Stock Returns, FII and Exchange Rate: Test of Causal Relationship

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ABSTRACT

This paper investigates the nature of the causal relationship between stock returns, net foreign institutional investment (FII) and exchange rate in India. By applying the techniques of unit root tests, cointegration and the long–run Granger causality test proposed by Granger, we test the causal relationships using monthly data for the period April 2000 to March 2009. The major findings are that (a) a bi-directional causality exists between stock return and the FII, (b) unidirectional causality runs from change in exchange rate to stock returns (at 10% level of significance), not vice versa, and (c) no causal relationship exist between exchange rate and net investment by FIIs.

Introduction

The US economic meltdown has hit the world financial markets very hard. So far India is concerned as much as 12 Billion dollars of investment was withdrawn in a year. The stock markets fell deep down and inflow was severely affected. Moreover, the recent changes in the international financial domain are exhibiting several features of which capital inflows is the most important. Emerging economies have experienced massive capital inflows, which in some cases have proved to be Dangerous later. Some of the reasons for the same could be

- Incompatible macroeconomic and exchange rate policies
- Imprudent banking policy
- Lack of liquidity in the market

Whatever be the reason, the issue boils down to the fact whether such flows are properly paced and properly sequenced such that the inflow of capital is not excessive relative to the maturity of the system in which it must be absorbed; only then the capital flows can be sustained and systemic stability ensured.

This may be attained through structural and operational realignment of the domestic and financial sector variables of the economies exposed to global financial network. It is in this context that the inter-linkage among the stock market, the most sensitive sector of the economy, exchange rate, the barometer of external interaction and the FII flows, indicator of capital surge needs to be addressed. To what extent the stock market can internalize or in other words, can capture the information on these is a case in point.

The present study focuses on this issue in the Indian context. In fact, from among the whole gamut of institutional reforms undertaken in India since the 1990's, gradual abolishment of capital inflow barriers and foreign exchange restrictions, adoption of more flexible exchange rate arrangements deserve a special attention at this juncture to re-examine whether India is approaching towards achieving the twin goals of stability and efficiency of the financial system .

A plethora of researches are being conducted to understand the current working of the economic and the financial system. Interesting results are emerging particularly for the developing countries where the markets are experiencing new relationships which are not perceived earlier. One of the most important changes that Indian capital market witnessed with the reforms is the entry of foreign institutional investors. Since then the country has been receiving increasing amounts of portfolio investment. The analysis of the interrelationship between stock prices, net foreign institutional investment (FII) and exchange rate in the present study runs in terms of efficiency of Indian stock markets.

The Efficient Market Hypothesis (semi-strong form), states that in a semi strong efficient market, everyone has perfect knowledge of all publicly available information in the market. The idea is, whether in a mutually interactive framework, stock market can effectively digest and incorporate all available information about economic variables.

This is important because, if it does so, then the rational behaviour of market participants ensures that past and current information is fully reflected in stock prices. Otherwise, the market participants are able to develop profitable trading rules and thereby can consistently earn more than average market returns, and the stock market is not likely to play an effective role in channelling financial resources to the most productive sector of the economy.

The use of Granger Causality Test in examining market informational efficiency has been there for quite some time.

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This is based on the hypothesis that informational efficiency exists if a unidirectional lagged causal relationship from an economic variable to stock prices or bi-directional lagged causal relationship from an economic variable to stock price or from the latter to the former, could not be detected. It implicates that the economic variable neither influences nor is influenced by stock price fluctuations, and the two series are independent of each other and the market is informational efficient.

The study investigates the empirical relationship between stock prices, net FII investment and exchange rate using monthly data from January 1993 to March 2008.

A survey of the existing literature including empirical evidences on the nature of interrelationships between stock prices, net FII investment and exchange rate is conducted in Section II. Section III discuses the methodology employed and presents the variables and data descriptions. Section IV analyses the empirical results followed by concluding observation in Section V.

Review of Literature

There have been attempts to explain FII in India. All the existing studies found that the equity return has a significant and positive impact on the FII (Agarwal, 1997; Chakrabarti, 2001; and Trivedi & Nair, 2003). But given the huge volume of investments, foreign investors could play a role of market makers and book their profits, i.e., they can buy financial assets when the prices are declining thereby jacking-up the asset prices and sell when the asset prices are increasing (Gordon & Gupta, 2003). Hence, there is a possibility of bi-directional relationship between FII and the equity returns.

Ahmad et al (2005) make a firm level analysis of FII's role in the Indian equity market. At the aggregate level FII investments and NSE Nifty seem to have a strong bi-directional causality. At the firm level FIIs are influencing equity returns especially in the government owned companies. On the issue of market stability Mazumdar (2004) finds that FII flows have enhanced liquidity in the Indian stock market but not much evidence is there to support the hypothesis that FII flows have generated volatility in the returns. Ahmed et al (2005) also confirms that there has been very little destabilizing effect of FII flows on individual equity returns of the firms during their period of study. Sumanjeet Singh (2009) reveals that ,the main danger posed by large and volatile capital inflows is that they may destabilize macroeconomic management. As evident, the intensified pressures due to large and volatile capital flows in India in the recent period in an atmosphere of global uncertainties has posed new challenges for monetary and exchange rate management. Ramesh Chander and Kiran Mehta (2009) reveals that Investors and analysts are unable to predict stock price movements consistently so as to beat the market in informationally efficient markets, their study conceptualised to scrutinise whether anomalous patterns yield abnormal return consistently for any specific day of the week even after introduction of the compulsory rolling settlement on Indian bourses. On the whole, the study noted stock markets moved more rationally and anomalous return pattern noticed earlier could not sustain, in the post rolling settlement period. Brian A. Ciochetti,- Timothy M. Craft" and James D, Shilling (2002) This article investigates the determinants of real estate investment trusts (REIT) portfolio investment and institutional REIT ownership using multivariate Tobit regressions. Study contended that many institutional investors take larger positions in more liquid assets like REIT stocks, as compared with private real estate equities, because of liquidity considerations. They also find that institutional investors have different preferences for REIT stocks than do other investors; they generally prefer larger, more liquid REIT stocks. Their empirical results S1K)W that liquidity-constrained institutional investors have a strong preference for liquid REIT shares, as compared with private real estate equities. Their findings also show that institutional investors have different preferences for REIT stocks than do other investors; they generally prefer larger, more liquid REIT stocks. They interpreted these results as evidence in favor of liquidity-constrained asset-liability portfolio choice model. Sanjay Sehgal and Neeta Tripathi (2009) In this paper, they tested empirically if Foreign Institutional Investors (FIIs) adopt positive feedback and herding strategies in the Indian environment. They find that FIIs exhibit return chasing behaviour when monthly data is used. However, they do not seem to be working on the positive feedback strategy when daily files were used. This may be owing to the fact that they wait for the market information to crystallize and do not react to it in an instantaneous manner. They also observed that the FIIs display strong herding behaviour based on quarterly shareholding pattern. The herding behaviour seems to be stronger at the aggregate level than at the individual stock level. This may be explained by the fact that FIIs are more cognizant of corporate fundamentals at the individual stock level.

Objective of the Study

The main objective of the present paper is to determine the lead and lag interrelationships between the Indian stock market, net foreign institutional investment, and exchange rate. This will help us to understand the intricacies in the economic scenario and the linkages between the Indian stock market, Excahnge rate and net foreign institutional investments.

India embarked on a programme of economic reforms in the early 1990s to tie over its balance of payment crisis and also as a step towards globalization. An important milestone in the history of Indian economic reforms happened on September 14, 1992, when the FIIs (Foreign Institutional Investors) were allowed to invest in all the securities traded on the primary and secondary markets, including shares, debentures and warrants issued by companies which were listed or were to be listed on the stock exchanges in India and in the schemes floated by domestic mutual funds. Initially, the holding of a single FII and of all FIIs, NRIs (Non-Resident Indians) and OCBs (Overseas Corporate Bodies) in any company was subject to a limit of 5% and 24% of the company's total issued capital respectively. In order to broad base the FII investment and to ensure that such an investment would not become a camouflage for individual investment in the nature of FDI, a condition was laid down that the funds invested by FIIs had to have at least 50 participants with no one holding more than 5%. Ever since this day, the regulations on FII investment have gone through enormous changes and have become more liberal over time.

Research Methodology

In order to check the causal relationship between the two variables we usually adopt the Granger Causality test .

Granger Causality Test

Granger causality is a statistical concept of causality that is based on prediction. According to Granger causality, if a signal X1 "Granger-causes" (or "G-causes") a signal X2, then past values of X1 should contain information that helps predict X2 above and beyond the information contained in past values of X2 alone. Its mathematical formulation is based on linear regression modeling of stochastic processes (Granger 1969).

This test states that, if past values of a variable Y significantly contribute to forecast the value of another variable Xt+1 then Y is said to Granger cause X and vice versa. The test is based on the following regressions:

$$Y_t = \beta_0 + \sum_{k=1}^{M} \beta_k Y_{t-k} + \sum_{l=1}^{N} \alpha_l X_{t-l} + u_t \quad \ldots\ldots (1)$$

$$X_t = \gamma_0 + \sum_{k=1}^{M} \gamma_k X_{t-k} + \sum_{l=1}^{N} \delta_l Y_{t-l} + v_t \quad \ldots\ldots (2)$$

where Yt and Xt are the variables to be tested, and ut and vt are mutually uncorrelated white noise errors, and t denotes the time period and *'k'* and *'l'* are the number of lags. The null hypothesis is $\alpha_l = \delta_l = 0$ for all *l's* versus the alternative hypothesis that $\alpha_l \neq 0$ and $\delta_l \neq 0$ for at least some *l's*. If the coefficient α_l's are statistically significant but δ_l' s are not, then X causes Y. In the reverse case, Y causes X. But if both α_l and δ_l are significant, then causality runs both ways.

Various Steps Involved in Granger Test

Unit Root Test

In order to avoid a spurious regression situation the variables in a regression model must be stationary or co integrated. Therefore, in the first step, we perform unit root tests on these eight time series variables to investigate whether they are stationary or not. The Augmented Dickey-Fuller (ADF) unit root test is used for this purpose. The ADF regression equations are:

$$\Delta Y_t = \alpha_1 Y_{t-1} + \sum_{j=1}^{p} \gamma_j \Delta Y_{t-j} + \varepsilon_t \quad \ldots\ldots (3)$$

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \sum_{j=1}^{p} \gamma_j \Delta Y_{t-j} + \varepsilon_t \quad \ldots\ldots (4)$$

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 t + \sum_{j=1}^{p} \gamma_j \Delta Y_{t-j} + \varepsilon_t \quad \ldots\ldots (5)$$

where $\varepsilon\tau$ is white noise. The additional lagged terms are included to ensure that the errors are uncorrelated. The tests are based on the null hypothesis (H0): Yt is not I (0). If the calculated DF and ADF statistics are less than their critical values from Fuller's table, then the null hypothesis (H0) is accepted and the series are non-stationary or not integrated of order zero.

Co integration Test

In the second step we estimate cointegration regression using variables having the same order of integration. The cointegration equation estimated by the OLS method is given as:

$$Y_t = a_0 + a_1 X_t + Z_t \quad \ldots\ldots (6)$$

In this study, we used monthly data series for three variables for the period April 2000 to March 2009 forming around 95 observations. The monthly return on stock prices (RBSE) is calculated by taking a percentage change in the BSE 100 Index (base: 1978-79=100). The other two variables included in our study are net investments by FIIs (in equities) in the Indian capital market and the indices of Real Effective Exchange Rate (REER) of the Indian Rupee (36-country bilateral weight with base 1985=100). The data has been compiled from Handbook of Statistics on Indian Economy published by Reserve Bank of India and various issues of RBI Bulletin.

Empirical Analysis

As part of empirical analysis Table 1 displays the summary statistics for the concerned variables over the sample period. The mean is positive for all the variables. The standard deviation (variance) of FII exceeds that of REER, which exceeds that of RBSE. All the variables exhibit positive skewness except RBSE. The significant Jarque Bera statistics shows that the data considered are found to be non-normal except RBSE.

Table 1 : Summary Statistics of three variables

	FII net investment : Equity (in Rs. Crore)	Monthly Return BSE 100 Index (RBSE)	REER Trade Based Weights
Mean	1708.5	0.27986	143.52
Median	1131.2	0.026038	167.22
Minimum	-17227	-0.25335	88.04
Maximum	18949	29.176	189.07
Standard Deviation	5206.7	2.8074	36.223
C.V.	3.0476	10.032	0.25239
Skewness	0.026753	10.238	-0.39512
Ex. Kurtosis	3.4345	102.88	-1.7483

Further the Analysis of the data on the basis of the following steps give the return as follow:

Step 1: testing for a unit root in Montly_retrn

Augmented Dickey-Fuller test for Montly_retrn

including 2 lags of (1-L)Montly_retrn
sample size 95
unit-root null hypothesis: a = 1
test with constant
model: (1-L)y = b0 + (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: 0.054
lagged differences: F(2, 91) = 7.399 [0.0011]
estimated value of (a - 1): -0.50781
test statistic: tau_c(1) = -3.96991
asymptotic p-value 0.001583

Step 2: testing for a unit root in FII

Augmented Dickey-Fuller test for FII

including 5 lags of (1-L)FII
sample size 95
unit-root null hypothesis: a = 1
test with constant
model: (1-L)y = b0 + (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: 0.021
lagged differences: F(5, 88) = 3.380 [0.0077]
estimated value of (a - 1): -0.502698
test statistic: tau_c(1) = -2.89107
asymptotic p-value 0.04638

Step 3: testing for a unit root in REER

Dickey-Fuller test for REER

sample size 95
unit-root null hypothesis: a = 1
test with constant
model: (1-L)y = b0 + (a-1)*y(-1) + e
1st-order autocorrelation coeff. for e: 0.041
estimated value of (a - 1): -0.0206896
test statistic: tau_c(1) = -0.846401
p-value 0.8009

Step 4: cointegrating regression

Cointegrating regression -
OLS, using observations 2000:04-2009:03 (T = 108)
Dependent variable: Montly_retrn

	coefficient	std. error	t-ratio	p-value
const	-0.504877	1.11632	-0.4523	0.6520
FII	-1.10465e-05	5.27028e-05	-0.2096	0.8344
REER	0.00559917	0.00757549	0.7391	0.4615

Mean dependent var	0.279860	S.D. dependent var	2.807417
Sum squared resid	838.8050	S.E. of regression	2.826415
R-squared	0.005366	Adjusted R-squared	-0.013579
Log-likelihood	-263.9371	Akaike criterion	533.8742
Schwarz criterion	541.9206	Hannan-Quinn	537.1367
rho	-0.010883	Durbin-Watson	2.021575

Step 5: testing for a unit root in uhat

Augmented Dickey-Fuller test for uhat

including 6 lags of (1-L)uhat
sample size 95
unit-root null hypothesis: a = 1
model: (1-L)y = b0 + (a-1)*y(-1) + ... + e
1st-order autocorrelation coeff. for e: 0.018

lagged differences: F(6, 88) = 4.686 [0.0004]

estimated value of (a - 1): -0.0562621

test statistic: tau_c(3) = -1.50259

asymptotic p-value 0.8959

Findings of the study

- A bi-directional causality between stock price and the net foreign institutional investment, thus implying that the market informational efficiency hypothesis can be rejected for BSE 100 Index with respect to the FII,
- Uni-directional causality runs from change in exchange rate to stock returns (at 10% level of significance), not vice versa, implying that the exchange rate movements lead the BSE 100 index, and
- No causal relationship exist between exchange rate and net investment by FIIs.

Conclusion

The main objective of the present paper is to determine the lead and lag interrelationships between the Indian stock market, net foreign institutional investment, and exchange rate. To test this, we employ the methodology of Granger causality test for the sample period April 2000 to March 2009. In this study, the returns on BSE 100 Index is used as a proxy for the Indian stock market and the indices of Real Effective Exchange Rate (REER) of the Indian Rupee (36-country bilateral weight with base 1985=100) for the exchange rate. The result suggests a bi-directional causality between stock price and the net foreign institutional investment, thus implying that the market informational efficiency hypothesis can be rejected for BSE Sensitive Index with respect to the FII. At the same time it is consistent with the 'base-broadening hypothesis' (Merton, 1987), which postulates a positive and long-term impact of foreign investment on stock prices due to reduction on risk premium from international diversification. The uni directional causality from change in exchange rate to stock returns (at 10% level of significance), implies that the exchange rate movements lead the BSE sensitive index. At the same time, the absence of any causal relationship between exchange rate and net investment by FIIs imply that the interlinkages between stock price and exchange rate is prominent not due to the presence of foreign institutional investors alone, but attributed to other factors as well. It suggests the policy implication that the authorities can focus on domestic economic policies to stabilize the stock market. Our results imply that stock prices can capture information on neither the FIIs nor the exchange rate. Investors can therefore apply profitable trading rules to earn supernormal profits. Also FII cannot capture information on exchange rate thus adding to the possibility of application of profitable trading rules. Under the circumstances, the Indian stock market seems to be bearing the underlying strain not currently visible at the surface. The implementation of profitable trading strategy may at any point of time generate over-enthused investment and this, if coupled with market overreaction, may result in a destabilized system. A point also to be noted here is the current concentration of FII funds in the IT and Banking sector, which in any event of flow reversals may worsen the situation.

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