Fund Flow of Financial Institutional Investors to Indian Stock Market: An Empirical Study

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Abstract

This study has tried to explore whether the foreign institutional investors (FIIs) have a significant impact on the Indian stock market, and also to find the linkages that these flows have with the exchange rate and the Index of Industrial Production. The study utilises data over a 13 year period (January 1995 to December 2007) for the variables from Centre for Monitoring Indian Economy (CMIE). The study found that FIIs net flow has a significant impact on the Indian stock market and is positively correlated with the Bombay Stock Exchange (BSE) Sensex movements though there is no evidence of causality between them. The study revealed the fact that the rupee–dollar exchange rates are negatively correlated with the FIIs flow. The Granger causality tests reveal that there is causation from FIIs flow to the rupee–dollar exchange rates but not vice versa. The study is divided into various sections. The first section gives an introduction to the study and the significance of the study. The second section presents a brief background to the study, including the determinants of FII flow, and literature review. The methodology is described in the third section, including the hypotheses and sampling. The results and findings of the research are discussed in the fourth section, while the last and fifth section comprises the conclusion to the study.

Keywords

Stock markets, investment flows, FIIs, industrial production, rupee–dollar exchange rates

Introduction

Capital flows into the country have always been a subject of debate. One always tends to debate whether the capital flows into the country is good or bad considering the volatile nature of a part of such investments. Much of the fear relating to capital flows is rooted in the fact that they are incomprehensible in nature. Thus, a study of these capital flows helps to provide a deeper understanding in this regard so that these flows can then be controlled to suit the requirements of a country.

The Indian stock market has come of age and has substantially aligned itself with the international order. Over the last 15 years, developments like screen-based trading, rolling settlements, dematerialisation of securities and derivative trading have made the Indian stock market almost on par with the global markets. In fact, today, India has one of the most sophisticated and well-regulated securities market. Along with these changes, the market has also witnessed a growing trend of 'institutionalisation' that may be considered a consequence of globalisation. Today, giant institutions control huge sums of money which they move continuously. In European and Japanese markets, institutions dominate virtually all trading. An important feature of the development of stock markets in India in the last 15 years has been the growing participation of institutional investors, both foreign institutional investors (FIIs) and the Indian mutual funds. The institutional investors in India can be classified into banks, all-India financial institutions (FIs), mutual funds (MFs), FIIs and life and general insurers. With the accelerating trends of reforms, Indian stock market has been witnessing more and more of institutionalisation and an increasing size of money under control. The importance of institutional investors, particularly FIIs, is very much evident as one of the routine reasons offered by market advocates whenever the market rises is that it is due to foreign investors' money. This is not unusual or unique to India alone, as most developed economies of today might have seen a similar trend in the past (Kumar, 2007).

The FII investment was first allowed in the country in the year 1992 when the economy was opened up. These

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flows are subject to high volatility and this has made the flows subject to high scrutiny (Gordon & Gupta, 2003). The FIIs have been known to be extremely sensitive to any news of any trouble in the host country, as has been proved in the past. The Indian stock market has been primarily driven by FII activity. If the Bombay Stock Exchange (BSE) Sensex movements are plotted against the FII net investments over the 15 period since FIIs have been allowed to enter the markets (refer Annexure 1), one can definitely notice a correlation, and more so in the past five years. It is in this context that a careful examination of the nature of FII flow into an economy is important, as it may help identify the strength of various factors, including macroeconomic factors like level of production, the interest rates that are likely to affect such flows and also, the possible impact of such flows on the performance of the equity market concerned.

This study focuses only on the flow of FIIs and understanding the relationship of these flows with certain macroeconomic variables and the impact these flows have on the stock markets.

Significance of the Study

This study is significant as it extends prior published study by:

- Extending the study of the existence of a relationship between FII investments and its impact on the stock market using updated data.
- Extending the study of causality between FII flows and the stock market movements using recent data.
- This study would be significant to those researchers who want to extend their research of previous FII impact studies to the current period.
- The study would also be significant as researcher to obtain background knowledge into the nature of FII flows for any further studies for the prediction of a reversal of FII flows.
- The volatile nature of these flows (refer to Annexures 1 and 2) makes it significant that there is adequate research in the area in order to identify any empirical evidence as regards such flows.

Background

Determinants of FII Flows

The FII flows have historically been believed to be dependent on several factors without any major dependence on any single factor. These are outlined as follows:

1. International: This refers to the international capital asset pricing model (CAPM) which states that an investor to have the ideal diversified portfolio needs to be adequately invested in different regions around the world. Thus, such diversification on the part of investors leads to FII flows into the country. In practice, however, there is a 'home bias', with the proportion of foreign assets in investors' portfolio tending to be very small (Report by Ministry of Finance, 2005). The international CAPM states that the proportion of equities from around the world that individuals should hold in their portfolio should be according to the market capitalisations. International investors may be subject to 'cumulative informational disadvantage' as compared to local investors (Shah & Patnaik, 2005). Furthermore, country risk ratings, comprising political and other risks along with economic and financial variables, also could have an impact on portfolio flows to a country, though this is more likely in the case of foreign direct investment (FDI) flows.
2. India: Equity market returns provided by the stocks listed in the country stock exchanges are considered to be a major factor. Additionally, daily market return and its volatility in domestic and international equity markets as well as the measure of beta in these markets—BSE Sensex, S&P 500 and MSCI WI—are important factors determining FII flows. Furthermore, macroeconomic variables that are likely to affect foreign investors' expectation about returns in Indian market include rupee–dollar exchange rates, that is, dollar returns, short-term interest rate, Index of Industrial Production (IIP) and the balance of payments. The financial market infrastructure like market size, market liquidity, trading costs, information dissemination and legal mechanisms relating to property rights also play a role in determining the FII flows into a country (Bose & Coondoo, 2004).

The list of factors identified is only indicative. The FII flows are related to a lot of other factors. In fact, in India, a number of times, FII flows are also dependent on the level of rainfall received in the country. Thus, FII flows are subject to a lot interrelated factors.

Relationship of FII Flows with the Exchange Rate

The FII flows have been closely connected with the rupee–dollar rates. The fluctuations in the rupee–dollar rates have been believed to cause fluctuation in the FII investments and vice versa. Thus, both the factors are considered to be interrelated. The fluctuations in the rupee–dollar exchange

rates can impact the returns on the FII investments. Thus, the dollar returns earned by the FIIs are in the spotlight and impact the flows into the country. Annexure 2 shows the movement of the rupee–dollar rates vis-à-vis the FII net investment in the country over the past 12 years. It is found that there is negative correlation between the rupee–dollar rates and the FII net investment.

Relationship of FII Flows with the Index of Industrial Production (IIP)

The foreign investors invest their funds in India taking into account several factors and one of the considerations is believed to be the level of the industrial activity in the country. This is so because the industrial activity in a country would be closely connected with the country's progress and its overall gross domestic product (GDP) growth. The IIP is considered to be representative of the level of industrial production in the country and all else being equal, the FII flows would be considered to be positively correlated with it.

Impact of FII Fund Flows on Indian Stock Markets

The Indian stock markets, it is believed, have historically been primarily driven by FII activity. In fact, the issue of the impact of FII flows on the national exchanges of the country has been the topic of huge debate and is also highly researched. A visual inspection of the BSE Sensex movements against the FII net investments over the 15 year period since FIIs have been allowed to enter the markets, as seen in Annexure 1, does definitely suggest a correlation more so in the past five years. Thus, one can claim there is a relationship between the two variables. Several studies have been conducted on the relationship between the stock markets and the FII flows and they have brought out interesting points.

Literature Review

Brennan and Cao (1997) argued that local investors possess greater knowledge about a country's financial market than foreign investors and that this asymmetry lies at the heart of the observed 'home bias' among investors in industrialised countries. A key implication of recent theoretical work in this area is that in the presence of such information asymmetry, portfolio flows to a country would be related to returns in both recipient and source countries. In the absence of such asymmetry, only the recipient country's returns should affect these flows.

Chakrabarti (2001) used FII data from May 1993 to December 1999 and found out that FII flows have a positive correlation of 0.52 with the BSE national index returns in rupee terms. He also found that FIIs were not at an informational disadvantage as compared to the local investors contrary to popular belief. He used ordinary least squares (OLS) regression between net monthly FII flow as a proportion of preceding month's BSE market capitalisation and the beta of MSCI world index as well as the beta of S&P 500 index and found that as the world returns were not significant in determining FII flows to the country and hence based on the Brennan and Cao model, there is no informational disadvantage to foreign investors. Another major conclusion of his study was that the changes in the country risk rating did not appear to affect the FII flows till September 1999.

Worasinchai (2001) studied the effect of cross-border portfolio flows and psychology of investors on stock returns—case of Thailand. The study investigated bivariate causal relationships between portfolio flows and stock returns in the Thai stock market using Granger causality tests. Daily time series data were used from the period before the Asian financial crisis of 1997 and during the crisis till 1999. The results showed that there existed a unidirectional relationship from stock return to portfolio flows both before and during the Asian financial crisis.

Another work in this area, by Mukherjee, Bose and Coondoo (2002), used an analysis of daily FII flows during January 1999 to May 2002. They found that FII flows to and from the country are caused by the return in the domestic equity market and not the other way round. Also, it was found that FIIs did not seem to use the Indian markets for the purpose of diversification. The return from exchange rate variation is not found to be a strong influence on FII decisions.

Kumar (2007) explored the role of institutional investors in the Indian stock markets and found that the movement of the markets can be explained by using the directions of the institutional investors fund flow. He used data from 1992 to 2005 and examined whether institutional activity (FIIs and the Indian mutual funds) has an influence on the market or not. He used OLS regression using advance to decline ratio as the dependant variable and the institutional purchase to sales ratio as the independent variable. The regression results explained that institutional activity does significantly influence the market's direction. Moreover, he found that both FIIs and Indian mutual funds individually also were significant influences on the market direction. Also, causality tests using the mentioned variables by Kumar suggested that institutional activity drives the market. He also studied whether there is a correlation between FII activity and mutual funds and interestingly, found that mutual fund activity can be used to predict FII activity but not vice versa. Thus, he stated that Indian

mutual funds are leading the FIIs and are giving direction to the Indian stock markets.

A study by Sensarma and Rao (2007) on the relationship between monetary policy, stock market and FII inflows using Vector Auto-Regression (VAR) framework and Granger causality tests, found that monetary policy and stock market returns together cause FII inflows and not vice versa.

Sethi and Patnaik (2007) examined the effect of international capital flows on India's capital markets and growth. They used monthly time series data from April 1995 to July 2005 and researched that FDI had positive impact on economic growth, while FII had negative impact on economic growth in India.

A study by Narayan Sethi (2013) examined the casual relationship of foreign capital inflows and economic growth in India. The study in part found that private foreign capital inflows had positive and direct impact on economic growth.

Methodology

Objectives of Study

The main objective of this study is to find whether FII activity has a significant impact on the flow of Indian stock markets. The study seeks to use the BSE Sensex returns (hereafter denoted as Sen_Ret) as the dependent variable and the FII net investment (hereafter denoted as FII_Net) as the explanatory variable and analyse whether the FII_Net has a significant impact on the Sen_Ret through an OLS regression. Additionally, the study also seeks to analyse whether there exists a causal relationship between the Sen_Ret and the FII_Net using causality tests.

The secondary objective of this study is to gauge the relationship of certain key macroeconomic variables with the flow of FIIs into and out of the country. Also, if there is a significant impact of these macroeconomic variables on the flows, the study seeks to further establish causality between the variables.

Hypotheses

1. Impact of FII activity on the Indian stock markets:
   H0:
   SENSEX_RETURNS does not Granger Cause FII_NET
   FII_NET does not Granger Cause SENSEX_RETURNS

   H1:
   SENSEX_RETURNS Granger Cause FII_NET
   FII_NET Granger Cause SENSEX_RETURNS
2. Linkage of macroeconomic variables, namely, exchange rate and IIP with FII flows:
   H0:
   LOG_FIINET does not Granger Cause RUPEEDOLLAR_RATE_1
   RUPEEDOLLAR_RATE_1 does not Granger Cause LOG_FIINET

   H1:
   LOG_FIINET Granger Cause RUPEEDOLLAR_RATE_1
   RUPEEDOLLAR_RATE_1 Granger Cause LOG_FIINET

Population and Sampling

The population for the study has been considered as monthly foreign institutional net investment (FII_Net = FII Purchase [INR Million] – FII Sales [INR Million]) in India and monthly returns from the BSE sensitive index (BSE 30 - Sen_Ret). The study utilises data over a 13 year period (January 1995–December 2007) for the two variables from Centre for Monitoring Indian Economy (CMIE, Business Beacon).

The FII_Net data are further utilised in the study of interrelationships with macroeconomic variables. The macroeconomic variables that have been considered include the exchange rate (rupee–dollar rates) and the IIP data. The study considers a data sample over a similar 13 year period (January 1995–December 2007) from CMIE for these two variables in the research.

Procedure and Study Period

The study is conducted by studying the sample data for the entire period from January 1995 to December 2007, and also by breaking it into phases based on the Asian crisis of the 1990s and the bull run of the decade of 2000. The statistical test used for the research includes the OLS regression and the Granger causality test. The OLS regression is useful in identification of the magnitude of the impact of FII flows into the stock markets. The Granger causality test is a statistical tool that would be helpful in identification of the existence of causality in a relationship between two variables, and hence is used for justifying the presence of causality, if any, between FII flows and stock market returns or the macroeconomic variables, namely, exchange rate and IIP numbers.

Analysis of Plan

For the purpose of studying the magnitude of the impact of FII activity, the regression model assumes BSE Sensex

index returns (Sen_Ret) as the dependent variable and FII_Net as the independent variable. Additionally, an exogenous variable, 'c', has included accounting for all the other factors influencing the index returns. The model for the study would be as follows:

$$\text{Sen\_Ret} = c + \beta_1 (\text{FII\_Net}) \quad (1)$$

Where,

Sen_Ret: BSE Sensex index returns
C: Constant
FII_Net: FII net investment

Based on the given model results, the study seeks to identify whether there exists a cause–effect relationship between the two variables. The Granger causality test would be used for the purpose. For the purpose of testing the causality, the variables would be first subject to stationarity tests to prove that they are stationary time series without the presence of a unit root.

In order to study the linkages of the FII flows with macroeconomic variables, namely, exchange rate and IIP, the research tries to first establish if the macroeconomic factors identified have a significant impact on the FII flows. For satisfying the condition of the normality of dependent variable, the FII_Net data are converted into its log form. Thus, the model comprises Log_fiinet as the dependent variable and the rupeedollar_rate_1 and iip_1 as the dependent variables. The rupeedollar_rate_1 and iip_1 are the first and second differences of the original data in order to convert them into a stationary series. The model for the study would be as follows:

$$\text{Log\_fiinet} = f(\text{rupeedollar\_rate\_1}, \text{iip\_1}) \quad (2)$$

Where,

Log_fiinet: Natural log of FII_Net
rupeedollar_rate_1: First difference of rupeedollar_rate
iip_1: Second difference of IIP

Based on the given model results, the study seeks to identify whether there exists a cause–effect relationship between the macroeconomic variable exchange rate and IIP and the FII net investment into the country. The Granger causality test has been applied for this purpose.

Scope of Study

The study results are restricted to the time period of the study. The study does not seek to forecast the future movement of the FIIs or the movement of the stock markets. The scope of the study and its limitations are identified are as follows:

- The study is only restricted to understanding the significance of the impact of the FII net investments on the BSE Sensex movements and also identifying whether there is any causality between the two variables. The study does not go further in establishing a VAR framework between the two variables.
- The study also is restricted to examining the significance of the impact of exchange rate and IIP on the FII flows, and also examining whether there is any causality between these macroeconomic factors and the FII activity. The study does not seek to test for cointegration between the three variables which is a possibility, considering the non-stationary nature of the data.

Limitations

The limitations of the study include the use of a limited set of explanatory variables for the model construction. Also, statistical significance does not imply economic significance. Considerations like transaction costs, taxes and strategy risks have an important bearing on the transactions in the markets.

Results and Findings

Impact of FII Activity in the Indian Stock Markets

The model variables need to be tested for unit root (that is, stationarity) as well as whether the assumptions of the OLS regression are fulfilled. As can be seen from Annexure 3, the unit root tests show that both variables, Sen_Ret and FII_Net, are stationary and hence we can proceed with the regression. Thereafter, the model needs to be tested for the assumptions of the OLS regression and the results are as follows:

- Normality of dependant variable: As can be seen from Annexure 4(i), the dependant variable, Sen_Ret, is normally distributed.
- Homogeneity of variance: The variance of the error term of FII_Net, the independent variable, is also homogenous, as can be seen from the graph in Annexure 4(ii).

The variables, Sen_Ret and FII_Net, being of the time series nature, were tested for the presence of unit root and as can be seen from Annexure 3, the series was founded to be stationary (that is, without unit root). The OLS regression results show that the model explains 15.2 per cent variation in BSE Sensex returns (refer to Annexure 5 and 6). The

analysis of variance (ANOVA) results show that the model results are not due to chance. The following result is obtained:

$$\text{Sen\_Ret} = c + 0.001\,(\text{FII\_Net}) \rightarrow \text{Equation (1)}$$

The model shows that FII net flows have a significant impact on the sensex returns. Also, a positive beta of 0.001 shows the fact that the sensex returns increase by 0.389 with a positive net FII flow of ₹10 million.

Causality between FII Flows and BSE Sensex Returns

The regression (equation 1) showed that FIIs do have a significant impact on the Indian stock market. However, it would be worthwhile analysing the direction of causation between the two variables—the BSE Sensex returns and the FII net investments. The correlation analysis of the data between the two variables from 1995 to 2007 reflects a significant positive correlation coefficient of 0.389 (Annexure 6 and 7). However, does this imply that the FII investments lead the stock markets to rise or fall? For this, we need to refer to the Granger causality tests which would help us to understand the causation between sensex returns and FII net investment activity, if there exists such a phenomenon. The causality results can be summarised as follows (refer to Annexure 8).

Period 1995–2007

If the entire data range is taken to identify the direction of causation, we find that based on the F-statistic, we can accept the null hypothesis—SENSEX_RETURNS does not Granger Cause FII_NET—and vice versa. This means that both variables act in independence of each other. That is there is no cause–effect relationship between the two variables. However, if the data are analysed more minutely by breaking the data into several time segments, different results are obtained.

Pre-Asian crisis (1995–1996)

Based on the F-statistic, the test result for this period shows that the null hypothesis, SENSEX_RETURNS does not Granger Cause FII_NET, can be accepted, while the hypothesis, FII_NET does not Granger Cause SENSEX_RETURNS, can be rejected. Thus, this shows that the FII net investment activity caused the returns in the BSE Sensex index during this period. This is possibly due to the fact that the Indian markets at the time were not too broad and hence, the lower number of participants coupled with the increasing interest towards the Indian economy after its opening meant that the FII investments gave direction to the markets.

Asian crisis (1997–1999)

Referring the causality result table (Annexure 8), the F-statistic again suggests that the null hypothesis, SENSEX_RETURNS does not Granger Cause FII_NET, can be accepted, while the hypothesis, FII_NET does not Granger Cause SENSEX_RETURNS, can be rejected. The Asian crisis which is believed to have begun around early 1997 as results of huge foreign investment pullout from the South East Asian economies had not had much of an impact on the Indian economy. This was on account of the fact that the Indian economy did not have as much foreign investment as compared to its South East Asian counterparts (Gordon & Gupta, 2003). This period probably saw the lowest levels of FII activity in the country and owing to the depth of the Indian markets, they still had a significant impact on the direction of the market.

Post-Asian crisis (2000–2004)

This period saw a dramatic shift in participation in India's stock markets on the part of the institutional investors. This phase was initially slack, still reeling under the after-effects of the Asian crisis. However, over time, with increased disinvestment activity imitated by the Indian government as well as the general upsurge with the outsourcing activity in India, the rupee appreciation during 2003–2004, as well the good monsoons couple with the fact that the United States (US) economy was experiencing its lowest interest rage regimes and the asset prices had appreciated quite a bit, the FII flows saw a jump from ₹33 billion in 2002 to ₹350 billion in 2003 (Annexure 1). This tremendous increase of over 10 times in flows was also attributed to the fact that the Indian stock prices at the time were generally believed to be undervalued.

If the causality results are referred to for this period, it can be seen that the BSE Sensex returns were a cause for the FII net investments in the country, a departure from prior periods where it was the contrary. Thus, the post-Asian crisis can be viewed as the period wherein the there was a pull effect on the FII investments in the country.

Period 2004–2007

The period post-2004 can be seen as a consolidation of the years 2003–2004 with FIIs increasing in numbers and investing more and more in the country. Thus, as can be seen from Annexure 1, the BSE Sensex started crossing historical levels during this phase with historical levels also being witnessed in the FII flows being received by the country. This period saw the housing market bubble in the US and the subsequent sub-prime crisis, another factor that might have spurred on more investment flows into the country by foreign investors. A causality study of data for sensex returns and FII investments shows that both varia-

bles are independent of each other, that is, there is no causation between them.

Linkage of Macroeconomic Variables—Exchange Rate and IIP with FII Flows

The FII net investment data that were used for the study were tested for normality and hence, it was required to be transformed to its log to allow for a regression to be run using the same. As can be seen from Annexure 9, the transformed FII_Net (that is, log_fiinet) was found to be normal as per the quantile-quantile (QQ) plots as well as the Kolmogorov–Smirnova (K–S) test of normality. Additionally, the time series data being used as part of the model need to be tested for the presence of unit root, that is, whether they are stationary or not, which is a prerequisite of the Granger causality test (Refer Annexure 10). The result of the regression as seen in Annexure 11 was as follows:

$$\text{log\_fiinet} = -0.924*\text{dollarrupee\_rate\_1} + 0.001*\text{iip\_1} + 7.035$$

The results show that the coefficient of the rupeedollar_rate_1 is statistically significant, while the coefficient of iip_1 is insignificant. Hence, rupee–dollar rates can be stated to have a significant impact on the FII, and every increase in the rate would lead to a negative impact on the FII flows. Based on this significance, we can try to understand whether the rupee–dollar rates actually lead to FII flows into and out of the country. A study of the correlation between the two variables further confirms that they are interrelated as there is a significant negative correlation of –0.336 between the two, as can be seen from Annexure 12. The insignificance of the relationship between IIP data and FII flow could be due to the period under consideration. In general terms and based on literature review, economic growth is found to have driven the FII flows into the country.

Causality between rupeedollar_rate_1 and log_fiinet

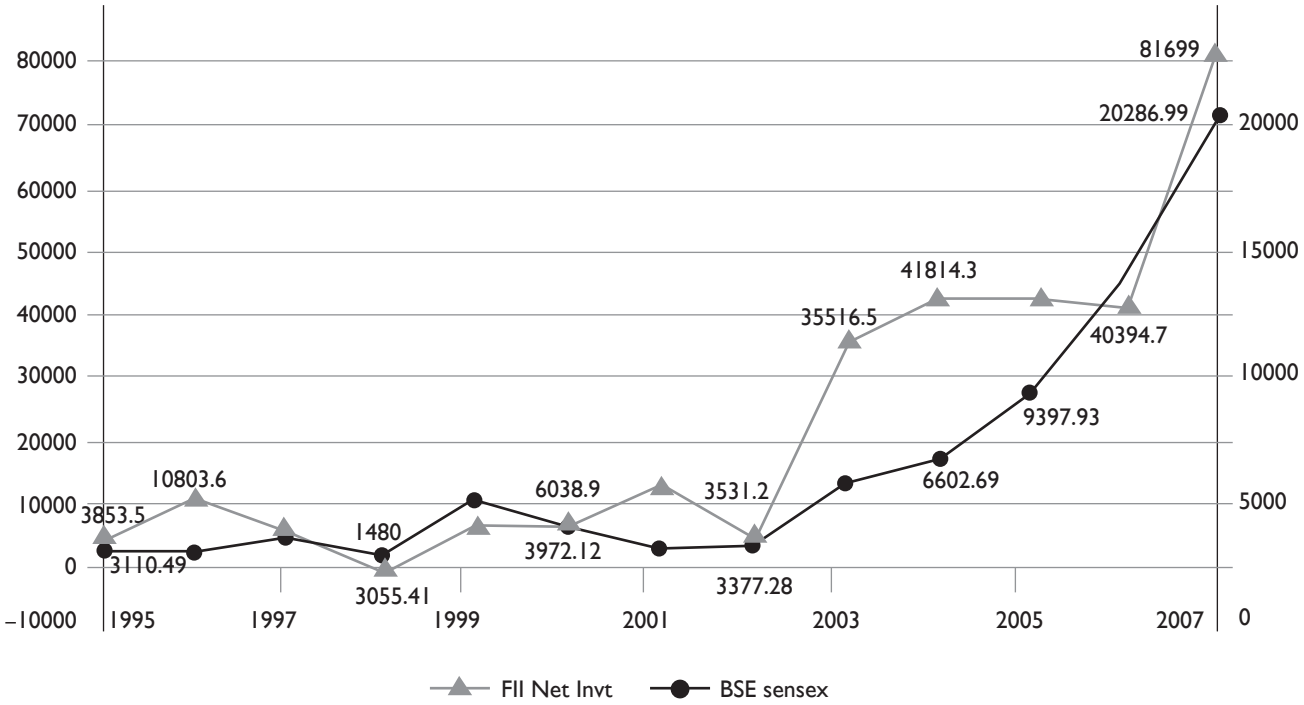
A granger causality study was administered on the two variables, log_fiinet and rupeedollar_rate_1, and the results are displayed in Annexure 13. The results show that the null hypothesis, log_fiinet does not Granger Cause rupeedollar_rate_1, can be rejected, whereas rupeedollar_rate_1 does not Granger Cause log_fiinet cannot be rejected. Thus, the FII flows actually cause the rupee–dollar rates to rise or fall. Thus, the government needs to monitor the FII flows into the country as these flows are extremely volatile, and the exchange rates could be adversely impacted leading to impact on the exports and thereby the trade balance of the country.

Conclusions and Recommendations

The sensex returns are seen to be impacted positively by the FII flows, with the data revealing an increase of 0.389 in returns with a positive net FII flow of ₹10 million. The analysis of the data reveals that FII activity does have an impact on the index returns if broken into phases. This data show that during the pre and post-Asian crisis periods, the stock market returns were driven by the FII flows into the country, while during the initial phase of the 2000s, sensex returns were leading FIIs into the country's stock markets. The study also reveals that the exchange rate (rupee–dollar rates) has a significant impact on the FII and every increase in the rate would lead to a negative impact of 0.338 on the FII flows, other factors held constant. However, causality studies between the exchange rate and the rupee–dollar rates reveal that the FII flows actually cause the exchange rate, that is, the rupee–dollar rates to rise or fall, while the rupee–dollar rates do not seem to have a similar reverse impact on the FII flows. The IIP data, however, do not have a significant impact on determining the quantum of flows into the country or vice versa.

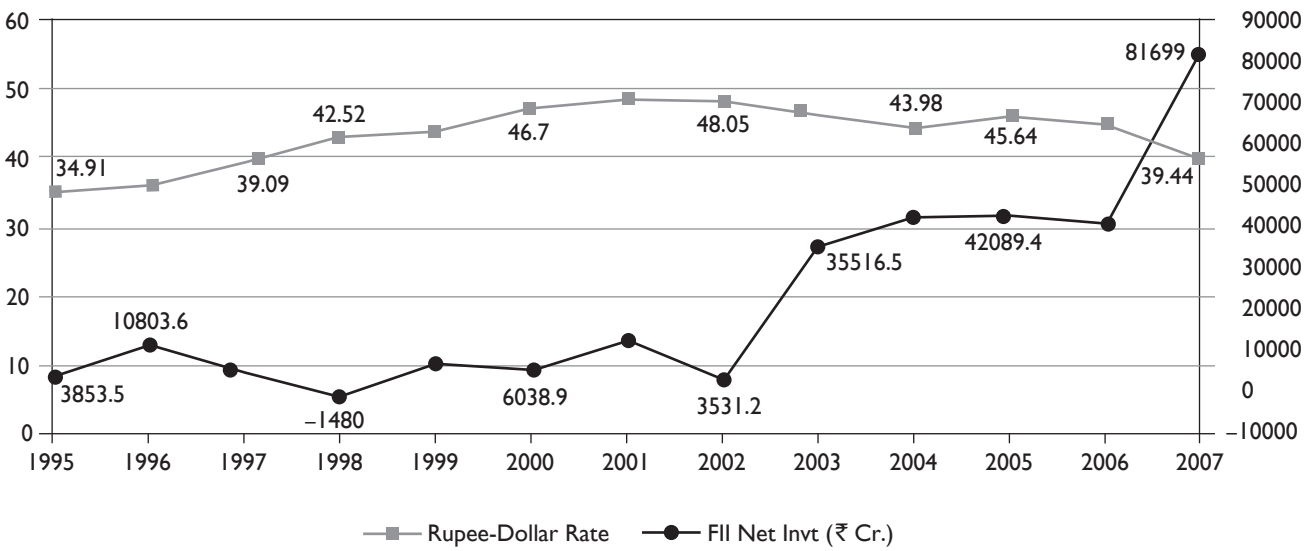
Annexure

Annexure 1. BSE Sensex and FII Activity (1995–2007)



Source: CMIE (Business Beacon).

Annexure 2. Rupee–Dollar Rates and FII Activity (1995–2007)



Source: CMIE (Business Beacon).

Annexure 3. Unit Root Tests

i. Sen_Ret and FII_Net: Correlogram analysis

Sample: 1995:01 2007:12
Included observations: 155

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	–0.018	–0.018	0.0490	0.825
.|* |	.|* |	2	0.165	0.165	4.3728	0.112
*|. |	*|. |	3	–0.070	–0.067	5.1660	0.160
.|. |	.|. |	4	–0.027	–0.057	5.2846	0.259
.|. |	.|. |	5	–0.032	–0.010	5.4473	0.364
.|* |	.|* |	6	0.094	0.107	6.8947	0.331
*|. |	*|. |	7	–0.102	–0.104	8.6185	0.281
.|. |	*|. |	8	–0.043	–0.088	8.9317	0.348
.|. |	.|* |	9	0.027	0.079	9.0552	0.432
.|* |	.|* |	10	0.095	0.125	10.585	0.391
.|. |	.|. |	11	0.020	–0.017	10.655	0.473
.|* |	.|. |	12	0.087	0.034	11.941	0.450
.|. |	.|. |	13	0.013	0.058	11.968	0.530
.|. |	.|. |	14	–0.007	–0.011	11.978	0.608
.|. |	.|. |	15	0.010	–0.021	11.997	0.679
*|. |	*|. |	16	–0.082	–0.089	13.172	0.660
.|. |	.|. |	17	–0.003	0.032	13.174	0.724
.|. |	.|. |	18	–0.020	0.012	13.246	0.777
.|. |	*|. |	19	–0.057	–0.087	13.832	0.793
.|. |	.|. |	20	–0.008	–0.013	13.844	0.838
.|. |	.|* |	21	0.035	0.067	14.070	0.867
.|. |	.|. |	22	0.016	0.014	14.114	0.897
.|* |	.|* |	23	0.182	0.139	20.215	0.629
.|* |	.|* |	24	0.127	0.134	23.208	0.508
.|* |	.|* |	25	0.084	0.067	24.541	0.488
*|. |	*|. |	26	–0.058	–0.088	25.177	0.509
*|. |	*|. |	27	–0.106	–0.142	27.297	0.448
*|. |	.|. |	28	–0.080	–0.016	28.536	0.436
.|. |	.|* |	29	0.037	0.080	28.794	0.476
.|. |	.|. |	30	–0.025	–0.039	28.918	0.522
.|. |	.|. |	31	0.041	0.033	29.251	0.556
.|. |	.|. |	32	–0.009	0.049	29.268	0.606
.|* |	.|* |	33	0.104	0.089	31.442	0.545
.|. |	.|. |	34	0.023	–0.048	31.552	0.588
.|* |	.|. |	35	0.111	0.006	34.051	0.514
*|. |	.|. |	36	–0.075	–0.043	35.188	0.507

(Annexure 3 continued)

(Annexure 3 continued)

Sample: 1995:01 2007:12
Included observations: 156

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|* |	.|* |	1	0.101	0.101	1.6201	0.203
.|* |	.|* |	2	0.155	0.146	5.4661	0.065
.|*** |	.|*** |	3	0.364	0.346	26.753	0.000
.|. |	*|. |	4	–0.041	–0.126	27.030	0.000
.|** |	.|* |	5	0.227	0.167	35.409	0.000
.|* |	.|. |	6	0.116	–0.023	37.608	0.000
.|* |	.|** |	7	0.153	0.203	41.500	0.000
.|** |	.|* |	8	0.241	0.076	51.186	0.000
.|. |	.|. |	9	0.056	0.018	51.707	0.000
.|* |	*|. |	10	0.079	–0.105	52.771	0.000
.|** |	.|* |	11	0.199	0.152	59.495	0.000
.|* |	.|* |	12	0.142	0.103	62.951	0.000
.|* |	.|* |	13	0.155	0.096	67.082	0.000
.|* |	*|. |	14	0.073	–0.144	68.009	0.000
.|* |	.|* |	15	0.148	0.086	71.835	0.000
.|* |	.|. |	16	0.097	–0.038	73.475	0.000
.|. |	.|. |	17	–0.008	0.002	73.486	0.000
.|. |	*|. |	18	0.039	–0.165	73.753	0.000
.|* |	.|* |	19	0.138	0.146	77.155	0.000
.|* |	.|. |	20	0.132	0.053	80.319	0.000
.|* |	.|* |	21	0.106	0.144	82.372	0.000
.|* |	.|. |	22	0.173	–0.007	87.871	0.000
.|. |	.|. |	23	0.054	–0.038	88.421	0.000
.|* |	.|. |	24	0.116	0.005	90.939	0.000
.|* |	.|* |	25	0.101	0.099	92.858	0.000
.|. |	.|. |	26	0.052	–0.022	93.372	0.000
.|* |	*|. |	27	0.096	–0.088	95.117	0.000
.|* |	.|. |	28	0.078	–0.017	96.294	0.000
.|. |	.|. |	29	0.024	0.026	96.408	0.000
.|. |	.|. |	30	0.040	0.001	96.723	0.000
.|** |	.|** |	31	0.218	0.204	106.13	0.000
.|* |	.|. |	32	0.108	–0.001	108.45	0.000
.|. |	*|. |	33	0.043	–0.068	108.82	0.000
.|* |	.|. |	34	0.159	–0.014	113.91	0.000
.|* |	.|* |	35	0.076	0.072	115.09	0.000
.|. |	.|. |	36	0.037	–0.051	115.36	0.000

ii. Unit root test

Sen_Ret

Test	Null Hypothesis	Test Statistic	Critical Value (1%)	Result
Augmented Dickey–Fuller test	Non-stationary	–12.57557	–3.473096	Stationary
Phillips–Perron test	Non-stationary	–12.57557	–3.473096	Stationary
Kwiatkowski–Phillips–Schmidt–Shin test	Stationary	0.528261	0.739	Stationary

FII_ Net

Test	Null Hypothesis	Test Statistic	Critical Value (1%)	Result
Augmented Dickey–Fuller Test	Non-stationary	–3.682084	–3.473382	Stationary
Phillips–Perron test	Non-stationary	–11.70678	–3.472813	Stationary
Kwiatkowski–Phillips–Schmidt–Shin test	Stationary	1.307753	0.739	Non-stationary

Source: CMIE (Business Beacon).

Annexure 4. Test for Assumptions of OLS

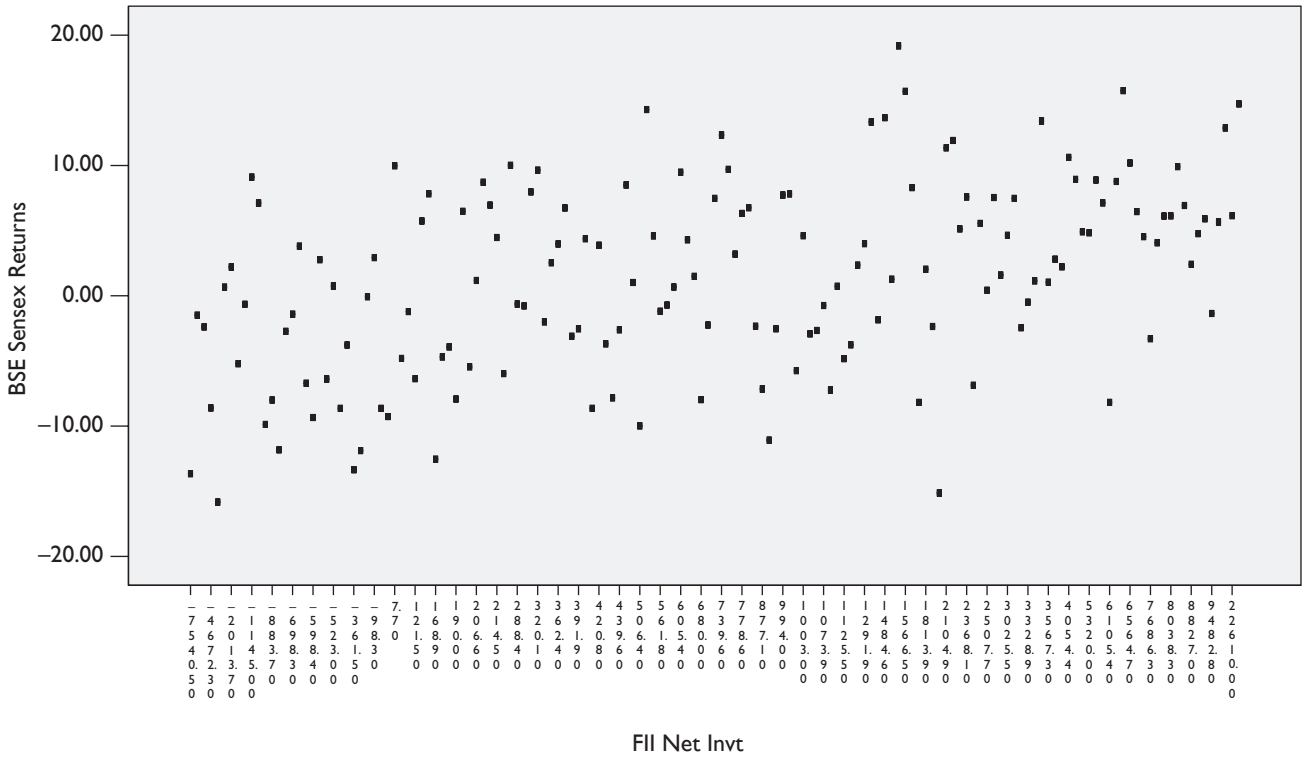
i) Normality of dependant variable (Sen_Ret)

Tests of Normality

	Kolmogorov–Smirnov[a]			Shapiro–Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
BSE Sensex Returns	.064	155	.200*	.990	155	.348

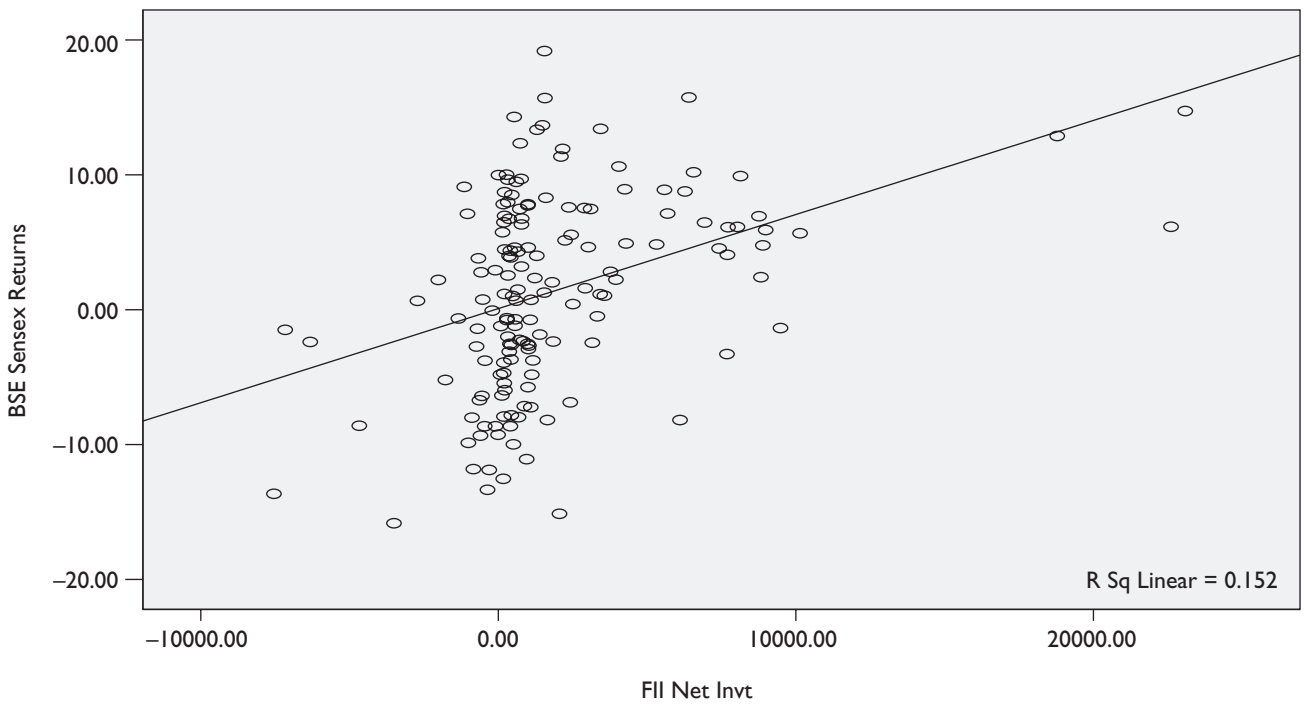
Notes: *This is a lower bound of the true significance.
[a]Lilliefors Significance Correction.

ii) Test of homogeneity of variance



Source: CMIE (Business Beacon).

Annexure 5. Scatter Plot



Source: CMIE (Business Beacon).

Annexure 6. Regression Results

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.389[a]	.152	.146	6.69020

ANOVA[c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1222.827	1	1222.827	27.320	.000[a]
	Residual	6848.096	153	44.759		
	Total	8070.923	154			

Coefficients[b]

		Unstandardised Coefficients		Standardised Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	.081	.592		.136	.892
	FII Net Invt	.001	.000	.389	5.227	.000

Source: CMIE (Business Beacon).
Notes: [a]Predictors: (Constant), FII Net Invt.
[b]Dependent Variable: BSE Sensex Returns.

Annexure 7. Correlation Results

Correlations

		FII Net Invt	BSE Sensex Returns
FII Net Invt	Pearson Correlation	1	.389 **
	Sig. (2-tailed)		.000
	N	156	155
BSE Sensex Returns	Pearson Correlation	.389**	1
	Sig. (2-tailed)	.000	
	N	155	155

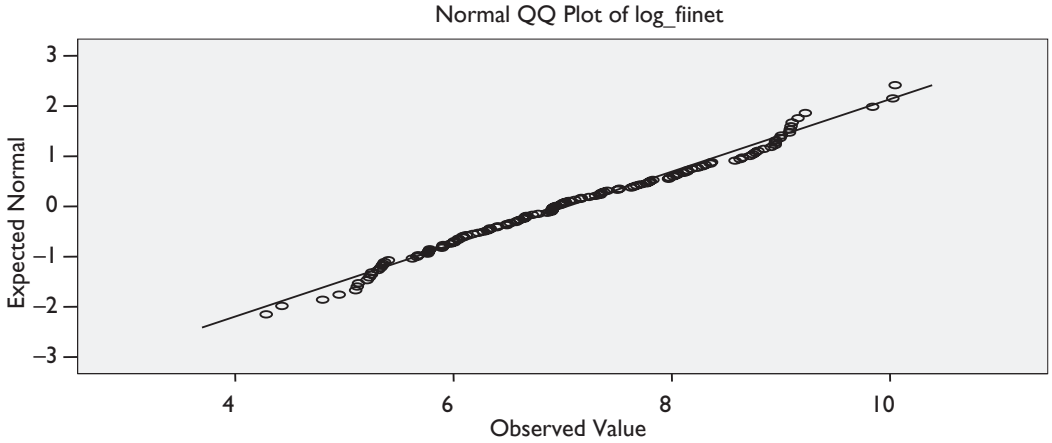
Source: CMIE (Business Beacon).
Note: **Correlation is significant at the 0.01 level (2-tailed).

Annexure 8. Pair-wise Granger Causality Tests

	Sample - F Statistic in [ ], Prob in ( )				
Null Hypothesis	1995:01 2007:12	1995:01 1996:12*	1997:01 1999:12	2000:01 2004:12	2005:01 2007:12
SENSEX_RETURNS does not Granger Cause FII_NET	[0.71714] (0.48983)	[0.75946] (0.48406)	[1.72753] (0.19613)	[2.76661] (0.07214)	[0.28294] (0.75569)
FII_NET does not Granger Cause SENSEX_RETURNS	[0.11901] (0.88789)	[2.98297] (0.07924)	[6.14828] (0.00612)	[1.56762] (0.21824)	[0.06636] (0.93594)

Source: CMIE (Business Beacon).
Note: *Causality using first difference of FII_Net, as FII_Net for the period 1995:01 to 1996:12 was found to be I(1).

Annexure 9. Normality Test of the Dependent Variable—FII_Net



Tests of Normality

	Kolmogorov–Smirnov[a]			Shapiro–Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
log_fiinet	.049	126	.200*	.981	126	.069

Source: CMIE (Business Beacon).
Notes: *This is a lower bound of the true significance.
[a]Lilliefors Significance Correction.

Annexure 10. Stationarity Tests

i. Correlogram analysis for rupeedollar_rate_1, iip_1 and FII_Net

Sample: 1995:01 2007:12
Included observations: 154

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|** |	.|** |	1	0.321	0.321	16.166	0.000
.|. |	*|. |	2	0.040	–0.070	16.418	0.000
.|* |	.|* |	3	0.112	0.135	18.411	0.000
.|. |	*|. |	4	0.013	–0.075	18.438	0.001
.|. |	.|* |	5	0.032	0.067	18.599	0.002
.|* |	.|* |	6	0.112	0.075	20.620	0.002
.|* |	.|. |	7	0.111	0.066	22.622	0.002
.|* |	.|* |	8	0.131	0.086	25.436	0.001
.|. |	.|. |	9	0.047	–0.041	25.800	0.002
.|. |	.|. |	10	–0.020	–0.027	25.870	0.004
.|. |	.|. |	11	–0.036	–0.048	26.089	0.006
.|. |	.|. |	12	–0.048	–0.034	26.485	0.009
.|. |	.|. |	13	0.021	0.043	26.563	0.014
.|. |	.|. |	14	0.034	–0.008	26.763	0.021
.|* |	.|* |	15	0.084	0.087	27.991	0.022
.|* |	.|. |	16	0.099	0.036	29.681	0.020
.|. |	*|. |	17	–0.033	–0.070	29.869	0.027
*|. |	*|. |	18	–0.095	–0.062	31.472	0.025
.|. |	.|. |	19	–0.036	0.004	31.707	0.034

Sample: 1995:01 2007:12
Included observations: 154

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
*|. |	*|. |	20	–0.086	–0.079	33.038	0.033
.|. |	.|. |	21	–0.023	0.027	33.130	0.045
.|* |	.|* |	22	0.114	0.095	35.505	0.034
.|* |	.|* |	23	0.151	0.109	39.707	0.017
.|. |	.|. |	24	0.045	–0.029	40.078	0.021
.|* |	.|* |	25	0.076	0.108	41.168	0.022
.|* |	.|. |	26	0.073	0.036	42.173	0.024
.|. |	.|. |	27	0.033	0.029	42.379	0.030
.|* |	.|. |	28	0.075	0.042	43.451	0.031
.|* |	.|. |	29	0.118	0.039	46.135	0.023
.|* |	.|. |	30	0.107	0.015	48.343	0.018
.|* |	.|. |	31	0.075	–0.017	49.456	0.019
.|* |	.|. |	32	0.079	0.043	50.698	0.019
.|. |	.|. |	33	0.060	0.032	51.422	0.021
.|. |	.|. |	34	0.018	–0.008	51.486	0.028
.|. |	*|. |	35	–0.047	–0.079	51.931	0.033
.|. |	.|. |	36	–0.013	–0.005	51.963	0.041

Note: *The rupee–dollar rates were found to be I(1). Hence, the first difference of rupee–dollar rate, that is, rupeedollar_rate_1 was used and it was found to be stationary.

Sample: 1995:01 2007:12
Included observations: 154

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
******|. |	******|. |	1	–0.747	–0.747	87.539	0.000
.|** |	****|. |	2	0.310	–0.559	102.74	0.000
.|. |	**|. |	3	–0.010	–0.218	102.75	0.000
*|. |	.|. |	4	–0.065	0.041	103.42	0.000
.|. |	*|. |	5	–0.011	–0.066	103.44	0.000
.|. |	*|. |	6	0.058	–0.153	104.00	0.000
.|. |	.|. |	7	–0.010	0.021	104.01	0.000
*|. |	.|. |	8	–0.080	–0.023	105.06	0.000
.|. |	**|. |	9	0.028	–0.361	105.19	0.000
.|** |	.|** |	10	0.214	0.232	112.79	0.000
****|. |	****|. |	11	–0.556	–0.492	164.76	0.000
.|****** |	.|. |	12	0.739	–0.030	257.06	0.000
****|. |	.|** |	13	–0.551	0.286	308.87	0.000
.|** |	.|* |	14	0.212	0.147	316.55	0.000
.|. |	.|** |	15	0.055	0.199	317.07	0.000
*|. |	.|. |	16	–0.141	–0.049	320.55	0.000
.|* |	*|. |	17	0.074	–0.073	321.51	0.000
.|. |	*|. |	18	–0.009	–0.080	321.53	0.000

(Annexure 10 continued)

(Annexure 10 continued)

Sample: 1995:01 2007:12
Included observations: 154

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	*|. |	19	0.022	–0.120	321.61	0.000
*|. |	.|. |	20	–0.077	–0.010	322.69	0.000
.|. |	.|. |	21	0.025	–0.042	322.80	0.000
.|* |	.|* |	22	0.182	0.090	328.82	0.000
***|. |	*|. |	23	–0.485	–0.149	372.00	0.000
.|***** |	.|. |	24	0.658	0.025	452.04	0.000
***|. |	.|** |	25	–0.492	0.198	497.10	0.000
.|* |	.|* |	26	0.186	0.182	503.62	0.000
.|. |	*|. |	27	0.030	–0.138	503.80	0.000
*|. |	*|. |	28	–0.088	–0.103	505.26	0.000
.|. |	.|. |	29	0.035	–0.009	505.49	0.000
.|. |	.|. |	30	0.014	0.049	505.53	0.000
.|. |	*|. |	31	–0.014	–0.088	505.57	0.000
.|. |	.|. |	32	–0.017	0.006	505.62	0.000
.|. |	.|. |	33	–0.029	0.060	505.80	0.000
.|* |	.|. |	34	0.194	0.024	513.30	0.000
**|. |	.|. |	35	–0.436	–0.035	551.72	0.000
.|**** |	.|. |	36	0.564	–0.037	616.57	0.000

Note: * The IIP data was found to be I(2) and hence, the second difference of IIP, that is, IIP_I was used which was found to be stationary.

Sample: 1995:01 2007:12
Included observations: 126

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|**** |	.|**** |	1	0.487	0.487	30.594	0.000
.|**** |	.|** |	2	0.479	0.318	60.489	0.000
.|*** |	.|* |	3	0.437	0.180	85.560	0.000
.|*** |	.|* |	4	0.384	0.079	105.06	0.000
.|*** |	.|* |	5	0.426	0.162	129.19	0.000
.|*** |	.|* |	6	0.417	0.127	152.60	0.000
.|*** |	.|. |	7	0.341	–0.018	168.33	0.000
.|*** |	.|. |	8	0.349	0.034	185.01	0.000
.|*** |	.|. |	9	0.340	0.054	200.90	0.000
.|** |	*|. |	10	0.239	–0.105	208.85	0.000
.|** |	.|* |	11	0.312	0.068	222.50	0.000
.|** |	.|. |	12	0.261	0.007	232.16	0.000
.|** |	.|. |	13	0.250	0.003	241.05	0.000
.|** |	.|. |	14	0.245	–0.004	249.67	0.000
.|** |	.|. |	15	0.249	0.059	258.71	0.000
.|** |	.|. |	16	0.225	0.012	266.16	0.000

Sample: 1995:01 2007:12
Included observations: 126

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|* |	*|. |	17	0.192	–0.059	271.62	0.000
.|** |	.|. |	18	0.221	0.058	278.92	0.000
.|* |	.|. |	19	0.168	–0.028	283.20	0.000
.|** |	.|. |	20	0.219	0.044	290.53	0.000
.|* |	.|. |	21	0.185	0.005	295.78	0.000
.|** |	.|* |	22	0.260	0.140	306.27	0.000
.|* |	.|. |	23	0.191	–0.038	311.97	0.000
.|** |	.|. |	24	0.202	0.001	318.45	0.000
.|* |	*|. |	25	0.130	–0.081	321.17	0.000
.|* |	.|. |	26	0.169	0.024	325.79	0.000
.|* |	.|. |	27	0.148	–0.043	329.34	0.000
.|* |	.|. |	28	0.134	–0.017	332.30	0.000
.|* |	.|. |	29	0.147	0.008	335.89	0.000
.|* |	.|. |	30	0.124	0.004	338.47	0.000
.|* |	.|. |	31	0.150	0.035	342.29	0.000
.|* |	.|* |	32	0.174	0.104	347.46	0.000
.|* |	.|. |	33	0.153	–0.001	351.54	0.000
.|* |	.|. |	34	0.173	0.054	356.78	0.000
.|* |	.|. |	35	0.143	–0.036	360.40	0.000
.|* |	*|. |	36	0.074	–0.105	361.38	0.000

Note: * Although the above correlogram of log_fiinet seems to be non-stationary, the unit root tests showed that log_fiinet is a stationary time series.

ii. Unit root tests

Rupeedollar_rate_l				
Test	Null Hypothesis	Test Statistic	Critical Value (1%)	Result
Augmented Dickey–Fuller test	Non-stationary	–9.481678	–4.019151	Stationary
Phillips–Perron test	Non-stationary	–9.290595	–4.019151	Stationary
Kwiatkowski–Phillips–Schmidt–Shin test	Stationary	0.057621	0.216	Stationary

iip_l				
Test	Null Hypothesis	Test Statistic	Critical Value (1%)	Result
Augmented Dickey–Fuller test	Non-stationary	–9.70475	–4.024935	Stationary
Phillips–Perron test	Non-stationary	–220.338	–4.019151	Stationary
Kwiatkowski–Phillips–Schmidt–Shin test	Stationary	0.208322	0.216	Stationary

log_fiinet				
Test	Null Hypothesis	Test Statistic	Critical Value (1%)	Result
Augmented Dickey–Fuller test	Non-stationary	–6.451401	–4.046925	Stationary
Phillips–Perron test	Non-stationary	–6.544886	–4.046925	Stationary
Kwiatkowski–Phillips–Schmidt–Shin test	Stationary	0.183964	0.216	Stationary

Source: CMIE (Business Beacon).

Annexure 11. Regression Results

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.338[a]	.114	.099	1.30003	.902

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	26.145	2	13.072	7.735	.001[a]
	Residual	202.808	120	1.690		
	Total	228.953	122			

Coefficients[b]

		Unstandardised Coefficients		Standardised Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	7.035	.117		59.963	.000
	DIFF(RupeeDollar_Rate,1)	–.924	.235	–.338	–3.932	.000
	DIFF(IIP,2)	.001	.007	.009	.109	.914

Source: CMIE (Business Beacon).
Notes: [a]Predictors: (Constant), DIFF(IIP,2), DIFF(RuppeDollar_Rate,1).
[b]Dependent Variable: log_fiinet.

Annexure 12. Correlation Study

Correlations

		DIFF(RupeeDollar_Rate,1)	DIFF(IIP,2)	log_fiinet
DIFF(RupeeDollar_	Pearson Correlation	1	.072	–.336**
Rate,1)	Sig. (2-tailed)		.375	.000
	N	154	153	124
DIFF(IIP,2)	Pearson Correlation	.072	1	.009
	Sig. (2-tailed)	.375		.917
	N	153	154	124
log_fiinet	Pearson Correlation	–.336 **	.009	1
	Sig. (2-tailed)	.000	.917	
	N	124	124	126

Source: CMIE (Business Beacon).
Note: ** Correlation is significant at the 0.01 level (2-tailed).

Annexure 13. Granger Causality Study: rupeedollar_rate_1 and log_fiinet

Null Hypothesis	Obs	F-statistic	Probability
LOG_FIINET does not Granger Cause RUPEEDOLLAR_RATE_1	91	5.3442	0.00649
RUPEEDOLLAR_RATE_1 does not Granger Cause LOG_FIINET		0.91059	0.40613

Source: CMIE (Business Beacon).

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