6.73	44.7257	125.5
Dec-2006	13786.91	-2,766	6.96	44.4835	132.8
Jan-2007	14090.92	-1,682	6.64	44.2062	134.9
Feb-2007	12938.09	8,195	6.63	44.0195	127.8
Mar-2007	13072.1	361	6.72	43.7936	144.9
Apr-2007	13872.37	7,722	6.22	42.0176	128.2
May-2007	14544.46	5,320	5.52	40.5686	136.9
Jun-2007	14650.51	1,102	4.46	40.5905	136.7
Jul-2007	15550.99	22,609	4.42	40.2738	136.6
Aug-2007	15318.6	-7,162	4.04	40.6791	134.6
Sep-2007	17291.1	18,788	3.39	40.1735	134.0
Oct-2007	19837.99	23,091	3.19	39.3661	140.7
Nov-2007	19363.19	-6,319	3.73	39.3267	137.9
Dec-2007	20286.99	8,891	4.01	39.3750	150.7
Jan-2008	17648.71	-11,082	4.54	39.2676	152.5
Feb-2008	17578.72	4,230	5.68	39.6735	149.3

Mar-2008	15644.44	-1,010	7.71	40.1452	161.9
Apr-2008	17287.31	627	7.86	39.9668	142.3
May-2008	16415.57	-5,174	8.20	42.0019	146.7
Jun-2008	13461.6	-11,095	10.89	42.7633	148.4
Jul-2008	14355.75	1,782	11.15	42.7027	144.3
Aug-2008	14564.53	46	11.12	42.9057	141.9
Sep-2008	12860.43	-5,074	10.78	45.5300	148.6
Oct-2008	9788.06	-17,205	10.66	48.6155	146.2
Nov-2008	9092.72	1,617	8.65	48.8517	139.7
Dec-2008	9647.31	2,377	6.68	48.5132	148.3
Jan-2009	9424.24	-3,443	5.87	48.6995	144.4
Feb-2009	8891.61	-3,124	3.61	49.2484	138.5
Mar-2009	9708.5	-5,890	1.65	51.1291	153.5
Apr-2009	11403.25	8,999	1.21	49.9655	139.6
May-2009	14625.25	17,406	1.45	48.5100	144.3
Jun-2009	14493.84	4,898	-0.39	47.6736	145.7
Jul-2009	15670.31	13,182	-0.31	48.3624	146.7
Aug-2009	15666.64	4,523	0.54	48.2426	149.4
Sep-2009	17126.84	20,572	1.40	48.2924	151.0
Oct-2009	15896.28	15,973	1.79	46.6524	149.6
Nov-2009	16926.22	6,181	4.73	46.5305	148.5
Dec-2009	17464.81	8,711	7.15	46.5273	162.4
Jan-2010	16357.96	4,363	8.68	45.8944	163.6
Feb-2010	16429.55	29,438	9.65	46.2732	157.5
Mar-2010	17527.77	13,293	10.36	45.4509	176.5
Apr-2010	17558.71	-6,986	10.88	44.4440	157.8
May-2010	16944.63	11,249	10.48	45.7690	156.5
Jun-2010	17700.9	24,724	10.25	46.4983	156.6
Jul-2010	17868.29	14,686	9.98	46.7617	161.3
Aug-2010	17971.12	32,669	8.87	46.4605	156.1
Sep-2010	20069.12	24,303	8.98	45.8729	160.3
Oct-2010	20032.34	21,211	9.08	44.3540	166.6
Nov-2010	19521.25	3,214	8.20	44.9315	158.0
Dec-2010	20509.09	8412.60	9.45	45.1000	175.6
Jan-2011	18327.76	5,364	9.47	45.3750	175.9
Feb-2011	17823.4	-3,270	9.54	45.3795	168.0
Mar-2011	19445.22	6,883	9.68	44.9143	193.1
Apr-2011	19135.96	7,196	9.74	44.3010	166.2

May-2011	18503.28	-4,276	9.56	44.9024	166.2
Jun-2011	18845.87	4,883	9.51	44.8109	171.4
Jul-2011	18197.2	10,653	9.36	44.3960	167.2
Aug-2011	16676.75	-7,903	9.78	45.3135	161.4
Sep-2011	16453.76	-1,866	10.00	47.6905	164.3
Oct-2011	17705.01	3,079	9.87	49.2020	158.3
Nov-2011	16123.46	-3,263	9.46	50.6785	167.5
Dec-2011	15454.92	21,873	7.74	52.3824	180.3
Jan-2012	17193.55	26,329	7.23	51.0015	177.6
Feb-2012	17752.68	35,228	7.56	49.1812	175.2
Mar-2012	17404.2	1,793	7.69	50.3635	187.6
Apr-2012	17318.81	-4,897	7.50	51.6900	164.1
May-2012	16218.53	3,222	7.55	54.3314	170.3
Jun-2012	17429.98	1,181	7.58	55.9424	168.0
Jul-2012	17236.18	13,664	7.52	55.4248	167.1
Aug-2012	17380.75	11,069	8.01	55.4935	164.7
Sep-2012	18762.74	19,884	8.07	54.3500	163.1
Oct-2012	18505.38	19,216	7.32	53.0995	171.6
Nov-2012	19339.9	9,869	7.24	54.7845	165.8
Dec-2012	19426.71	26,792	7.31	54.6470	179.3
Jan-2013	19894.98	25,006	7.31	54.2290	182.0
Feb-2013	18861.54	28,441	7.28	53.8079	176.2
Mar-2013	18835.77	14,919	5.65	54.4229	194.2

Source: website of SEBI & BSE