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Dynamic Interactions between Foreign Institutional Investment Flows and Stock Market Returns – The Case of India

Hemantkumar P. Bulsara¹, Vaishali Samir Dhingra¹, Shailesh Gandhi²

ABSTRACT

There has been a marked increase in the magnitude of Foreign Institutional Investments (FIIs) into India since the 1990s, resulting in increased forex reserves and liquidity and a higher-valued Indian capital market. However, such investment is more volatile than other types of flows, causing disruptive effects in the form of sudden stops (for example, the crash of the Indian stock market on January 21, 2008). This study empirically examines the dynamic relationship between FIIs and Indian stock market returns. It also analyses the effects of FIIs on Indian capital market returns, using data from January, 2004 through September, 2012. The analysis employs a Cross Correlation Function (CCF) approach, a Granger Causality Test and Vector Auto Regression after dividing the data into two parts: Pre Global financial crisis and Post Global financial crisis periods. The results of the CCF suggest bi-directional causality between FIIs and Nifty returns, whereas the Granger Causality Test and the VAR analysis suggest uni-directional causality running Nifty returns to FIIs.

KEY WORDS: Foreign Institutional Investment, Indian stock market, Cross Correlation Function approach, Granger Causality test, Vector Auto Regression

JEL Classification: C580, F410, G100, G230

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Introduction

India opened up its economy in the early 1990s following a major crisis led by a foreign exchange crunch that dragged the economy near default. Until 1991, India followed a restrictive policy towards Foreign Institutional Investments (FIIs) and Foreign Direct Investments (FDIs) – relying more heavily on bilat-

eral and multilateral pacts with long maturities. India has continued to be attractive to FIIs since 1993, when foreign institutional investors started investing in the Indian capital market. Additionally, the government supported FIIs by gradually loosening policy barriers. Statistics show that FIIs registered with SEBI increased from 492 in 1999 to 1,759 in 2012¹. FIIs help achieve a high degree of liquidity in stock markets and increase price-earning (PE) ratios. FIIs also improve the functioning of the stock market, as foreign institutional investors invest on the basis of well-researched strategies and realistic stock valuations. Foreign institutional investors are known to have highly competent

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analysts who possess domain expertise, voluminous information and high frequency data and have experience operating in varying economic and political environments. FIIs play a very important role in building up Forex Reserves, enabling various economic reforms. They have also given the country a respectable place in the global community. In the current scenario, approximately 30% of total market share is captured by FIIs. Annual average market capitalization increased from US\$ 12,719.9 billion in 1995 to US\$ 126,333.55 billion in 2012, which includes a remarkable percentage of shareholding by FIIs.

Derivatives trading commenced in India in June 2000 at National Stock Exchange (NSE). Derivatives are believed to perform various functions, of which future price discovery is seen as the most important. Individuals with better information and judgement are inclined to participate in this market to take advantage of such information asymmetry; the actions of participants swiftly feed this information into the market, causing changes in the prices of derivatives. Therefore, these markets indicate what is likely to happen and help improve price discovery. The empirical research carried out by Chan, Chan & Karolyi (1991), Antonios & Phil (1995), Choudhry (1997), Pericil & Koutmos (1997), Bollen (1995), Abhayankar (1998), Gulen & Mayhew (2000), Mckenzie, Brailsford & Faff (2001), Themozhi (2002), Shenbagaraman (2003), Hetam-saria & Swain (2003) and Mukherjee & Mishra (2006) suggest the existence of a lead-lag relationship between the derivatives market and the underlying spot market.

Attractive prospects in emerging market economies (EMEs), together with low interest rates in advanced economies, are likely to lead to continuing net capital inflows and exchange rate pressures in many emerging market economies. Along with some of the EMEs, such as Brazil, China and Korea, India has witnessed a greater preponderance of portfolio flows. According to the 2012 World Investment Report released by the United Nation's Conference on Trade and Development (UNCTAD), of 179 major global companies surveyed, India is the third most-preferred investment destination after China and the United States. Undoubtedly, the increasing presence of FIIs has affected securities trading and the transaction system, the nurturing of securities brokers and the liquidity of markets. They aid financial innovation and the de-

velopment of hedging instruments. They not only enhance competition in financial markets but improve the alignment between asset prices and fundamentals. At the same time, one cannot avoid the flip side of FIIs. Foreign capital is free, unpredictable and always on the lookout for higher profits. FIIs frequently move investments, and those swings can bring severe price fluctuations, resulting in increased volatility. In fact, FIIs bear significant responsibility for volatility in Indian markets. Increased investment from overseas may shift control of domestic firms to foreign hands. Foreign institutional investors play a major role in the derivatives market, as their investments, measured in rupees, greatly exceed those of domestic institutional investors. Their massive buying and selling activities create problems for small retail investors, whose fortunes are driven by the actions of large FIIs. The Japanese Asset Price Bubble (1990), the East Asia Financial Crisis (1997), the Russian Financial Crises (1998) and the Global Financial Crisis (2007-08) are a few examples of such adversity.

However, portfolio flows, which move in tandem with domestic and international market sentiment, are more volatile than other types of flows. Calvo (1998) showed that a sudden stop (Dornbusch, Goldfajn & Valdes, 1995) or sudden withdrawal is followed by a large capital inflow in the form of Foreign Portfolio Investment and later Calvo (1998) proposed an analytical framework to examine the impact of a sudden and largely unexpected cut-back in foreign capital inflows to emerging economies. Calvo (2009) noted that India might have undergone a "sudden stop" episode, with the onset of the global crisis. While the Indian market witnessed significant peaks in May 2006 and January 2008, corresponding declines occurred within 3 to 6 months of these peaks, confirming sudden episodic reversals. India received approximately US\$ 17.7 billion in equity investment inflows from FIIs during 2007, which turned into a disinvestment of US\$ 13.3 billion during the period 2008-09² — the result of massive deleveraging of US banks after the financial meltdown to meet the liquidity requirements of their principals in the US. The sudden withdrawal of FIIs from the Indian stock market caused a crash in the market in January 2008. How to safeguard the interests of individual inventors during periods of financial upheaval is thus a crucial question for policy makers. To determine and

delineate convulsions in FII flows and the behavior of the Indian stock market in reaction to these flows, this study examines dynamic interactions between FIIs and security returns. Issues such as the lead-lag relationship and causality have been extensively researched for mature markets. For emerging markets, particularly for India, however, such work is very limited. The inclusion of derivatives trading, particularly futures trading by FIIs, is a point of departure from previous research, as no attempt has yet been made to determine the impact of futures trading by FIIs on Indian capital markets. Once this relationship is established, decisions and actions by policy makers and small investors will be greatly facilitated. Situations of sudden stops cannot be fully avoided, but at least the adversity associated with these events can be reduced.

The paper is organized as follows: Section 2 summarizes the previous literature. The data, the sample period and the methodology used to examine dynamic interactions between stock market returns and foreign institutional investment are elaborated in section 3. The empirical results of the study are discussed in section 4. Section 5 summarizes the findings and derives the conclusion of the study.

Literature Review

Although many economies liberalized during the 1980s and 1990s, several studies have documented home-bias among foreign investors (Frankel, 1991). French and Poterba (1991) and Cooper and Kaplanis (1994) showed empirically that if equity returns are negatively correlated with inflation in the home country, investors with low levels of risk aversion tend to exhibit home-bias in their equity portfolios. Information asymmetry between domestic and foreign investors has been found by Gehrig (1993), Coval and Moskowitz (1999), Brennan and Cao (1997) and Kang and Stulz (1997) to be among the main factors driving home-bias. Foreigners face 'lemons' effects, as they are poorly informed and vulnerable to being overcharged in acquiring shares of domestic firms (Gordon & Bovenberg, 1996). Categorizing investors in the Korea Stock Exchange (KSE) into domestic individual investors, domestic institutional investors and foreign investors, Choe, Kho, and Stulz (2001) find that foreign institutions are at less of a disadvantage relative to domestic institutions than they are relative to domestic

individuals. Grinblatt and Keloharju (2000), in a study of the Finnish stock market, found foreign investors to be heavy momentum investors, i.e., buying past winning stocks and selling past losers. On the other hand, Finnish investors, particularly households, are contrarians - buying losers and selling winners. More generally, they find that Finnish investors in all categories are less sophisticated than foreign investors. Furthermore, in Thailand and Singapore, foreign investors are found not to be at an informational disadvantage but rather to possess superior information processing ability (Bailey, Mao, & Sirodom, 2007). Therefore, it is plausible that global institutional investors invest in acquiring information, owing to their resources, size, domain expertise, global experience and niche skills. Dvořák (2005) mediates these disagreements, finding that global investors lack local information but possess expertise.

Several researchers have shown that portfolio investment in an emerging market often gives rise to classic speculative bubbles. Foreign institutional investors pump capital into these markets, generating bubbles and increasing stock market volatility (Grabel, 1995). The process of liberalization, innovation, deregulation and globalization increases the volatility of capital markets. Foreign portfolio flows, which are unstable, act as an additional source of volatility (Claessens, Dooley & Warner 1995; Grabel, 1995), creating difficulties in the pricing of financial assets. On the constructive side, foreign portfolio flows increase the efficiency of capital markets (Clark & Berko, 1997). De Brouwer (1999) observes that the volatility of capital flows is unlikely to end: outflows were preceded by inflows, and most likely, they will be followed by inflows. The pattern of capital movements to emerging markets over the past 30 years or so has been one of ebb and flow rather than stasis.

Some observers, however, believe that the built-in volatility of capital flows, as demonstrated most starkly by "sudden stops" (Calvo & Reinhart, 2000), "hot money" (Stiglitz, 1999) and even capital flight, adversely affects the economy, especially during economic downturns in countries with small "absorptive capacity" and weak investor protections (Lemmon & Lins, 2003). It is possible that openness and integration could depress growth (Ferreira & Laux, 2009). Wang & Shen (1999) observed that FIIs, due to their

stabilizing and demonstration effects, positively affect local stock markets in host countries. With respect to stabilizing and demonstration effects, they argue that because FIIs in developing countries focus on stock fundamentals, their trading schemes tend to stabilize stock markets. In the long run, this strategy helps stock markets mature.

Momentum trading or the feedback trading hypothesis (Grinblatt & Keloharju, 2000) suggest that a shock to security returns leads to changes in capital inflows, causing further changes in security returns. They reported that foreign investors tend to be momentum investors, i.e., they tend to buy past winning stocks and sell past losers. Foreign institutional investors tend to exhibit return-chasing behavior, i.e., they buy when the market rises and sell when the market drops. This is destabilizing, as selling activities cause the capital market to sink further (Radelet & Sachs, 1998).

Chakrabarti (2001) states that flows are highly correlated with equity returns in India and that they are more likely to be an effect rather than a cause of such returns. These findings are in line with the findings of Mukherjee, Bose & Coondoo (2002), Rai & Bhanumurthy (2004), Ahmad, Ashraf & Ahmed (2005) and Kumar (2009). The dependence of net FII flows on daily returns in the domestic equity market at a day's lag is suggestive of foreign investors' return-chasing behavior; their decisions appear to be affected by the recent history of market returns and volatility. This casts them as feedback traders (Mukherjee *et al.*, 2002). Gordon & Gupta (2003) find a significant negative correlation between monthly flows and lagged returns and examine the determinants of FIIs in India, using a multivariate regression model. Griffin, Nardari & Stulz (2004) reveal that foreign flows are significant predictors of returns in Korea, Thailand, Taiwan and India, indicating that foreign investors buy before the market index increases. They also find that contemporaneous flows are positive and highly significant in India but fail to predict future values. The results of Ananthanarayanan, Krishnamurti & Sen (2009) are consistent with the base-broadening hypothesis; however, they do not find compelling confirmation of momentum strategies employed by foreign institutional investors and reject the claim that foreigners destabilize the market. Foreign investors have the ability to be market makers, given their voluminous investments (Babu & Prabheesh,

2008). Inoue (2008), supporting the findings of Griffin *et al.* (2002), finds unidirectional causality running from FIIs to stock returns only post-2003. Bansal & Pasricha (2009) find no impact of FIIs on Indian stock market average returns. Contrary to the above observation, Srinivasan & Kalaivani (2010) obtain evidence of negative feedback trading before the global financial crisis and positive feedback trading during the crisis period by foreign investors. Tayde & Rao (2011) suggest that FIIs exhibit herding and positive feedback trading while investing in India. Jain, Meena & Mathur (2012) show that FIIs influence movements of the Indian stock market significantly, with index value increases during inflows of FIIs and decreases during outflows. Kulshrestha (2014) supports the findings of Jain *et al.* (2012).

Data and Methodology

The data set comprises daily closing prices of the S&P CNX Nifty of the National Stock Exchange of India Ltd. and values of different FIIs-related series, viz. Futures Buy, Futures Sell, Futures OI, Inflow, Outflow and Net flow of long positions of FIIs in futures, short positions of FIIs in futures, Open interest of FIIs in futures, Gross inflows of FIIs in Indian capital markets, gross outflows from India and net flows for the period 1st January, 2004 through 30th September, 2012. The data related to daily FIIs and Nifty Closing prices are collected from the official websites of SEBI and NSE of India, respectively. India has an efficient and permanent system of capital controls (Patnaik & Shah, 2012). The Security Exchange Board of India (SEBI) compiles FIIs-related data on the basis of reports submitted by custodian banks, the National Stock Exchange of India (NSE) and the Bombay Stock Exchange of India (BSE). FIIs trading activities in index futures are included in the analysis, as their long and short positions in index futures clearly indicate how FIIs perceive the overall Indian economy, i.e., bullish or bearish. Weekends, Diwali holidays and bank holidays are excluded from the sample, due to unavailability of data. The first difference of the natural logarithm of daily stock index values is the daily, continuously compounded rate of return:

$$\Delta P = \ln\left(\frac{P_t}{P_{t-1}}\right) = \ln(P_t) - \ln(P_{t-1}) \quad (1)$$

Table 1. Chow Forecast Test: Forecast from February, 2008 to September, 2012

F-statistic	1.19898	Probability	0.001695
Log likelihood ratio	1870.22	Probability	0.000000

Due to globalization, the Indian economy has become more vulnerable to macro-economic changes around the world. Indian capital markets have witnessed many such events. Thus, we examine how the market has responded to various events. The dot.com bubble burst and subsequent recession in the USA, international oil shocks, volatile exchange rates, the sub-prime crisis and global economic meltdown and political uncertainties (including border tensions) are major events around which significant trend breaks can be identified. Furthermore, conventional unit root test results may be misleading in the presence of structural breaks. Therefore, two structural break tests are carried out, with one significant structural break found in the net flows of the FIIs series. The presence of a structural break is identified using Chow's Forecast Test in Table 1. The Chow forecast test is used to estimate two models—one employing the full set of data T and the other employing a long sub-period T_1 . The F-statistic is computed as:

$$F = \frac{(\tilde{u}\tilde{u} - \tilde{u}u)/T_2}{\tilde{u}u/(T_1 - k)} \quad (2)$$

where $\tilde{u}\tilde{u}$ is the residual sum of squares when the equation is fitted to all sample T observations, $\tilde{u}u$ is the residual sum of squares when the equation is fitted to T_1 observations, and k is the number of estimated coefficients. The log likelihood ratio statistic is based on a comparison of the restricted and unrestricted maximum of the (Gaussian) log likelihood function. Both restricted and unrestricted log likelihoods are obtained by estimating the regression using the whole sample.

Both forecast test statistics reject the null hypothesis of no structural change in the return series of the S&P CNX Nifty before and after 1st February, 2008, when the Global Recession began and many FIIs started leaving the Indian economy.

The CUSUM of squares test (Brown, Durbin & Evans, 1975) provides a plot of S_t (expected standard error

of regression) against t and a pair of 5 percent critical lines. As with the CUSUM test, movements outside the critical lines suggest parameter or variance instability.

The graph in Figure 1 indicates the presence of a structural break during the global financial crisis. Therefore, further analysis, applied to the whole sample period (January, 2004 - September, 2012) and to two sub-periods (from 1st January, 2004 to 31st January, 2008 (Phase 1) and from 1st February, 2008 to 30th September, 2012 (Phase 2)), is conducted.

Stationarity is examined by means of an autocorrelation function (correlogram) and a unit root test. The pioneering work on testing for unit roots in time series was performed by Dickey and Fuller (1979; 1981), and later, a non-parametric test was used by Phillips and Perron (1988) to check for the presence of a unit root in time series. The Nifty is stationary after the first log difference i.e., $I(1)$, but all FIIs-related series are $I(0)$ and show the presence of a significant trend. Therefore, the deterministic trend is removed by regressing the series against the time trend, and the residuals thereby obtained are used as a detrended FII series.

To establish a lead-lag relationship between two time series, Nifty and FII, Cross Correlation Functions (CCF) are estimated, as CCF can help identify lags of the independent variable that might be useful in predicting the dependent variable.

In this study, the Cross Correlation Function takes the following form:

$$\rho_{FII, NIFTY}(i) = \frac{\text{Cov}(NIFTY_t, FII_{t-i})}{\sigma_{FII} \sigma_{NIFTY}} \quad (3)$$

where the standard deviation of each sequence is assumed to be time-independent.

Granger Causality tests are used to determine causality between two variables. In the present study, a Granger Causality test is applied to the following pair of regression equations:

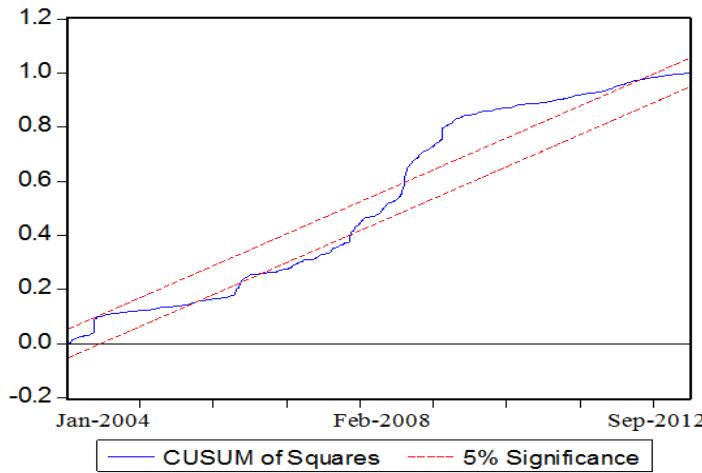


Figure 1. CUSUM Square Test Suggesting Variance Instability for Two Sub Time Periods and Structural Break

$$NIFTY_t = \sum_{i=1}^m \alpha_i NIFTY_{t-i} + \sum_{j=1}^m \beta_j FII_{t-j} + \lambda_1 t + \mu_{1t} \quad (4)$$

$$FII_t = \sum_{i=1}^m \gamma_i FII_{t-i} + \sum_{j=1}^m \delta_j NIFTY_{t-j} + \lambda_2 t + \mu_{2t} \quad (5)$$

where m is a suitably chosen positive integer; α_i , β_j , γ_i and $\delta_j = 0, 1, \dots, k$ are parameters; t is a time or trend variable; and it is assumed that μ_{1t} and μ_{2t} are uncorrelated disturbance terms with zero mean and finite variance. The equations are estimated for each type of FII flow and Nifty returns.

A vector auto-regression (VAR), as proposed by Sims (1980), is estimated to capture short-run causality between Nifty returns and FII investment. VAR is commonly used to make forecasts using systems of interrelated time series and to analyze the dynamic effects of random disturbances on systems of variables. In VAR modelling, the value of a variable is expressed as a linear function of past or lagged values of the variable and all other variables included in the model. Thus, all variables are regarded as endogenous. In estimating a VAR function, futures trading by FIIs are distinguished from gross investment and treated

separately along with the Nifty, but all positions of FIIs in the futures market are viewed as a whole system, enabling observation of their inter-relationships. In another system, the same procedure has been adopted for gross investment of FIIs in the Indian market.

The VAR equations can be formulated as:

$$NIFTY_t = A_1 + \sum_{j=1}^{j=p} B_j NIFTY_{t-j} + \sum_{j=1}^{j=p} C_j FII_{t-j} + u_{1t} \quad (6)$$

$$FII_t = A_2 + \sum_{j=1}^{j=p} D_j NIFTY_{t-j} + \sum_{j=1}^{j=p} E_j FII_{t-j} + u_{2t} \quad (7)$$

Empirical Analysis

The autocorrelation figures for daily index returns, daily trends of FIIs in the futures market and overall daily FII flows in different time periods are shown in Panels A, B and C of table 2. The autocorrelation coefficients for all underlying series have been computed up to 36 lags, but the results are shown only up to the 10th order, as the remaining coefficients follow the same pattern. The coefficients for the Nifty and Futures Buy series are significant up to the second or third lag, while the

remaining coefficients are non-significant. The serial correlations up to the third lag are significant for both series but are relatively small for the remaining lags. By contrast, all coefficients for the remaining series are statistically significant, as they fall outside the critical interval. This shows the presence of autocorrelation in all series considered.

Unit root tests can be used to confirm serial correlation or autocorrelation. Table 3 presents the results of an Augmented Dickey-Fuller Test and a Phillips-Perron Test to test for the presence of unit roots in the considered series. If the variables in the regression model are not stationary, the usual “*t* ratios” will not follow a *t* distribution and would thus be unsuitable for hypothesis tests of the regression parameters. The results show that the null hypothesis for both tests is rejected, so that the stationarity of all series is confirmed. As noted above, all FII series have been detrended. All trend coefficients are non-significant.

Correlations between Nifty and other types of FII flows are not large. However, Futures Buy is highly positively correlated with Futures Sell, and Inflow is highly positively correlated with Outflow, as seen in Panels A, B and C of table 4. This suggests that FII flows may be unstable, with higher or lower inflows associated with either Futures Flow or Aggregate flow have impact on outflows in the same direction. Furthermore, FIIs are short-lived in the economy and do not have stabilizing effects, although their effect in boosting liquidity cannot be denied.

Cross-correlations are estimated up to ten leads and lags, as shown in table 5. We observe a contemporaneous correlation or bidirectional lead-lag relationship between Nifty and FIIs, as both the lead and lag coefficients for FIIs are significant over the whole time period. In panel B, more lead coefficients than lag coefficients for FIIs are significant, and in panel C, only lead coefficients for FIIs are significant. In other words, the forecasting power of FII flows is found to be stronger than that of Nifty returns. This indicates that causality runs from FII to Nifty i.e., Nifty is affected by the flow of FII. Phase 2 clearly shows the turmoil caused by the sudden withdrawals or sudden stops of FII flows that occurred in India during the global crisis, as during that phase, only the lead coefficients for FIIs are significant.

The results of the Granger Causality Test, based on the bivariate VAR framework, are shown in table 6 of

Panels A, B and C. In Panel A, the null hypothesis, “**Nifty does not Granger Cause FII flows**”, is rejected for Futures Sell, Inflow, Outflow and Net Flow, which suggests that Nifty contains useful information regarding the aggregate flows of FII and FII involved in the Feedback Trading Process. In other words, FIIs are not market makers but return chasers. For Futures Buy and Futures OI, no causation is captured by any variable in panel A.

From Panel B, it can be inferred that there is no causal relationship between Nifty and Futures Buy or Futures Sell but that Futures OI significantly Granger causes Nifty. Bidirectional causal relationships are established between Nifty and Outflow and between Nifty and Net Flow.

In Panel C, all F-statistics used to test the null hypothesis, “**Nifty does not Granger Cause FII flow**”, are significant at the 5% level except that for Futures OI. Hence, it is shown that the Nifty return series contains information useful in predicting all kinds of FII flows and that FIIs tend to be return chasers or feedback traders.

Panels A, B and C of table 7 present the results of the Vector Auto Regression for the three periods. Relationships are established between Nifty and flow of FII in the Futures market and between Nifty and Aggregate FII flows, where each series is separately considered as a dependent variable (and the lags of the remaining series and the dependent variables are considered as independent variables). The R-squared values for all considered dependent variables are high except that for Nifty returns, strongly supporting the model. The results suggest that Nifty is better explained by its own lagged values, in particular, by its second lag (see Panels A, B and C). No other series (regressors) is found to significantly influence Nifty returns; hence, the R-squared values for these series are quite low.

Panel A of table 7 shows the interdependence of all FIIs Futures-related flows. All independent variables (including Nifty) are found to affect FIIs Futures-related dependent variables in the estimated VAR Model. The same is not true for aggregate flows of FIIs, as they are explained by Nifty returns. In addition to Nifty returns, only Outflow is explained by its own lagged values.

In Panel B, Futures Buy and Futures Sell are significantly affected by Futures Sell and Futures OI. Futures OI is found to depend on Futures Buy, Futures Sell and

Table 2. Autocorrelation Coefficients of Daily Index Returns, Daily Trends of FII in the Futures Market and Aggregate Daily FII Flows

Panel A:

Whole Sample (January-2004 to September-2012) (N=2121)							
Lag	Nifty	Futures Buy	Futures Sell	Futures OI	Inflow	Outflow	Net flow
1	0.051	0.447	0.68	0.96	0.599	0.677	0.414
2	-0.044	0.293	0.441	0.937	0.479	0.571	0.284
3	-0.009	0.153	0.244	0.918	0.444	0.521	0.267
4	-0.001	0.109	0.138	0.903	0.461	0.53	0.234
5	-0.025	0.074	0.072	0.888	0.453	0.521	0.225
6	-0.05	0.053	0.033	0.874	0.437	0.503	0.203
7	0.019	0.011	-0.006	0.862	0.396	0.471	0.16
8	0.049	0.005	-0.02	0.849	0.393	0.46	0.152
9	0.008	0.013	-0.026	0.838	0.388	0.47	0.134
10	0.037	-0.011	-0.024	0.828	0.407	0.467	0.18

Note: Asymptotic standard errors for the autocorrelation coefficients can be approximated as the square root of the reciprocal of the number of observations, that is, $(1/N)^{0.5}$ (i.e., 0.022 for 2,121 observations), and the confidence interval is 0 ± 1.96 (0.022), that is, -0.04256 to 0.04256.

Panel B:

Phase 1 (January-2004 to January-2008) (N=971)							
Lag	Nifty	Futures Buy	Futures Sell	Futures OI	Inflow	Outflow	Net flow
1	0.052	0.173	0.617	0.911	0.571	0.654	0.38
2	-0.074	0.101	0.363	0.85	0.504	0.534	0.266
3	-0.008	0.034	0.207	0.799	0.472	0.456	0.243
4	0.047	0.047	0.073	0.754	0.44	0.434	0.168
5	0.003	0.03	0.003	0.707	0.482	0.393	0.211
6	-0.066	0.022	-0.071	0.667	0.441	0.344	0.168
7	-0.034	-0.031	-0.149	0.633	0.384	0.329	0.106
8	-0.027	-0.037	-0.173	0.594	0.385	0.316	0.09
9	0.025	-0.012	-0.166	0.553	0.376	0.339	0.072
10	0.098	-0.055	-0.177	0.525	0.351	0.333	0.105

Note: Asymptotic standard errors for the autocorrelation coefficients for 971 observations are ± 0.0629

Table 2. Autocorrelation Coefficients of Daily Index Returns, Daily Trends of FII in the Futures Market and Aggregate Daily FII Flows (Continued)**Panel C:**

Phase 2 (February-2008 to September-2012) (N=1146)							
Lag	Nifty	Futures Buy	Futures Sell	Futures OI	Inflow	Outflow	Net flow
1	0.047	0.653	0.644	0.919	0.483	0.501	0.424
2	-0.023	0.388	0.391	0.873	0.295	0.332	0.295
3	-0.004	0.146	0.161	0.838	0.253	0.276	0.27
4	-0.036	0.03	0.055	0.809	0.297	0.31	0.253
5	-0.048	-0.033	-0.025	0.783	0.26	0.303	0.217
6	-0.044	-0.069	-0.06	0.755	0.238	0.251	0.19
7	0.045	-0.096	-0.086	0.733	0.194	0.219	0.168
8	0.091	-0.1	-0.097	0.706	0.188	0.211	0.168
9	0.01	-0.103	-0.104	0.685	0.182	0.207	0.151
10	0.005	-0.105	-0.085	0.665	0.221	0.21	0.212

Note: Asymptotic standard errors for the autocorrelation coefficients for 1146 observations are ± 0.0579

Table 3. Unit Root Test for Daily Index Returns, Daily Trends of FII in the Futures Market and Aggregate Daily FII Flows**Panel A:**

Whole Sample (January-2004 to September-2012) (N= 2121)							
Augmented Dickey-Fuller test statistic							
Variable	Nifty	Futures Buy	Futures Sell	Futures OI	Inflow	Outflow	Net flow
t-Statistic	-43.72*	-3.93*	-3.907*	-4.471*	-8.244*	-6.286*	-12.727*
Slope Coefficient	-0.949*	-0.185*	-0.135*	-0.027*	-0.177*	-0.122*	-0.364*
Intercept	0.001	17.134	12.149	16.245	-0.202	3.072	-1.466
Trend Coefficient	0.000	-0.015	-0.011	-0.014	0.002	-0.002	0.002
Phillips-Perron test statistic							
Variable	Nifty	Futures Buy	Futures Sell	Futures OI	Inflow	Outflow	Net flow
Adj. t-Statistic	-43.72*	-28.342*	-19.937*	-6.587*	-23.05*	-20.22*	-29.56*
Slope Coefficient	-0.949*	-0.551*	-0.317*	-0.040*	-0.401*	-0.323*	-0.586*
Intercept	0.001	-0.644	-1.273	13.095	1.778	2.387	-0.662
Trend Coefficient	0.000	0.002	0.002	-0.013	-0.001	-0.002	0.001

Table 3. Unit Root Test for Daily Index Returns, Daily Trends of FII in the Futures Market and Aggregate Daily FII Flows (Continued)

Panel B:

Phase 1 (January-2004 to January-2008) (N=974)							
Augmented Dickey-Fuller test statistic							
Variable	Nifty	Futures Buy	Futures Sell	Futures OI	Inflow	Outflow	Net flow
t-Statistic	-29.55*	-25.72*	-13.743*	-5.450*	-6.01*	-3.798*	-8.356*
Slope Coefficient	-0.948*	-0.816*	-0.340*	-0.066*	-0.19*	-0.122*	-0.369*
Intercept	0.000	-4.541	-9.956	-25.481	-10.40	-30.147	67.299
Trend Coefficient	0.000	0.011	0.028	0.063	0.019	0.072	-0.009
Phillips-Perron test statistic							
Variable	Nifty	Futures Buy	Futures Sell	Futures OI	Inflow	Outflow	Net flow
Adj. t-Statistic	-29.56*	-25.721*	-13.743*	-4.491*	-23.167*	-16.577*	-24.198*
Slope Coefficient	-0.948*	-0.816*	-0.340*	-0.066*	-0.429*	-0.325*	-0.603*
Intercept	0.000	-4.541	-9.956	-25.481	-2.518	-8.166	102.777*
Trend Coefficient	0.000	0.011	0.028	0.063	0.007	0.024	0.005

Panel C:

Phase 2 (February-2008 to September-2012) (N=1146)							
Augmented Dickey-Fuller test statistic							
Variable	Nifty	Futures Buy	Futures Sell	Futures OI	Inflow	Outflow	Net flow
t-Statistic	-32.295*	-3.789*	-15.377*	-5.231*	-9.887*	-8.743*	-10.49*
Slope Coefficient	-0.954*	-0.229*	-0.410*	-0.062*	-0.341*	-0.310*	-0.382*
Intercept	-0.001	462.29*	890.83*	900.68*	935.87*	852.056*	-10.631
Trend Coefficient	0.000	0.122	0.140	-0.036	0.025	-0.112	0.016
Phillips-Perron test statistic							
Variable	Nifty	Futures Buy	Futures Sell	Futures OI	Inflow	Outflow	Net flow
Adj. t-Statistic	-32.28*	-13.124*	-13.965*	-6.502*	-24.791*	-24.437*	-26.82*
Slope Coefficient	-0.954*	-0.340*	-0.351*	-0.083*	-0.515*	-0.506*	-0.576*
Intercept	-0.001	728.91*	743.17*	1243.47*	1433.74*	1399.71*	-4.148
Trend Coefficient	0.000	0.128	0.145	-0.103	0.007	-0.200	0.006

Note: Figures in parenthesis are Mackinnon one-sided p-values. The estimation procedure follows the Ordinary Least Square (OLS) method. The *t*-statistics of the slope coefficient follows the τ (tau) statistics. Critical values are -3.4119 and -3.1277 at the 5% and 10% significance levels, respectively.

* Significant at the 5% level.

Table 4. Correlation Matrix**Panel A:**

Variable	Nifty	Futures Buy	Futures Sell	Futures OI	Inflow	Outflow	Net flow
Nifty	1						
Futures Buy	0.016	1					
Futures Sell	-0.114	0.728	1				
Futures OI	-0.035	0.390	0.465	1			
Inflow	0.072	0.302	0.322	0.481	1		
Outflow	-0.126	0.364	0.460	0.577	0.784	1	
Net flow	0.289	-0.030	-0.131	-0.049	0.476	-0.163	1

Panel B:

Variable	Nifty	Futures Buy	Futures Sell	Futures OI	Inflow	Outflow	Net flow
Nifty	1						
Futures Buy	0.026	1					
Futures Sell	-0.196	0.464	1				
Futures OI	-0.097	0.224	0.395	1			
Inflow	0.003	0.166	0.214	0.304	1		
Outflow	-0.204	0.227	0.410	0.432	0.740	1	
Net flow	0.285	-0.080	-0.264	-0.169	0.382	-0.339	1

Panel C:

Variable	Nifty	Futures Buy	Futures Sell	Futures OI	Inflow	Outflow	Net flow
Nifty	1						
Futures Buy	0.001	1					
Futures Sell	-0.089	0.907	1				
Futures OI	-0.046	0.364	0.372	1			
Inflow	0.115	0.265	0.238	0.289	1		
Outflow	-0.116	0.317	0.361	0.353	0.727	1	
Net flow	0.292	0.025	-0.064	0.038	0.626	-0.055	1

Table 5. Cross Correlation between Nifty and Daily Trends of FII in the Futures Market and Aggregate Daily FII Flows**Panel A:**

Whole Sample (January-2004 to September-2012) (N= 2121)						
Lag <i>k</i>	Futures Buy	Futures Sell	Futures OI	Inflow	Outflow	Net Flow
-10	-0.016	-0.002	0.007	0.041	0.011	0.050*
-9	-0.048	-0.018	0.010	0.037	0.010	0.044
-8	-0.040	-0.021	-0.002	0.050	-0.006	0.085*
-7	-0.043	-0.027	-0.002	0.036	-0.019	0.082*
-6	-0.007	-0.017	0.004	0.024	-0.002	0.041
-5	-0.061*	-0.036	-0.005	0.007	-0.038	0.070*
-4	-0.051*	-0.036	-0.011	0.020	-0.033	0.078*
-3	-0.028	-0.040	-0.017	0.030	-0.050*	0.116*
-2	-0.023	-0.064*	-0.024	0.032	-0.054*	0.125*
-1	0.009	-0.130*	-0.026	0.071*	-0.117*	0.274*
0	0.016	-0.114*	-0.035	0.072*	-0.126*	0.289*
1	0.024	-0.010	-0.032	-0.012	-0.048	0.050*
2	0.025	0.024	-0.029	-0.003	-0.024	0.029
3	0.002	0.017	-0.019	0.004	-0.011	0.020
4	0.013	0.036	-0.014	-0.029	-0.030	-0.005
5	-0.012	-0.001	-0.015	-0.028	-0.027	-0.007
6	-0.004	0.007	-0.014	-0.006	-0.031	0.033
7	-0.023	-0.026	-0.017	-0.026	-0.046	0.024
8	0.005	-0.014	-0.018	-0.033	-0.043	0.008
9	0.008	-0.023	-0.021	-0.037	-0.048	0.009
10	-0.027	-0.020	-0.027	-0.014	-0.036	0.029

Note: Asymptotic standard errors for the cross correlation coefficients are ± 0.04256 .

Table 5. Cross Correlation between Nifty and Daily Trends of FII in the Futures Market and Aggregate Daily FII Flows (Continued)**Panel B:**

Phase 1 (January-2004 to January-2008) (N=974)						
Lag k	Futures Buy	Futures Sell	Futures OI	Inflow	Outflow	Net Flow
-10	-0.0225	-0.0505	-0.0448	-0.0424	-0.0596	0.0229
-9	0.0596	-0.0194	-0.036	-0.0391	-0.0553	0.0204
-8	0.0087	-0.0118	-0.0542	-0.0788*	-0.0728*	-0.0104
-7	-0.0275	-0.0086	-0.0733*	-0.0547	-0.056	0.0011
-6	-0.0106	0.0254	-0.0475	0.0147	-0.0195	0.048
-5	-0.0103	0.0274	-0.0546	-0.0226	-0.0128	-0.0141
-4	0.0259	0.0708*	-0.033	-0.0115	-0.0138	0.0032
-3	0.0097	0.0405	-0.0449	-0.0063	-0.0177	0.0158
-2	0.0235	0.0361	-0.0718*	0.0014	-0.0214	0.0319
-1	0.0419	-0.0039	-0.0747*	-0.0155	-0.0842*	0.096
0	0.0261	-0.196	-0.097*	0.0026	-0.2043*	0.2846*
1	-0.0435	-0.1311	-0.0867*	-0.0206	-0.1861*	0.2254*
2	-0.0182	-0.056	-0.0797*	-0.0116	-0.1164*	0.1437*
3	-0.0279	-0.0935*	-0.0782*	0.0418	-0.052	0.1302*
4	-0.0509	-0.0793*	-0.0622*	0.0192	-0.0463	0.0908*
5	-0.0635*	-0.0718*	-0.0339	-0.0048	-0.0381	0.0465
6	0.0422	-0.0246	-0.0214	0.0096	-0.0067	0.0234
7	-0.0316	-0.0241	-0.0152	0.0379	-0.0064	0.062
8	-0.0584	-0.0129	-0.0087	0.0439	0.0359	0.0128
9	-0.0748*	0.0044	0.0074	0.0325	0.0367	-0.0042
10	-0.0349	0.0005	0.0016	0.0416	0.0075	0.0482

Note: Asymptotic standard errors for the cross correlation coefficients are ± 0.0629

Table 5. Cross Correlation between Nifty and Daily Trends of FII in the Futures Market and Aggregate Daily FII Flows (Continued)

Panel C:

Phase 2 (February-2008 to September-2012) (N=1146)						
Lag <i>k</i>	Futures Buy	Futures Sell	Futures OI	Inflow	Outflow	Net Flow
-10	-0.046	-0.027	-0.047	-0.003	-0.031	0.028
-9	-0.052	-0.045	-0.040	-0.045	-0.079	0.020
-8	-0.003	-0.022	-0.027	-0.033	-0.050	0.008
-7	-0.014	-0.027	-0.009	-0.019	-0.053	0.030
-6	0.009	0.006	-0.013	-0.026	-0.058	0.023
-5	-0.007	-0.004	-0.020	-0.044	-0.047	-0.013
-4	0.010	0.031	-0.019	-0.043	-0.045	-0.016
-3	-0.009	0.004	-0.032	0.004	-0.021	0.024
-2	0.014	0.007	-0.047	-0.018	-0.052	0.028
-1	-0.003	-0.025	-0.054	-0.025	-0.056	0.026
0	0.001	-0.089*	-0.046	0.115*	-0.116*	0.292*
1	0.058*	-0.137*	-0.030	0.120*	-0.109*	0.293*
2	-0.029	-0.069*	-0.028	0.055	-0.035	0.114*
3	-0.039	-0.021	-0.017	0.026	-0.069*	0.111*
4	-0.063*	-0.029	-0.014	0.009	-0.059*	0.077*
5	-0.071*	-0.033	-0.007	0.003	-0.056	0.073*
6	-0.047	-0.005	0.006	0.008	-0.026	0.040
7	-0.042	-0.019	-0.003	0.044	-0.015	0.075*
8	0.001	0.007	-0.004	0.051	-0.030	0.101*
9	-0.015	-0.017	0.013	0.050	0.002	0.068*
10	0.011	0.004	0.008	0.042	-0.012	0.072*

Note: Asymptotic standard errors for the cross correlation coefficients are ± 0.0579 . The first column of the table represents the lag values of FII. Here, the correlation is for $(Nifty_t, FII_{t+k})$. Negative and positive values of *k* represent the lag values and lead values of FII-related series.

* Significant at the 5% level.

Table 6. Granger Causality Test Results**Panel A:**

Whole Sample (January-2004 to September-2012) (N= 2121)				
	Lag	Null Hypothesis	F-statistics	Prob.
Daily Trends of FII in Futures Market	1	Nifty does not Granger Cause Futures Buy	0.011	0.915
		Futures Buy does not Granger Cause Nifty	1.152	0.283
	2	Nifty does not Granger Cause Futures Buy	1.127	0.324
		Futures Buy does not Granger Cause Nifty	0.852	0.427
	1	Nifty does not Granger Cause Futures Sell	10.636	0.001*
		Futures Sell does not Granger Cause Nifty	0.030	0.863
	2	Nifty does not Granger Cause Futures Sell	6.101	0.002*
		Futures Sell does not Granger Cause Nifty	1.429	0.240
	1	Nifty does not Granger Cause Futures OI	1.496	0.221
		Futures OI does not Granger Cause Nifty	1.936	0.164
Aggregate Daily FII Flows	2	Nifty does not Granger Cause Futures OI	0.847	0.429
		Futures OI does not Granger Cause Nifty	1.062	0.346
	1	Nifty does not Granger Cause Inflow	2.483	0.115
		Inflow does not Granger Cause Nifty	0.516	0.473
	2	Nifty does not Granger Cause Inflow	3.036	0.048*
		Inflow does not Granger Cause Nifty	0.273	0.761
	1	Nifty does not Granger Cause Outflow	4.042	0.045*
		Outflow does not Granger Cause Nifty	3.661	0.056
	2	Nifty does not Granger Cause Outflow	6.083	0.002*
		Outflow does not Granger Cause Nifty	2.372	0.094
	1	Nifty does not Granger Cause Net Flow	68.109	0.000*
		Net Flow does not Granger Cause Nifty	2.858	0.091
	2	Nifty does not Granger Cause Net Flow	39.891	0.000*
		Net Flow does not Granger Cause Nifty	3.308	0.037

Table 6. Granger Causality Test Results (Continued)**Panel B:**

Phase 1 (January-2004 to January-2008) (N=974)				
	Lag	Null Hypothesis	F-statistics	Prob.
Daily Trends of FII in Futures Market	1	Nifty does not Granger Cause Futures Buy	2.824	0.093
		Futures Buy does not Granger Cause Nifty	1.525	0.217
	2	Nifty does not Granger Cause Futures Buy	1.688	0.185
		Futures Buy does not Granger Cause Nifty	0.764	0.466
	1	Nifty does not Granger Cause Futures Sell	0.208	0.649
		Futures Sell does not Granger Cause Nifty	0.021	0.884
	2	Nifty does not Granger Cause Futures Sell	0.306	0.736
		Futures Sell does not Granger Cause Nifty	0.573	0.564
	1	Nifty does not Granger Cause Futures OI	0.066	0.797
		Futures OI does not Granger Cause Nifty	5.008	0.025*
Aggregate Daily FII Flows	2	Nifty does not Granger Cause Futures OI	0.067	0.936
		Futures OI does not Granger Cause Nifty	3.138	0.044*
	1	Nifty does not Granger Cause Inflow	0.895	0.344
		Inflow does not Granger Cause Nifty	0.230	0.632
	2	Nifty does not Granger Cause Inflow	0.333	0.717
		Inflow does not Granger Cause Nifty	0.285	0.752
	1	Nifty does not Granger Cause Outflow	6.016	0.014*
		Outflow does not Granger Cause Nifty	5.692	0.017*
	2	Nifty does not Granger Cause Outflow	4.753	0.009*
		Outflow does not Granger Cause Nifty	4.753	0.009*
Net Flow	1	Nifty does not Granger Cause Net Flow	18.418	0.000*
		Net Flow does not Granger Cause Nifty	7.360	0.007*
	2	Nifty does not Granger Cause Net Flow	10.403	0.000*
		Net Flow does not Granger Cause Nifty	5.619	0.004*

Table 6. Granger Causality Test Results (Continued)**Panel C:**

Phase 2 (February-2008 to September-2012) (N=1146)				
	Lag	Null Hypothesis	F-statistics	Prob.
Daily Trends of FII in Futures Market	1	Nifty does not Granger Cause Futures Buy Futures Buy does not Granger Cause Nifty	6.860 0.005	0.009* 0.944
	2	Nifty does not Granger Cause Futures Buy Futures Buy does not Granger Cause Nifty	8.975 0.256	0.000* 0.774
	1	Nifty does not Granger Cause Futures Sell Futures Sell does not Granger Cause Nifty	12.303 0.481	0.000* 0.488
	2	Nifty does not Granger Cause Futures Sell Futures Sell does not Granger Cause Nifty	6.455 0.840	0.002* 0.432
	1	Nifty does not Granger Cause Futures OI Futures OI does not Granger Cause Nifty	1.112 2.946	0.292 0.086
	2	Nifty does not Granger Cause Futures OI Futures OI does not Granger Cause Nifty	0.746 1.555	0.475 0.212
	1	Nifty does not Granger Cause Inflow Inflow does not Granger Cause Nifty	6.479 0.990	0.011* 0.320
	2	Nifty does not Granger Cause Inflow Inflow does not Granger Cause Nifty	4.320 0.426	0.014* 0.653
Aggregate Daily FII Flows	1	Nifty does not Granger Cause Outflow Outflow does not Granger Cause Nifty	4.106 2.878	0.043 0.090
	2	Nifty does not Granger Cause Outflow Outflow does not Granger Cause Nifty	2.599 2.164	0.075* 0.115
	1	Nifty does not Granger Cause Net Flow Net Flow does not Granger Cause Nifty	46.344 0.193	0.000* 0.661
	2	Nifty does not Granger Cause Net Flow Net Flow does not Granger Cause Nifty	29.178 0.761	0.000* 0.467

Note: Lag length was selected using Schwarz Bayesian Criterion (BIC). If we compare the Akaike Information Criterion (AIC) and the Schwarz Bayesian Criterion, BIC imposes a harsher penalty for adding more variables to the model. According to BIC, there could be a significant causal relationship either at lag 1 or lag 2. Therefore, in analysis, lags up to 2 are considered in estimating the regression model.

* Significant at the 5% level.

Table 7. Vector Auto Regression Results**Panel A:**

Whole Sample (January-2004 to September-2012) (N= 2121)					
	Endogenous Variable	Exogenous Variable	Coefficient	Std. Error	t-Statistic
Nifty (Adj. R-squared=0.016)		Nifty(-1)	0.042	0.022	1.900
		Nifty(-2)	-0.055*	0.022	-2.439
		Futures Buy(-1)	0.000	0.000	2.056
		Futures Buy(-2)	0.000	0.000	0.906
		Futures Sell(-1)	0.000	0.000	-1.988
		Futures Sell(-2)	0.000	0.000	0.877
		Futures OI(-1)	0.000	0.000	-0.066
		Futures OI(-2)	0.000	0.000	-0.508
		CONS.	0.001	0.000	1.366
Futures Buy (Adj. R-squared=0.356)		Nifty(-1)	6923.628*	1890.409	3.663
		Nifty(-2)	3624.966	1910.941	1.897
		Futures Buy(-1)	0.063*	0.026	2.411
		Futures Buy(-2)	-0.023	0.026	-0.87
		Futures Sell(-1)	0.553*	0.038	14.601
		Futures Sell(-2)	0.025	0.038	0.67
		Futures OI(-1)	0.223*	0.025	8.926
		Futures OI(-2)	-0.162*	0.026	-6.31
		CONS.	-4.926	32.147	-0.153
Nifty with Daily Trends of FII in Futures Market		Nifty(-1)	-5184.490*	1322.044	-3.922
		Nifty(-2)	964.391	1336.403	0.722
		Futures Buy(-1)	0.062*	0.018	3.357
		Futures Buy(-2)	-0.017	0.018	-0.965
		Futures Sell(-1)	0.554*	0.026	20.904
		Futures Sell(-2)	0.009	0.027	0.325
		Futures OI(-1)	0.223*	0.017	12.757
		Futures OI(-2)	-0.169*	0.018	-9.439
		CONS.	2.380	22.482	0.106
Futures OI (Adj. R-squared=0.931)		Nifty(-1)	1563.282	1606.787	0.973
		Nifty(-2)	-1984.46	1624.238	-1.222
		Futures Buy(-1)	0.006	0.022	0.262
		Futures Buy(-2)	-0.021	0.022	-0.949
		Futures Sell(-1)	-0.078*	0.032	-2.433
		Futures Sell(-2)	-0.255*	0.032	-7.897
		Futures OI(-1)	0.716*	0.021	33.703
		Futures OI(-2)	0.301*	0.022	13.821
		CONS.	-0.020*	27.324	-0.001

Table 7. Vector Auto Regression Results (Continued)**Panel A:** (Continued)

Whole Sample (January-2004 to September-2012) (N= 2121)					
Endogenous Variable	Exogenous Variable	Coefficient	Std. Error	t-Statistic	Prob.
Nifty (Adj. R-squared=0.006)	Nifty(-1)	0.036	0.023	1.563	0.118
	Nifty(-2)	-0.067*	0.023	-2.89	0.004
	Inflow(-1)	0.000	0.000	-0.11	0.913
	Inflow(-2)	0.000	0.000	0.219	0.827
	Outflow(-1)	0.000	0.000	-0.134	0.893
	Outflow(-2)	0.000	0.000	-0.169	0.866
	Net Flow(-1)	0.000	0.000	0.393	0.694
	Net Flow(-2)	0.000	0.000	-0.023	0.982
	CONS.	0.001	0.000	1.393	0.164
Inflow (Adj. R-squared=0.396)	Nifty(-1)	5671.005*	1388.106	4.085	0.000
	Nifty(-2)	1611.782	1403.22	1.149	0.251
	Inflow(-1)	0.123	0.172	0.715	0.475
	Inflow(-2)	0.036	0.172	0.207	0.836
	Outflow(-1)	0.427*	0.174	2.448	0.014
	Outflow(-2)	0.153	0.174	0.879	0.379
	Net Flow(-1)	0.209	0.169	1.234	0.217
	Net Flow(-2)	0.114	0.169	0.673	0.501
	CONS.	-2.465	22.87	-0.108	0.914
Nifty with Aggregate Daily FII Flows	Nifty(-1)	-3213.699*	1137.435	-2.825	0.005
	Nifty(-2)	2278.015*	1149.819	1.981	0.048
	Inflow(-1)	-0.097	0.141	-0.688	0.491
	Inflow(-2)	-0.091	0.141	-0.648	0.517
	Outflow(-1)	0.630*	0.143	4.409	0.000
	Outflow(-2)	0.305*	0.143	2.131	0.033
	Net Flow(-1)	0.122	0.139	0.875	0.381
	Net Flow(-2)	0.088	0.139	0.637	0.524
	CONS.	1.539	18.74	0.082	0.935
Net Flow (Adj. R-squared=0.216)	Nifty(-1)	8904.383*	1008.609	8.828	0.000
	Nifty(-2)	-754.083	1019.599	-0.74	0.46
	Inflow(-1)	0.224	0.125	1.789	0.074
	Inflow(-2)	0.128	0.125	1.023	0.307
	Outflow(-1)	-0.205	0.127	-1.62	0.105
	Outflow(-2)	-0.156	0.127	-1.232	0.218
	Net Flow(-1)	0.087	0.123	0.705	0.481
	Net Flow(-2)	0.024	0.123	0.193	0.847
	CONS.	-4.143	16.621	-0.249	0.803

Table 7. Vector Auto Regression Results (Continued)**Panel B:**

Phase 1 (January-2004 to January-2008) (N=971)						
	Endogenous Variable	Exogenous Variable	Coefficient	Std. Error	t-Statistic	Prob.
Nifty (Adj. R-squared=0.012)		Nifty(-1)	0.040	0.033	1.199	0.231
		Nifty(-2)	-0.076	0.033	-2.319	0.021
		Futures Buy(-1)	0.000	0.000	1.502	0.133
		Futures Buy(-2)	0.000	0.000	0.595	0.552
		Futures Sell(-1)	0.000	0.000	-0.711	0.477
		Futures Sell(-2)	0.000	0.000	1.132	0.258
		Futures OI(-1)	0.000	0.000	0.034	0.973
		Futures OI(-2)	0.000	0.000	-1.163	0.245
Futures Buy (Adj. R-squared=0.143)		CONS.	0.001	0.001	1.958	0.050
		Nifty(-1)	2975.624	3613.471	0.823	0.410
		Nifty(-2)	4104.466	3566.215	1.151	0.250
		Futures Buy(-1)	0.017	0.034	0.490	0.624
		Futures Buy(-2)	-0.024	0.034	-0.702	0.483
		Futures Sell(-1)	0.532	0.078	6.837	0.000
		Futures Sell(-2)	0.066	0.079	0.831	0.406
		Futures OI(-1)	0.268	0.079	3.405	0.001
Nifty with Daily Trends of FII in Futures Market		Futures OI(-2)	-0.158	0.080	-1.959	0.050
		CONS.	-3.471	57.150	-0.061	0.952
	Futures Sell (Adj. R-squared=0.465)	Nifty(-1)	-192.299	1648.209	-0.117	0.907
		Nifty(-2)	2068.874	1626.654	1.272	0.204
		Futures Buy(-1)	0.026	0.016	1.660	0.097
		Futures Buy(-2)	-0.015	0.016	-0.964	0.335
		Futures Sell(-1)	0.597	0.036	16.806	0.000
		Futures Sell(-2)	0.002	0.036	0.067	0.947
		Futures OI(-1)	0.271	0.036	7.570	0.000
		Futures OI(-2)	-0.193	0.037	-5.273	0.000
Futures OI (Adj. R-squared=0.873)		CONS.	1.276	26.068	0.049	0.961
		Nifty(-1)	-761.000	1497.348	-0.508	0.611
		Nifty(-2)	-2191.687	1477.766	-1.483	0.138
		Futures Buy(-1)	0.008	0.014	0.554	0.579
		Futures Buy(-2)	-0.028	0.014	-2.010	0.045
		Futures Sell(-1)	-0.051	0.032	-1.590	0.112
		Futures Sell(-2)	-0.187	0.033	-5.698	0.000
		Futures OI(-1)	0.808	0.033	24.793	0.000
		Futures OI(-2)	0.177	0.033	5.319	0.000
		CONS.	5.945	23.682	0.251	0.802

Table 7. Vector Auto Regression Results (Continued)**Panel B:** (Continued)

Phase 1 (January-2004 to January-2008) (N=971)					
Endogenous Variable	Exogenous Variable	Coefficient	Std. Error	t-Statistic	Prob.
Nifty (Adj. R-squared=0.018)	Nifty(-1)	0.013	0.034	0.399	0.690
	Nifty(-2)	-0.107	0.034	-3.164	0.002
	Inflow(-1)	-0.023	0.031	-0.739	0.460
	Inflow(-2)	0.023	0.031	0.737	0.461
	Outflow(-1)	0.023	0.031	0.739	0.460
	Outflow(-2)	-0.023	0.031	-0.737	0.461
	Net Flow(-1)	0.023	0.031	0.739	0.460
	Net Flow(-2)	-0.023	0.031	-0.737	0.461
	CONS.	-0.011	0.013	-0.830	0.406
Inflow (Adj. R-squared=0.381)	Nifty(-1)	893.939	1614.694	0.554	0.580
	Nifty(-2)	1360.713	1624.617	0.838	0.402
	Inflow(-1)	720.834	1479.933	0.487	0.626
	Inflow(-2)	-720.807	1479.931	-0.487	0.626
	Outflow(-1)	-720.332	1479.935	-0.487	0.627
	Outflow(-2)	721.025	1479.932	0.487	0.626
	Net Flow(-1)	-720.545	1479.933	-0.487	0.626
	Net Flow(-2)	721.074	1479.931	0.487	0.626
	CONS.	-76.574	646.296	-0.118	0.906
Nifty with Aggregate Daily FII Flows	Nifty(-1)	-4721.609	1474.096	-3.203	0.001
Outflow (Adj. R-squared=0.466)	Nifty(-2)	134.622	1483.155	0.091	0.928
	Inflow(-1)	544.551	1351.069	0.403	0.687
	Inflow(-2)	-545.793	1351.067	-0.404	0.686
	Outflow(-1)	-544.017	1351.070	-0.403	0.687
	Outflow(-2)	546.005	1351.068	0.404	0.686
	Net Flow(-1)	-544.546	1351.069	-0.403	0.687
	Net Flow(-2)	545.919	1351.067	0.404	0.686
	CONS.	-221.188	590.020	-0.375	0.708
	Nifty(-1)	5614.887	1327.998	4.228	0.000
Net Flow (Adj. R-squared=0.183)	Nifty(-2)	1225.020	1336.178	0.917	0.359
	Inflow(-1)	175.728	1217.149	0.144	0.885
	Inflow(-2)	-175.461	1217.147	-0.144	0.885
	Outflow(-1)	-175.760	1217.150	-0.144	0.885
	Outflow(-2)	175.467	1217.148	0.144	0.885
	Net Flow(-1)	-175.443	1217.149	-0.144	0.885
	Net Flow(-2)	175.602	1217.147	0.144	0.885
	CONS.	144.059	531.565	0.271	0.786

Table 7. Vector Auto Regression Results (Continued)**Panel C:**

Phase 2 (February-2008 to September-2012) (N=1146)					
Endogenous Variable	Exogenous Variable	Coefficient	Std. Error	t-Statistic	Prob.
Nifty (Adj. R-squared=0.012)	Nifty(-1)	0.032	0.030	1.045	0.296
	Nifty(-2)	-0.059	0.034	-1.756	0.079
	Futures Buy(-1)	0.000	0.000	1.788	0.074
	Futures Buy(-2)	0.000	0.000	0.715	0.475
	Futures Sell(-1)	0.000	0.000	-2.007	0.045
	Futures Sell(-2)	0.000	0.000	-0.209	0.834
	Futures OI(-1)	0.000	0.000	-0.498	0.618
	Futures OI(-2)	0.000	0.000	-0.218	0.827
	CONS.	0.003	0.002	1.550	0.121
Futures Buy (Adj. R-squared=0.143)	Nifty(-1)	8312.854	1937.239	4.291	0.000
	Nifty(-2)	-1164.219	2148.556	-0.542	0.588
	Futures Buy(-1)	0.367	0.058	6.365	0.000
	Futures Buy(-2)	-0.050	0.051	-0.983	0.326
	Futures Sell(-1)	0.315	0.057	5.553	0.000
	Futures Sell(-2)	0.015	0.052	0.294	0.769
	Futures OI(-1)	0.211	0.021	9.837	0.000
	Futures OI(-2)	-0.164	0.022	-7.454	0.000
	CONS.	145.721	123.602	1.179	0.239
Nifty with Daily Trends of FII in Futures Market	Nifty(-1)	-8929.857	1981.829	-4.506	0.000
	Nifty(-2)	-2812.914	2198.010	-1.280	0.201
	Futures Buy(-1)	0.287	0.059	4.869	0.000
	Futures Buy(-2)	-0.073	0.052	-1.391	0.164
	Futures Sell(-1)	0.362	0.058	6.238	0.000
	Futures Sell(-2)	0.046	0.053	0.875	0.382
	Futures OI(-1)	0.215	0.022	9.802	0.000
	Futures OI(-2)	-0.165	0.022	-7.364	0.000
	CONS.	172.038	126.447	1.361	0.174
Futures OI (Adj. R-squared=0.873)	Nifty(-1)	2587.448	2611.139	0.991	0.322
	Nifty(-2)	-2207.853	2895.965	-0.762	0.446
	Futures Buy(-1)	0.012	0.078	0.160	0.873
	Futures Buy(-2)	0.006	0.069	0.085	0.932
	Futures Sell(-1)	-0.084	0.077	-1.096	0.273
	Futures Sell(-2)	-0.306	0.070	-4.396	0.000
	Futures OI(-1)	0.678	0.029	23.420	0.000
	Futures OI(-2)	0.306	0.030	10.342	0.000
	CONS.	1103.555	166.599	6.624	0.000

Table 7. Vector Auto Regression Results (Continued)**Panel C:** (Continued)

Phase 2 (February-2008 to September-2012) (N=1146)					
Endogenous Variable	Exogenous Variable	Coefficient	Std. Error	t-Statistic	Prob.
Nifty (Adj. R-squared=0.018)	Nifty(-1)	0.013	0.034	0.399	0.690
	Nifty(-2)	-0.107	0.034	-3.164	0.002
	Inflow(-1)	-0.023	0.031	-0.739	0.460
	Inflow(-2)	0.023	0.031	0.737	0.461
	Outflow(-1)	0.023	0.031	0.739	0.460
	Outflow(-2)	-0.023	0.031	-0.737	0.461
	Net Flow(-1)	0.023	0.031	0.739	0.460
	Net Flow(-2)	-0.023	0.031	-0.737	0.461
	CONS.	-0.011	0.013	-0.830	0.406
Inflow (Adj. R-squared=0.381)	Nifty(-1)	893.939	1614.694	0.554	0.580
	Nifty(-2)	1360.713	1624.617	0.838	0.402
	Inflow(-1)	720.834	1479.933	0.487	0.626
	Inflow(-2)	-720.807	1479.931	-0.487	0.626
	Outflow(-1)	-720.332	1479.935	-0.487	0.627
	Outflow(-2)	721.025	1479.932	0.487	0.626
	Net Flow(-1)	-720.545	1479.933	-0.487	0.626
	Net Flow(-2)	721.074	1479.931	0.487	0.626
	CONS.	-76.574	646.296	-0.118	0.906
Nifty with Aggregate Daily FII Flows	Nifty(-1)	-4721.609	1474.096	-3.203	0.001
	Nifty(-2)	134.622	1483.155	0.091	0.928
	Inflow(-1)	544.551	1351.069	0.403	0.687
	Inflow(-2)	-545.793	1351.067	-0.404	0.686
	Outflow(-1)	-544.017	1351.070	-0.403	0.687
	Outflow(-2)	546.005	1351.068	0.404	0.686
	Net Flow(-1)	-544.546	1351.069	-0.403	0.687
	Net Flow(-2)	545.919	1351.067	0.404	0.686
	CONS.	-221.188	590.020	-0.375	0.708
Net Flow (Adj. R-squared=0.183)	Nifty(-1)	5614.887	1327.998	4.228	0.000
	Nifty(-2)	1225.020	1336.178	0.917	0.359
	Inflow(-1)	175.728	1217.149	0.144	0.885
	Inflow(-2)	-175.461	1217.147	-0.144	0.885
	Outflow(-1)	-175.760	1217.150	-0.144	0.885
	Outflow(-2)	175.467	1217.148	0.144	0.885
	Net Flow(-1)	-175.443	1217.149	-0.144	0.885
	Net Flow(-2)	175.602	1217.147	0.144	0.885
	CONS.	144.059	531.565	0.271	0.786

Note: No. of lags has been determined using BIC criterion. Significant lagged variables are highlighted with * (at 5% level). First VAR is estimated for Nifty and FII flow in Futures market and secondly for Nifty and aggregate FII flows. (-1) and (-2) represents lagged values.

Table 8. Variance Decomposition Results**Panel A:**

Whole Sample (January-2004 to September-2012) (N=2121)					
		Nifty	Futures Buy	Futures Sell	Futures OI
Nifty with daily trends of FII in Futures Market	Nifty	100.000	0.000	0.000	0.000
	Futures Buy	0.008	99.992	0.000	0.000
	Futures Sell	0.039	55.269	44.692	0.000
	Futures OI	0.129	11.058	61.636	27.177
		Nifty	Inflow	Outflow	Net flow
Nifty with Aggregate Daily FII Flows	Nifty	100.000	0.000	0.000	0.000
	Inflow	26.120	73.880	0.000	0.000
	Outflow	0.949	30.169	68.882	0.000
	Net flow	21.663	57.541	11.847	8.950

Panel B:

Phase 1 (January-2004 to January-2008) (N=971)					
		Nifty	Futures Buy	Futures Sell	Futures OI
Nifty with daily trends of FII in Futures Market	Nifty	100.000	0.000	0.000	0.000
	Futures Buy	2.021	97.979	0.000	0.000
	Futures Sell	14.045	16.516	69.439	0.000
	Futures OI	74.863	0.290	0.794	24.052
		Nifty	Inflow	Outflow	Net flow
Nifty with Aggregate Daily FII Flows	Nifty	100.000	0.000	0.000	0.000
	Inflow	63.832	36.168	0.000	0.000
	Outflow	43.263	56.736	0.001	0.000
	Net flow	0.410	99.590	0.000	0.000

Panel C:

Phase 2 (February-2008 to September-2012) (N=1146)					
		Nifty	Futures Buy	Futures Sell	Futures OI
Nifty with daily trends of FII in Futures Market	Nifty	100.000	0.000	0.000	0.000
	Futures Buy	1.826	98.174	0.000	0.000
	Futures Sell	20.046	16.114	63.840	0.000
	Futures OI	8.343	2.206	0.668	88.783
		Nifty	Inflow	Outflow	Net flow
Nifty with Aggregate Daily FII Flows	Nifty	100.000	0.000	0.000	0.000
	Inflow	24.416	75.584	0.000	0.000
	Outflow	15.229	70.091	14.680	0.000
	Net flow	94.942	2.076	0.102	2.880

its own lagged values. It is particularly worth noting that during this time period, all FII futures trading was unaffected by movements of Nifty returns. The results of interactions between Nifty returns and aggregate flows show that Outflow and Net flow are affected by past Nifty returns only at lag 1.

The results for Nifty's interactions with futures FII flows in Panel C are similar to those in Panel A, whereas the results for Nifty's interactions with aggregate FII flows in Panel C are similar to those in Panel B.

As can be clearly seen throughout the time periods (Panels A, B and C), the coefficients for Nifty returns at lag 1 for Net flow are strongly positive. This confirms that FIIs are feedback traders.

As is immediately evident from table 8, Nifty shocks and Futures Buy shocks explain almost all of the forecast error variance of Nifty and Futures Buy, respectively, throughout the time period. Nifty and Futures Buy shocks explain a considerable part of the forecast error variance of Futures Sell. Nifty is significantly responsible for movements of Inflow, Outflow and Net flow. These findings accord with the findings of the VAR analysis.

Policy Suggestions

The study offers findings that policy makers can use to strengthen the Indian capital market. Indian capital market returns are found to be the prime mover of FII flows into India. These flows are primarily governed by the performance of the domestic equity market and/or expectations of foreign investors regarding performance. A drop in returns in the Indian capital market may result in sudden massive withdrawals of FIIs, adversely affecting the Indian economy. Similarly, an increase in returns would attract foreign capital into India, resulting in variations in the country's foreign exchange reserves that might be outside the control of the monetary authority, as experienced in the past. India should move towards a more liberalized regime along with improvements in the regulatory framework of the Indian financial system.

Although there is a need to remain vigilant about non-fundamental factors, such as speculation, sentiment, manipulation of institutions and so on, the Indian economy, and particularly the Indian capital market, should be stabilized on the basis of fundamental factors. The focus should be on regaining the confidence of domestic savers to enhance the investor

base in the equity market. Participation by domestic institutional investors would strengthen the base of the domestic stock market and end the anomaly of the existing situation in which foreign investors dominate the Indian equity market. FIIs should be allowed greater flexibility to switch between equity and debt investments, as more balanced strategies may help stabilize movements of FIIs into and out of India (Bawa, 2012).

To address these issues, the government might seek to promote financial sector prudence, which would be an indirect effort to prevent asset bubbles in the financial markets. It can impose restrictions on bank loans, asking banks to maintain higher provisions on loans to certain sectors such as real estate or the equity market to avoid bubbles in these asset classes. Macro-economic managers can impose a ban on certain financial activities temporarily, as deemed necessary. For instance, Taiwan imposed capital controls on November 9, 2010 to curb currency appreciation. A tax on exit can be imposed on investors wishing to sell assets or withdraw money before a stipulated time. Brazil doubled its tax on foreign portfolio inflows into bonds and some other financial instruments from 2 to 4 percent in 2010 to curb currency appreciation. During the same time period, Thailand imposed a 15 percent withholding tax on capital gains and interest income from foreign investments. The Thai baht gained the most among currencies in the region except that of Japan, and the SET index of the Thai stock market soared by 30 percent in four months. Ceiling or capping inflows is a direct measure, which India is now implementing. For instance, the upper limit on FIIs in corporate bonds is fixed at \$ 15 billion, and that in government bonds is \$ 5 billion. Policy makers can also implement a Tobin tax. For example, the securities transaction tax (STT) imposed by India in 2004 is a type of Tobin tax. The Taiwanese and Brazilian measures mentioned above are also examples of Tobin taxes (Kazi, 2011). There is no universally appropriate solution to sudden stops. Based on circumstances, a country can adopt one or a combination of policy measure(s).

Conclusion

This study has examined the Lead-lag relationships between FII flows into the futures market – in terms of long positions (Futures Buy), short positions (Futures Sell) and open interest (Futures Open Interest) – and

Nifty returns and between Aggregate FII flow (viz. In-flow, Outflow and Net flow) and Nifty returns in the Indian capital market. A positive relationship between stock market returns and FII flows has been established, one that persists after dividing the data into two periods, Pre Global financial crisis (Phase 1) and Post Global financial crisis (Phase 2).

To investigate the causal relationship between FII flows and market returns, a cross correlation approach and a combination of Granger causality and Vector Auto Regression approaches have been adopted. The results provide insights into the behavior of FIIs that would be useful to the formulation of utilitarian policies. Under the cross-correlation approach, bidirectional causality is found between FII flows and Nifty returns. In Phase 2, strong unidirectional causality is found to run from FIIs to Nifty returns, confirming the behavior of FIIs as feedback traders. Since January, 2008 FII outflows have been persistent, giving rise to episodic sudden reversals. A Granger Causality Test suggests that FII flows are significantly affected by returns in the equity market; however, the latter is not significantly influenced by variations in these flows. A Vector Auto Regression indicates that variations in the time series are strongly explained by its own lags. However, variations in Futures Buy and Futures Sell are also explained by Nifty along with their own lags. The reason for this result is that FIIs in the Indian market extrapolate trends in stock price changes. Thus, after some price decrease, they anticipate a further dip in stock prices and hence sell shares. Such actions, when taken by a large number of investors, suggest that stock prices will continue to decline in the future. Therefore, investors' expectations lead them to sell their shares following a decrease in index prices, leading to negative feedback trading behavior among FIIs. Thus, the turbulent effects of FIIs cannot be disregarded.

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Endnotes

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