Direction and Durability of Causality Between Foreign Institutional Investment and Selected Economic Variables in the Indian Context During Pre and Post Sub-Prime Crisis

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Abstract

The present paper attempted to understand the long-run relationship along with the direction of relationship between foreign institutional investments (FII) and macro-economic variables. For the purpose, three macro variables namely, index of industrial production, exchange rate, and wholesale price index were considered. The data relates to the period from 2003-04 to 2012-13, divided into two durations : pre sub-prime (2003-04 to 2007-08) and post sub-prime (2008-09 to 2012-13) on a monthly basis. The study found a long run equilibrium relationship between set of variables in the pre sub-prime duration ; whereas, this relationship disappeared in the post sub-prime duration. As per the results of Granger's causality test, no relationship was found between FII net investment and exchange rate, and uni-directional relationship moved from FII net investment to index of industrial production and FII net investment to wholesale price index in the pre sub-prime duration. In the post sub - prime duration, bi-directional causality was found between FII net investment and exchange rate ; whereas, uni-directional relationship was found from index of industrial production to FII net investment and FII net investment to wholesale price index. The main contribution of the research was to study the direction of relationship between FII and macro-economic variables in two; pre sub-prime and post sub-prime durations. Moreover, the direction of causality throws significant light on the behaviour of FIIs in a macro-economic perspective.

Key words : **macro-economic variables, foreign institutional investment, exchange rate, index of industrial production, wholesale price index, granger causality test**

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An economy is a complex web of economic - social - technological variables which are often affected by domestic as well as international forces. The focus of economic activities is fast concentrating around emerging economies, while the economies themselves are transiting from closed to open and less developed to developing status. This phenomenon is significantly marked by the inflow-outflow of foreign capital through direct route as well as the institutional route. Various forces influence the flow of foreign capital, including macro-economic variables such as: stock market returns, inflation, interest rate, index of industrial production (IIP), money supply, gross domestic product, exchange rate, and foreign exchange reserves.

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It may be worthwhile for an economy to get an insight into the determinants of FII movement in and out of the economy. Furthermore, it may also be useful to know the impact of FIIs on various macro-economic parameters. Several researchers have conducted studies to find these relationships. However, there is scope to conduct such a study in the Indian context for select variables over a period of time, assuming cause and effect relationship between FII inflow and outflow and various macro-economic variables.

The present study is an attempt to examine a trend analysis of FIIs and macro-economic variables over a period of 2003-04 to 2012-13. It is also aims to find out the possibility of a long-term relationship as well as direction of relationship between the set of macro variables and FII behaviour during pre and post sub-prime crisis duration. The choice of the period is significant because it saw placid to turbulent to a normalized global environment.

Related Literature

A resurgent macro-economic fundamental of a country provides confidence to the investors to invest their money in an economy. Strong macro-economic parameters, positive investment climate, sound business outlook lead FIIs to put their money in a particular economy (Tripathi, 2008). FIIs contributed significantly towards the stock market volatility (Dadhich, Chotia, & Chaudhry, 2015), however, as per De and Chakraborty (2015), foreign institutional ownership could negatively be related to volatility. Hence, macro-economic variables play a significant role for determining the FIIs' buying behavior (Chandra, 2012). On the other hand, FIIs' investments could also influence the macro-economic variables of the country. Several macro-economic variables contribute for the development of an economy like foreign exchange reserves, foreign direct investment (FDI), interest rate, money supply, gross domestic product, foreign exchange rate, IIP, and wholesale price index (WPI). The relationship between FIIs' investment and macro-economic variables has attracted significant attention of academicians (Anuradha & Rajendran, 2012 ; Bhasin & Khandelwal, 2014 ; Ghosh & Herwadkar, 2009 ; Girisha, 2012 ; Kaur & Dhillon, 2010 ; Khandelwal, 2014; Kumar, 2011 ; Mitra, 2010 ; Mukherjee, Bose, & Coondoo, 2002 ; Rajkumar & Gupta, 2010 ; Raju, Kumar, Shahab, & Tavishi, 2011 ; Srikanth & Kishore, 2012).

FIIs' net flows result into an accumulation of foreign exchange reserves that provide a stronger financial base along with strengthening the risk bearing capacity of the country. Bhasin and Khandelwal (2014), by using monthly data for the period from September 1993 to July 2013, found that FIIs' flows influence the foreign exchange reserves in the long run. Bhatia and Kishor (2013) observed bi-directional relationship between FIIs and foreign exchange reserves. However, Srikanth and Kishore (2012) found a positive influence of foreign exchange reserves on FIIs to pour their money in capital markets, and Sethi (2012) examined the short and long run relationship between private foreign capital inflows and foreign exchange reserves in India.

Foreign direct investment is the foremost macro-economic variable that contributes towards the development of an economy. Jain, Meena, and Mathur (2013) concluded that FIIs and foreign direct investment both are positively associated with stock market and FDI is a more preferred form of foreign investment than FIIs for the economy as a whole. Banerjee (2013) found that foreign direct investment positively influences the stock market than FII, as a long-term investment option. Sethi (2013), by using monthly data from April 1995 to July 2011, found a bi-directional relationship between FII and FDI.

Kumar, Kumar, and Kumar (2014) observed that in the long run, interest rate differential has no significant impact on FIIs' flows. In contradiction to that, Dua and Garg (2013) found the influence of interest rate differential on FIIs' flows. Srikanth and Kishore (2012) conducted a study from the duration of April 2003 to March 2011 and found no relationship between FIIs and weighted average call money rate. Anuradha and Rajendran (2012) and Kumar (2011) also found the same results for significant economic crisis and recovery period of 2007-2011 and for the January 1993 to December 2009 period. Rajkumar and Gupta (2010) observed that the interest rate was not significantly contributing to the investment decision of FIIs. As per Kaur and Dhillon (2010), foreign interest rate has an adverse impact on FIIs' flows in the short and long run. However, FIIs' net flows pose a negative impact on

call money rate and yield as per Ghosh and Herwadkar (2009). Mukherjee, Bose, and Coondoo (2002) observed a positive association between call money rate and FIIs' flows.

Among the relationship between investment patterns of FIIs and money supply, no relationship was found between the two for the period of January 2003 to December 2009 and April 2003 to March 2011 as per the findings of Srikanth and Kishore (2012) and Kumar (2011). Sethi (2012) observed short and long run relationship between money supply and private foreign capital inflows.

Economic growth is a role of capital creation (Kaur & Kaur, 2014). Strong fundamentals of capital market depict a clear picture about the growth prospect of a country and influence overseas investors to infuse money in the financial market. Slesman, Baharumshah, and Wokar (2015) found that portfolio equity and debt inflows positively influenced the economic growth of the countries having high-quality institutions. Sethi (2013) argued that economic growth influenced the short term (FII) as well as long term (FDI) investment in India. Jain et al. (2013) observed that foreign investments influenced the economic development of the country to a greater extent. Mishra, Das, and Pradhan (2010) threw light on the relationship between FIIs' net flows and economic growth in India. They found that the growth of the country is determined by the institutional investments of that country. As per Morgan (2002), FIIs are considered to be important players contributing to the economic growth of the country.

(1) Exchange Rate and FIIs : FIIs consider the exchange rate as an important determinant for infusing capital in India (Dua & Garg, 2013 ; Kumar, 2011). Relationship between FII investment and exchange rate was examined by Chaudhuri, Mukhopadhyay, and Maskara (2014) on a daily basis for the period of September 2008 to July 2013. The study indicated that when exchange rate depreciated, net FII inflows increased. Bhasin and Khandelwal (2014), by using monthly data for the period of September 1993 to July 2013, found strong evidence of long run relationship between FII investment and exchange rate. The study emphasized that in the long run, exchange rate caused FII flows, wherein exchange rate had a significant negative impact on FIIs' investments. Khandelwal (2014), by using monthly data from the duration of April 1994 to December 2011, concluded that FIIs coming to India were return chasers and their inflows were affected by exchange rate movements. Inflow of foreign capital causes exchange rate appreciation that ultimately leads to an increase in net import of goods and services (Rakshit, 2006).

In the line of that, Suganthi and Dharshanna (2014), by using monthly data from April 2005 to March 2013, and Ghosh and Herwadkar (2009) from April 1998 to March 2008 found unidirectional causality from FII flows to exchange rate. Further, Anuradha and Rajendran (2012), by taking economic crisis period of 2007-2011 and Kumar (2011), by taking data from January 1993 to December 2009, found unidirectional causality from exchange rate to FII flows. In opposite of that, by daily data from January 2000 to March 2010, Raju et al. (2011) explored the relationship of FII flows with four different exchange rates and found different causality results. They found bi-directional relationship between FII flows and dollar ; unidirectional relationship with pound and yen ; and no relationship with euro. Mitra (2010) observed bi-directional causality between exchange rate and FII investment by using daily data from January 2000 to July 2009. Rajkumar and Gupta (2010) took data from 1996-97 to 2006-07 and concluded that there was no significant influence of exchange rate on the flows of FIIs. However, Srikanth and Kishore (2012) observed no relationship between them for the duration of April 2003 to March 2011. Thus, it leads us to hypothesize that there is a causal relationship between FIIs flows and index of industrial production, and we were interested to test this relationship during two most significant durations, that is, the pre and post sub-prime crisis period.

↳ **Hypothesis 1 :** There is a causal relationship between FIIs flows and index of industrial production.

(2) Index of Industrial Production and FIIs : Index of industrial growth reflects the industrial growth of the

country. FIIs consider the index of industrial production as an important determinant for the flow of foreign capital (Kumar, 2011). As per Suganthi and Dharshanna (2014), index of industrial production acts as a mechanism which influences FIIs to infuse their money in an economy. In contradiction to that, index of industrial production has not significantly contributed to the FIIs' flows in India as per Kumar, Kumar, and Kumar (2014). Sethi (2013) found the short and long run relationship between index of industrial production and foreign capital flows, and observed a positive and direct impact of foreign capital flows on economic growth.

Srikanth and Kishore (2012) observed that market sentiments improved due to growth in IIP and increased net FII flows into India by taking data from the duration of April 2003 to March 2011. Anuradha and Rajendran (2012) found uni-directional relationship from index of industrial production to FIIs' flows. Further, as per Srikanth and Kishore (2012), growth in IIP improves market sentiments and increases net FIIs' flows in India. Kaur and Dhillon (2010) found significant and positive impact of index of industrial production on FIIs' investments both in the long and short run. Mukherjee et al. (2002) provided an evidence of positive association between FIIs' flows and index of industrial production. Thus, it leads us to hypothesize that there is a significant relationship between FIIs flows and industrial growth of the country. So, there is a need to examine the causal relationship between FIIs flows and IIP during two most significant durations, that is, the pre and post sub-prime crisis period.

↳ **Hypothesis 2 :** There is a causal relationship between FIIs flows and index of industrial production.

(3) Wholesale Price Index and FIIs : As per Sugnathi and Dharshanna (2014), Srikanth and Kishore (2012), and Kumar (2011), no relationship was found between wholesale price index and investment pattern of FIIs in India. Srinivasan and Kalaivani (2013) found that domestic inflation rate posed negative and significant influence on FIIs' flows in the short run. Kaur and Dhillon (2010) found that in the long run, inflation in foreign country posed a positive influence ; whereas, inflation in India had negatively influenced FIIs' investment. Further, as per Singh (2006), when domestic inflation rate increases, purchasing power of fund invested decreases, which discourages the investors to invest in a particular economy. On the other hand, when the inflation rate in a foreign country increases, the purchasing power of the fund in that country falls, which discourages the investors' to invest in that country. Hence, the existing literature on the relationship between FIIs and wholesale price index leads us to hypothesize that there exists a causal relationship between the two and this relationship needs to be tested for the two most significant durations, that is, pre and post sub-prime crisis.

↳ **Hypothesis 3 :** There is a causal relationship between FIIs flows and wholesale price index.

As it is evident that there is enough evidence of relation between FII flows and macro-economic variables, but the exact picture about the direction of causality of FIIs flows with exchange rate, IIP, and WPI is still debatable. It is found in the literature that in the relationship between FII and exchange rate, Khandelwal (2014), Kumar (2011), and Anuradha and Rajendran (2012) found unidirectional causality from exchange rate to FII flows ; however, Suganthi and Dharshanna (2014) and Ghosh and Herwadkar (2009) found unidirectional causality from FII flows to exchange rate. In opposite of that, Srikanth and Kishore (2012) observed no relationship between them. However, Mitra (2010) observed bi-directional causality between exchange rate and FII investment. Raju et al. (2011) explored the relationship of FII flows with four different exchange rates and found different causality results. They found bi-directional relationship between FII flows and dollar, unidirectional relationship with pound and yen, and no relationship with euro. Further, among the FII flows and index of industrial production, Suganthi and Dharshanna (2014), Sethi (2013), Anuradha and Rajendran (2012), Kumar (2011), and Srikanth and Kishore (2012) observed unidirectional relationship from index of industrial production to FII investments.

Among the association between FIIs and wholesale price index, Suganthi and Dharshanna (2014), Kumar (2011), and Srikanth and Kishore (2012) observed no relationship. In the relationship between FIIs and money

Table 1. Causality Direction : Summary of Literature Review

S. No.	Relationship	Author(s)	Direction of Causality
1.	**FII Flows and Exchange Rate**	Mitra (2010)	Bi-directional
		Khandelwal (2014) ; Kumar (2011); Anuradha & Rajendran (2012)	Uni-directional- Exchange Rate to FII Flows
		Suganthi & Dharshanna (2014) ; Ghosh & Herwadkar (2009)	Uni-directional- FII Flows to Exchange Rate
		Srikanth & Kishore (2012)	No Relationship
		Raju et al. (2011)	Bi-directional- FII flows and dollar Uni-directional- pound and yen to FII flows No relationship- FII fows and euro
2.	**FII Flows and Index of Industrial Production**	Suganthi & Dharshanna (2014); Sethi (2013); Anuradha & Rajendran (2012); Kumar (2011); Srikanth & Kishore (2012)	Uni-directional- Index of Industrial Production to FII investment
3.	**FII Flows and Wholesale Price Index**	Suganthi & Dharshanna (2014); Anuradha & Rajendran (2012); Kumar (2011); Srikanth & Kishore (2012)	No Relationship
4.	**FIIs Flows and Foreign Exchange Reserves**	Bhatia & Kishor (2013)	Bi-directional
		Srikanth & Kishore (2012)	Uni-directional - FII flows to Foreign Exchange Reserves
5.	**FIIs Flows and Foreign Direct Investment**	Sethi (2013)	Bi-directional
6.	**FII Flows and Interest Rate**	Srikanth & Kishore (2012); Anuradha & Rajendran (2012); Kumar (2011)	No Relationship
7.	**FII Flows and Money Supply**	Srikanth & Kishore (2012); Kumar (2011)	No Relationship

supply and call money rate, Kumar (2011) found no relationship.

As per the Table 1, different results have been found by different authors between FII flows and macro variables in India. These results show that there is inconsistency in the results obtained by various authors and need to retest and hypothesize the relationship, especially for the pre and post sub-prime crisis duration.

↳ **Hypothesis 4 :** The sub-prime crisis influenced the relationship between FIIs and macro-economic variables.

Research Methodology

The literature review has helped in identification of the research gap. Firstly, there is no consensus on the direction of relationship between FII flows and macro-economic variables. Secondly, a gap is found in the extant literature on a systematic analysis of trend of FIIs' investment in India separately in two durations, that is, before and after the occurrence of the sub - prime crisis in 2008. The present study deals with the real time series data that depend upon the changes in market sentiments. Monthly data for selected variables was considered for the duration from 2003-04 to 2012-13, segregated into two durations, pre sub - prime (2003-04 to 2007-08) and post sub - prime (2008-09 to 2012-13).

This period is highly significant as it has seen placid markets followed by global meltdown due to the sub-prime crisis in U.S. in 2007 and recovery thereafter. Monthly data is used because the purpose is to analyze the frequent

Table 2. Description of Variables

S. No	Variables	Acronyms	Source
1.	FII Net Investment; difference between purchase and sales of total equity and debt investment	FNI	Securities and Exchange Board of India (2014)
2.	Exchange Rate	EXR	Reserve Bank of India (2014)
3.	Index of Industrial Production	IIP	Centre for Monitoring Indian Economy (2014)
4.	Wholesale Price Index	WPI	Centre for Monitoring Indian Economy (2015)

Table 3. Research Hypotheses

H. No.		Null Hypothesis	S. No.		Alternate Hypothesis
I.		**Causality between *FII* ⇔ *EXR***			
H_{0a}	H_{0a1}	*FNI* does not Granger cause *EXR*	H_{1a}	H_{1a1}	*FNI* Granger causes *EXR*
	H_{0a2}	*EXR* does not Granger cause *FNI*		H_{1a2}	*EXR* Granger causes *FNI*
II.		**Causality between *FII* ⇔ *IIP***			
H_{0b}	H_{0b1}	*FNI* does not Granger cause *IIP*	H_{1b}	H_{1b1}	*FNI* Granger causes *IIP*
	H_{0b2}	*IIP* does not Granger cause *FNI*		H_{1b2}	*IIP* Granger causes *FNI*
III.		**Causality between *FII* ⇔ *WPI***			
H_{0c}	H_{0c1}	*FNI* does not Granger cause *WPI*	H_{1c}	H_{1c1}	*FNI* Granger causes *WPI*
	H_{0c2}	*WPI* does not Granger cause *FNI*		H_{1c2}	*WPI* Granger causes *FNI*

behaviour of FIIs' investment in the Indian capital market. The description of the variables and their acronyms are shown in the Table 2.

Our analyses deal with the three macro-economic variables namely, exchange rate, index of industrial production, and wholesale price index (taken as a proxy for inflation). Exchange rate gives an indication about the movement of the domestic currency in the global market. Further, IIP is an index of industrial growth. It provides a clear picture about the performance of domestic industries; however, the whole sale price index is a reflection of inflation in the country. All these variables are directly or indirectly associated with the FIIs' investment in India. The macro-economic data was collected from websites of RBI and Centre for Monitoring Indian Economy Pvt. Ltd.; Industry and Economic Outlook database. Data of FIIs' net flow were taken from the Securities and Exchange Board of India (SEBI).

To address the objective of the study, three main hypotheses have been framed, which are divided into six sub-hypotheses under a causality framework. Description of the null and alternate hypotheses is shown in the Table 3.

(1) Statistical Tools and Techniques : To address the research objectives and to test the hypotheses, the Granger causality test has been applied. This test has been widely used by various researchers to examine the cause and effect relationship among variables (Anuradha & Rajendran, 2012 ; Bodla & Kumar, 2009 ; Chandra, 2012 ; Chakraborty, 2007 ; Goudarzi & Ramanarayanan, 2011 ; Gupta, 2011 ; Khan, Rohit, Goyal, Ranjan, & Agrawal, 2010 ; Mishra et al., 2010 ; Poshakwale & Thapa, 2010 ; Rajput, Chorpra, & Rajput, 2012 ; Ray, 2009 ; Srikanth & Kishore, 2012 ; Srinivasan, Kalaivani, & Bhat, 2010 ; Takeshi, 2009). This required the data analysis in three steps : First, the stationarity test to check the nature of time series data ; second, the Cointegration test to examine the long run equilibrium relationship along with the error correction model ; and third, the Granger causality test to identify direction or short run relationship among the variables. The stationarity of the data was checked by

Table 4. Research Models

S.No.		Direction of Causality	Models
I.		**Causality between *FII* ⇔ *EXR***	
1.	1.1	*FNI* → *EXR*	$FNI_t = \sum_{i=1}^{n} \alpha_i EXR_{t-i} + \sum_{j=1}^{n} \beta_j FNI_{t-j} + \mu_{1t}$
	1.2	*EXR* → *FNI*	$EXR_t = \sum_{i=1}^{n} \lambda_i EXR_{t-i} + \sum_{j=1}^{n} \delta_j FNI_{t-j} + \mu_{2t}$
II.		**Causality between *FII* ⇔ *IIP***	
2.	2.1	*FNI* → *IIP*	$FNI_t = \sum_{i=1}^{n} \alpha_i IIP_{t-i} + \sum_{j=1}^{n} \beta_j FNI_{t-j} + \mu_{1t}$
	2.2	*IIP* → *FNI*	$IIP_t = \sum_{i=1}^{n} \lambda_i IIP_{t-i} + \sum_{j=1}^{n} \delta_j FNI_{t-j} + \mu_{2t}$
III.		**Causality between *FII* ⇔ *WPI***	
3.	3.1	*FNI* → *WPI*	$FNI_t = \sum_{i=1}^{n} \alpha_i WPI_{t-i} + \sum_{j=1}^{n} \beta_j FNI_{t-j} + \mu_{1t}$
	3.2	*WPI* → *FNI*	$WPI_t = \sum_{i=1}^{n} \lambda_i WPI_{t-i} + \sum_{j=1}^{n} \delta_j FNI_{t-j} + \mu_{2t}$

employing unit root test consisting of Augmented Dickey Fuller (ADF) test. The correlation analysis was undertaken to find out the strength of the relationship of the two series. Software named as 'E-views 8' was applied for the analysis of data. The optimal lag lengths were selected on the basis of automatic lag lengths selection under Schwarz information criterion (SIC).

(2) Research Models : Three research models were formulated in the study that is further divided into six sub-models under the causality framework (Table 4).

Results and Discussion

This section deals with the data analysis and interpretation of results obtained in the study. The analysis is divided into two sections ; first deals with correlation analysis ; whereas, the second deals with the time series analysis; ADF test, cointegration test, and Granger causality test.

The Table 5 reveals the correlation among variables. Amount of correlations varies from low degree of negative (-.202) to medium degree of positive (.404) effect. As per the results, in the first duration, low degree of negative relation is found between *FNI* and *EXR* (-.202) that turned into positive, but again, low degree in second duration (.192), indicating that during the pre sub - prime duration, FII flows and exchange rate were negatively related with each other that might have resulted into withdrawal of funds by FIIs, however, it turned to positive in the post sub - prime duration and started connecting with each other. In all, *FIIs* are not highly correlated with *EXR*. Industrial growth reflects the internal stability of the financial system of the country that could attract larger

Table 5. Correlation Between Research Variables

	Pre Sub-Prime Duration (2003-04 to 2007-08)		
	EXR	***IIP***	***WPI***
FNI	-.202	.063	.061
	Post Sub-Prime Duration (2008-09 to 2012-13)		
	EXR	***IIP***	***WPI***
FNI	.192	.404*	.349*

Note *p <0.01

Table 6. Augmented Dickey Fuller Test with Respect to Research Variables

Variables	First Difference (*T*-Statistics)		Decision
	Intercept	Intercept and Trend	
Pre Sub-Prime Duration (2003-04 to 2007-08)			
FNI	-5.124027*	-5.061973*	*I*(1)
EXR	-6.318746*	-6.274095*	*I*(1)
IIP	-5.759958*	-8.998827*	*I*(1)
WPI	-6.078800*	-6.210528*	*I*(1)
Post Sub-Prime Duration (2008-09 to 2012-13)			
FNI	-9.849450*	-9.755114*	*I*(1)
EXR	-6.774512*	-6.704636*	*I*(1)
IIP	-5.122841*	-5.260266*	*I*(1)
WPI	-5.288763*	-5.262928*	*I*(1)

Note: * $p < 0.05$, *I*(1) Integrated of order 1

foreign funds to the domestic country. There is almost a lack of relationship between *FNI* and *IIP* (.063) in the pre sub - prime duration, which improved to a medium degree in the post sub-prime duration (.404), reflecting that industrial growth and FIIs flows were initially not connected, but started correlating with each other in the post sub - prime duration. Growth of industrial production might have made an impact on confidence of FIIs with larger inflow of the overseas funds in India. Further, the same trend is found in case of *FNI* and *WPI* that registered a low degree of almost negligible relation in the first duration (.061), which turned into a medium positive relation with the correlation value of .349 in the post sub - prime duration, indicating that may be, in the second duration, excessive inflows of foreign funds into the country could lead to high circulation of money in the economy that, in turn, could result into an increase in inflation. The variables are found to be statistically significant at the 1% level of significance.

The prerequisite for performing the Granger causality test is to check the stationarity of data. To check the stationary of data, the ADF test was performed for all the variables. The results of the ADF test are shown in the Table 6. As per the results, in the pre and post sub - prime durations, all the variables are found to be stationary at first difference *I* (1) with intercept as well as with intercept and trend.

If the series of the data used for analysis are found to be stationary at first difference or *I* (1), then it is possible that there exists a long run relationship among the variables, and the linear combination of the series is cointegrated with each other. The Johansen cointegration test was performed to test the long run relationship between the variables along with the error correction model to adjust the coefficients of set of variables with short-run dynamics. The results of the ADF test in Table 6 indicate that all the series are integrated of same order. Then, the next step is to perform the Johansen cointegration test.

The Johansen cointegration test consists with trace and maximum Eigen statistics. The results of both the statistics are presented in the Table 7. The test deals with the null hypotheses that the series are not cointegrated and alternate that the series are cointegrated. As per the results, in the pre sub-prime duration, both trace and maximum Eigen statistics indicate that cointegration exists among the set of variables at the 5% level of significance and have at least two cointegrated equations in the series. Further, in the post sub - prime duration, both trace and maximum Eigen statistics indicate that the set of variables are not cointegrated with each other at the 5% level of significance. The results of the cointegration test confirm the existence of a long run relationship between the set of variables in the pre sub -prime duration. However, this relationship has disappeared in the post sub - prime duration.

Table 7. Johansen's Cointegration Test with Respect to Research Variables

Pre Sub-Prime Duration (2003-04 to 2007-08)				
Hypothesized No. of CE(s)	**Eigen Value**	**Trace Statistics**	**Critical Value**	**Prob.**
None*	0.388217	61.51289	47.85613	0.0016
At most 1*	0.344745	33.50432	29.79707	0.0179
At most 2	0.107485	9.408641	15.49471	0.3289
At most 3	0.050056	2.927083	3.841466	0.0871
Hypothesized No. of CE(s)	**Eigen Value**	**Maximum Eigen Statistics**	**Critical Value**	**Prob.**
None*	0.388217	28.00857	27.58434	0.0441
At most 1*	0.344745	24.09568	21.13162	0.0186
At most 2	0.107485	6.481559	14.26460	0.5522
At most 3	0.050056	2.927083	3.841466	0.0871
Post Sub-Prime Duration (2008-09 to 2012-13)				
Hypothesized No. of CE(s)	**Eigen Value**	**Trace Statistics**	**Critical Value**	**Prob.**
None	0.308353	42.29984	47.85613	0.1505
At most 1	0.214383	21.28514	29.79707	0.3401
At most 2	0.110936	7.531864	15.49471	0.5167
At most 3	0.014446	0.829434	3.841466	0.3624
Hypothesized No. of CE(s)	**Eigen Value**	**Maximum Eigen Statistics**	**Critical Value**	**Prob.**
None	0.308353	21.01470	27.58434	0.2753
At most 1	0.214383	13.75328	21.13162	0.3856
At most 2	0.110936	6.702430	14.26460	0.5249
At most 3	0.014446	0.829434	3.841466	0.3624

Note: * indicates rejection of null hypotheses at 0.05 significance level

Table 8. VECM Model with Respect to Research Variables

	Coefficient	**Standard Error**	***t*-statistics**	**Prob.**
ECM (-1)	-1.417936*	0.345519	-4.103783	0.0002
ECM (-2)	-14.18015*	4.009407	-3.536720	0.0009

* indicates $p < 0.05$

The results clearly indicate that FIIs are governed by market dynamics. The results can be utilized by financial sector experts to understand the market dynamics. When the economy is surging ahead and opportunities of growth are visible, foreign investors bring in capital, but when the conditions are not favourable, FIIs are discouraged. The market emotions reflect in FIIs' behavior very dominantly. The government can take lessons from this finding to evolve a strategy so as to create a robust economic system where growth opportunities continue to exist.

Further, from the results of the Table 7, it is concluded that FII flows have a long run relationship with macro-economic variables in the pre sub - prime duration, but it could be confirmed only through the adjustment of deviation in coefficients of set of variables with short-run dynamics or equilibrium. Such adjustment and equilibrium could be achieved through the error correction model (ECM). ECM was applied only for the first duration because the variables are found to be cointegrated in this duration only. The results of the vector error

Table 9. Results of Granger Causality Test : Hypotheses Testing

H. No.		Null Hypothesis	Pre Sub-Prime Duration			Post Sub-Prime Duration		
			Lag Length	*F* Statistics	Decision	*F* Statistics	Lag Length	Decision
		I. Causality Between *FII* ⇔ *EXR*						
H_{0a}	H_{0a1}	*FNI* does not Granger cause *EXR*	1	0.62208	Accept	1	6.39807*	Reject
	H_{0a2}	*EXR* does not Granger cause *FNI*	1	0.00832	Accept	2	6.91706*	Reject
		II. Causality Between *FII* ⇔ *IIP*						
H_{0b}	H_{0b1}	*FNI* does not Granger cause *IIP*	1	4.29015*	Reject	1	0.22470	Accept
	H_{0b2}	*IIP* does not Granger cause *FNI*	1	1.10767	Accept	5	2.66431*	Reject
		III. Causality Between *FII* ⇔ *WPI*						
H_{0c}	H_{0c1}	*FNI* does not Granger cause *WPI*	4	2.56089**	Reject	6	2.00070**	Reject
	H_{0c2}	*WPI* does not Granger cause *FNI*	1	0.09645	Accept	1	0.89743	Accept

Note: *p<0.05 **p<0.10

correction model (VECM) (Table 8) indicate that the error correction terms and adjustment coefficient are statistically significant at the 5% level of significance. It rejects the null hypothesis that there is no cointegration among the variables and confirms the presence of a stable long run relationship between FII flows and macro-economic variables of the country.

The Table 9 shows the results of Granger's causality test. In this study, maximum eight lags are selected for both the durations automatically by using SIC criterion through E-views 8. The acceptance and rejection of the null hypothesis depends upon the *F*-statistics and its probability value. In the pre sub-prime duration, *FNI* and *EXR* did not cause each other, that is, no causal relationship is found between the two. It indicates that before the crisis, these two macro-economic parameters moved independently without getting influenced by each other. However, it turned to bi-directional or two way relationship between the two in the post sub - prime duration. Both started influencing each other after the crisis. It reveals that during the post sub - prime duration, investors started thinking more about the exchange rate variations before taking their investment decisions so that they could avoid the situation of fund loss. On the other hand, the decision of FIIs to pump their money in the market started influencing the exchange rate of the country. Inflow of foreign capital in any economy influences the exchange rates that ultimately could influence the economic growth of the country and vice-versa. This could also motivate the investors to invest in a particular economy with the expectation of higher rate of returns, and at the same time, could shake their confidence. Hence, in the null hypothesis H_{0a}, both the sub-hypotheses H_{0a1} and H_{0a2} are accepted in the pre sub-prime duration ; whereas, these are rejected in the post sub-prime duration.

In the relationship between *FNI* and *IIP*, unidirectional causality ran from *FNI* to *IIP* in the pre sub-prime duration, *FNI* granger caused *IIP* but *IIP* did not cause *FNI*. The inflow of the foreign funds encouraged domestic industries and helped them in growth, which ultimately contributed towards the economic growth of the country. But industrial growth did not influence inflow of foreign funds during the first duration. The situation went just opposite in the post sub-prime duration, again uni-directional causality is found, but this time, it moved from *IIP* to *FNI*. It indicates that industrial growth infused confidence amongst investors. FIIs flows influenced industrial growth causing Indian rupee to strengthen and opening the door for fresh investments. High industrial growth mobilized FIIs to pour overseas money into the Indian financial market. This indicates that under the null hypothesis H_{0b}, sub-hypotheses H_{0b1} is rejected whereas, H_{0b2} is accepted in the pre sub-prime duration. But in the post sub-prime duration, the situation reverses with the acceptance of H_{0b1} and rejection of H_{0b2} (Table 9).

Further, in the relationship between *FNI* and *WPI* taken as proxy for inflation, uni-directional causality moved from *FNI* to *WPI* in both the durations that means FII investments influenced *WPI*, but reverse is not found to be

true. It reveals that larger flow of foreign funds caused the inflation of the country in both the durations, because inflow of foreign funds brings more money in circulation that ultimately leads to inflation in the country. Hence, in the null hypothesis H_{0c}, sub-hypotheses H_{0c1} is rejected ; whereas H_{0c2} is accepted in both pre sub-prime and post sub-prime durations (Table 9).

The results have significant practical implications that can be used by practitioners as well policy makers. FIIs became very cautious about exchange rate variations after the happening of the sub - prime crisis. Their returns are largely affected by the fluctuations in the exchange rate. For practical purposes, it is an important finding that FIIs are affected by exchange rate movements and vice-versa. The bi-directional causality between the two is also an indicator of maturity of capital markets in the country.

Strong domestic fundamentals of the economy attract FIIs to a large extent. The favourable condition of the market invites more funds by the FIIs because it increases the returns of the foreign investors. There is a need to promote the domestic parameters so that the economy could sustain in the world platform with its own strong fundamentals. This result can help the government to improve the industrial output of the country by formulating strategies that would enhance the economic base of the country in the world market.

Further, the results can be utilized by financial analysts to understand the market conditions at the time of flow of funds by FIIs. When FIIs infuse their money in any economy, then there is free flow of funds moving across without any barrier, which leads to huge money circulation in the economy. Hence, the government can build a strategy at the time of announcing the policy rates to absorb the excess money.

Conclusion

The findings of the study clearly show the relationship between FIIs' investment and selected macro-economic variables in the Indian capital market. As per the results of the cointegration test, long run equilibrium relationship is found between *FNI, IIP, WPI,* and *EXR* in the first duration ; whereas, this relationship disappeared among the variables in the post sub - prime duration. This indicates that before the sub - prime crisis in the U.S., the economy was highly integrated with macro-economic parameters, and long run relationship existed, but after the crisis, this relationship was no longer there, and the confidence of the investors was shaken.

In order to find out the direction of causality between the set of variables, bi-directional causality was found between FIIs' net investment and exchange rate in the post sub - prime duration, however, these were found to be not influenced by each other in the pre sub - prime duration. This is to conclude that the relationship between the two has now emerged out in the market after the sub-prime crisis as these two started determining each other in the financial market. This finding supports the findings of Mitra (2010). The inflow of foreign funds strengthened the domestic currency, that, in return, led to more circulation of foreign funds into the country during the period of the study. In contradiction, Suganthi and Dharshanna (2014), Khandelwal (2014) , Anuradha and Rajendran (2012) , and Kumar (2011) found a one way relationship between FIIs' flows and exchange rate.

Further, when we move to statistics and findings related to net investments by *FIIs* and *IIP*, net investments by *FIIs* Granger caused *IIP* ; whereas, *IIP* did not influence *FIIs'* net investments in the pre sub-prime duration, however, the situation changed in the post sub-prime duration as *IIPs* started influencing *FIIs'* net investments. This indicates that during the pre sub - prime duration, our domestic economy was much more dependent upon inflow of foreign funds, but after the crisis, the situation changed , and now, our domestic setup has strengthened and started attracting more foreign funds to the economy, which ultimately leads to economic growth of the country. In support of this finding, Suganthi and Dharshanna (2014) also found unidirectional causality from *IIP* to *FII*.

The findings related to net investment by FIIs and whole sale price index recorded uni-directional causality from *FNI* to *WPI* in both the durations. The inflow of foreign funds affected the inflation of the country. This finding contradicts the findings of Suganthi and Dharshanna (2014), Anuradha and Rajendran (2012), Srikanth

and Kishore (2012) , and Kumar (2011). In their studies, the authors found no direction of relationship between *WPI* and investment pattern of *FIIs* ; whereas, our study concludes that there is one way relationship between these two. The inflow of foreign funds leads to more money in circulation, which, in turn, influences inflation in the country.

Research Implications, Limitations of the Study, and Scope for Further Research

The major contribution of the study is the analysis of FIIs' behaviour with reference to three major macro variables, each representing three major constituents of the economy, the international markets, the domestic markets, and the industrial section. The research has contributed new findings in the relationship which could not be established by past research studies. Furthermore, the research has also supported the work of other scholars through some of the findings. The research has established causality between *WPI* and *FII*, which has been less explored so far.

The findings of the research have major implications for various sections. The investors, financial analysts, and policy makers may understand the behavior of FIIs and macro-economic variables in the Indian financial market to their advantage. This study gives significant insight to investors regarding their investment decisions. With a deep pocket, FIIs' investments offer liquidity and scale up demand as well as the price that encourages domestic investors to invest in a surging market. They can diversify their portfolio by analyzing the trends prevailing in the market on account of movement of FIIs' flows and its relationship with macro-economic variables. They can take the advantage of favourable market conditions and can generate higher rate of returns. Furthermore, policy makers can understand the behaviour of FIIs in the Indian financial market that will help them to decide their policy initiatives to attract funds by FIIs in the Indian capital market. FIIs help in equity market development that contributes towards the economic growth of the country.

The study concludes with three validated models of causality between macro variables and FIIs. In a further study, other variables can be used. Furthermore, a longer duration can be studied to analyze FIIs' behaviour in response to various macro-variables. However, it will not be assertive to say that such a study cannot be exhaustive in terms of choice of variables and there will always be a possibility of expanding the scope of analysis.

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