"Dynamism of FII flows and Expected Volatility in Indian Stock Markets: An Empirical Analysis"

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ABSTRACT

This study is aimed at exploring the inter-relationships of Foreign Institutional Investor (FII) flows and option implied Volatility Index (VIX). Studies on the FII flows and realized volatility provide a ground work for this research. Covering over 7 years' time period, this paper establishes the importance of VIX i.e. expected volatility in explaining the FII flows into the Indian stock market. Very strong evidence has been proposed by the Granger Causality test which confirms the uni-directional flow of causality from option implied volatility to FII investments into Indian markets. VAR model developed in the study has high explanatory power in explaining VIX but not the FII flows.

Keywords : *FIIs, Granger Causality, Illiquidity, Stock Market, VIX, Volatility*

INTRODUCTION

With the Indian economy portraying all the healthy signs of long term growth, there seems nothing in the visibility to seize the opportunity from India from attracting investments and becoming the most preferred investment destination for FIIs worldwide. It is fairly visible that interest rates are up for a downward trend and this would further attract flows from FIIs. For the financial years 2017 and 2018, expectations for the growth rate of the Nifty-50 companies' net profits are 14.4% and 20.7% respectively which can be attributed to high profits in several sectors and overall economic reclamation. Indian markets have so far been witnessing consistent participation of FIIs which is only expected to increase with the support of the government.

India's solar energy projects and plans have been committed US$ 1 billion by the World Bank Group to work with other multilateral development banks and financial institutions in order to develop financing instruments to support future solar energy development in the country. Also, the Government has signed a US$ 100 million loan agreement with the Asian Development Bank, which will be used to support irrigation and drainage systems thereby improving water management in Tamil Nadu. Many more investment plans are ready to be effected aiding in fetching foreign money.

For providing relief to foreign portfolio investors (FPIs), Minimum Alternate Tax has been abolished with retrospective effect for the period prior to April 2015. Foreign Portfolio Investors can now invest in Real Estate Investment Trusts (REITs), infrastructure investment trusts (InvITs) and Category III Alternative Investment Funds (AIFs) as per the latest guidelines of SEBI.

Figure 1.1 represents the Annual Net FII investments into Indian equity market for the last seven years from April 2009 to March 2016. Despite a choppy 2015-16 when global markets observed a bear phase on account of China's growth woes and falling crude oil prices thereby pushing out FIIs from Indian markets, the year 2016 saw strong FII flows till August 2016 at an astounding Rs. 38,464 crore.
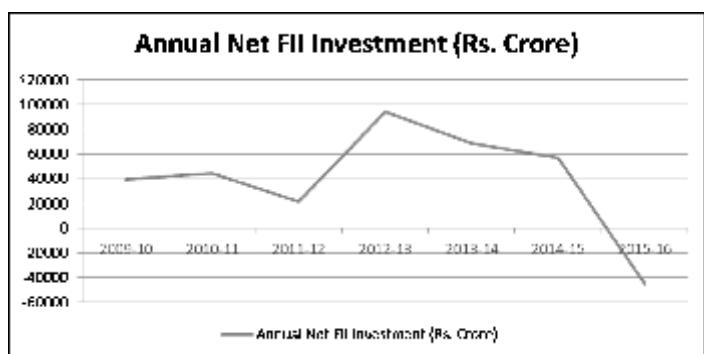

Figure 1.1: Annual Net FII Investments (2009-2016)

Such dynamics of the FII inflows and outflows over a period of time have huge impact on the movements of the stock markets. Numerous other domestic as well as international factors are also engaged in creating bulls and bears in the markets which in turn can lead to market volatility. Volatility is a term for the fluctuations or changes in the stock values from their mean values. Since the variations in security values bring about deviations in the returns, it is so very essential to measure such dispersion and attribute a value to it. Volatility Index (VIX) as a measure of market expectations offers a solution. In a highly volatile market, it suddenly moves up or down and hence, during this time, value of the volatility index rises and vice versa. Volatility Index measures the dispersion or variance and is calculated using the order book of the underlying index options; denoted as an annualized percentage. NSE started real time dissemination of India VIX which is a step towards introduction of India VIX derivatives. India VIX futures and India VIX options can be used to hedge the risk of market volatility.

The present study is an endeavor to investigate the relationships between expected volatility and flows of FIIs into the Indian equity market while also pondering over exchange rate and Nifty returns over a seven years' time period.

LITERATURE REVIEW
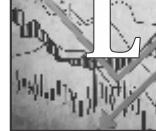
Paramita Mukherjee et al. (2002) studied the relationship between FII flows to Indian equity market and other variables i.e. market returns, volatility, exchange rate, short term interest rates and IIP. The results show that returns in Indian equity market cause FII sale and net inflows but not the FII purchases. Global investors are not investing in Indian equities for diversification purpose. Daily FII flows are found to be auto-correlated and this auto-correlation could not be accounted for by all the other variables considered in the study.

Dipankor Coondoo, Paramita Mukherjee (2004) examined the volatility of the FII in India in terms of strength, duration and persistence. Volatility of the stock market returns was found to be similar to that of the FII flows. Strength of volatility of FII flows was highly correlated both with that of stock market returns and call money rate.

Tanupa Chakraborty (2007) performed a cause and effect relationship study on daily data set of FIIs and Indian equity market returns from April 1997 to March 2005. The study revealed that FII flows are more an effect than a cause of stock market returns in India. This proves the return-chasing behavior of foreign investors thereby supporting the theory of cumulative informational disadvantage of foreign investors in comparison to domestic investors.

Swami P. Saxena, Sonam Bhadauriya (2011) explored the causal relationship between FIIs and stock market returns over the period 2003 to 2010. The data was analyzed using STATA IC 10 software with Granger Causality Test and VAR framework applied on the FII and the Nifty index series. Only uni-directional causal relationship was observed and it was suggested that past data of stock market returns can predict the present and future trends of FII inflows into Indian stock markets.

Bashir Ahmad Joo, Zahoor Ahmad Mir(2014) examined the effect of FII movements on Indian stock market volatility analyzing the monthly data of FII, Nifty and Sensex from January, 1999 to December, 2013.Volatility measures like standard deviation, correlation and GARCH model were used to evaluate the variables. Results revealed that there is positive correlation between the series and FIIs significantly affecting the volatility of Nifty and Sensex.

Rakesh Kumar, Sarita Gautam(2014) established the inverse relationship between FII investments and BSE Sensex returns for the time period April 2014 to June 2014. Further they found strong influence of FTSE 100, NIKKEI 225 and NASDAQ 100 indices on Indian stock market.

Devdatt. J. Vyas, Manoj. D. Shah(2015)studied the correlation between FIIs and BSE Sensex for the time period 2005 to 2015 and concluded that Sensex was not solely affected by FIIs; other variables may be significantly contributing to its fluctuations. FIIs contribute considerably to the efficiency of all the stock markets around the world.

Suddhasanta De, Tanupa Chakrabarty (2016) explained the relationship between FII flows into Indian equity markets and the option implied volatility index over the time period 2009 to 2013. Multi variate analysis tools were used and results suggested flow of causality from FII flows to volatility index. FII flows affect the investors' perception about the future volatility.

DATA & METHODOLOGY

Variables used in the research were India VIX (Implied Volatility Index), FII Net purchases in equity markets, Exchange rate of USD to INR and Nifty returns. Data for all the variables has been taken on daily basis for the time period April 2009 to March 2016.

India VIX is an index of measurement of expectation of volatility of stock options traded at NSE. As the calculation of the VIX started from April 2009, time period for the study has been selected accordingly and data. The data for FII Net purchases in equity has been taken as reported on the trading day by the brokers in the trading system.

Exchange rate of USD to INR has been used as a parameter affecting FII flows and stock market volatility. The data for the exchange rate has been compiled from International Monetary Fund website.

NIFTY returns are an important constituent of any model explaining the relationships of FII flows and financial markets volatility and the same has been measured by computing the daily returns of the index.

Illiquidity, as explained by Amihud(2002) is a measure for computing illiquidity by providing a model that explains the liquidity of any security with reference to its turnover over a specified period of time.

Amihud's measure of Illiquidity used in the study:

$$ILLIQ\,pt = \frac{1}{N_{pt}} \sum_{n=1}^{i=N_{pt}} \frac{|R\,pdt|}{V_{pdt}}$$

In this measure, ILLIQpt is Amihud's illiquidity for stock p for the quarter t; R_{pdt} and V_{pdt} are the daily NIFTY returns & the total trade value of the NIFTY at the end of the day respectively and N_{pt} is the observed number of days in quarter t of stock p.

Augmented Dickey Fuller Test has been applied on all the data series to test the stationarity using the equation stated in the model below:

$$\Delta Y_t = \alpha_0 + Y_{t-1} + \sum \beta_i \, \Delta Y_{t-1} + e_t$$

For this purpose, the null hypothesis of a single root is tested against the alternative of stationarity. The solution is to take the first differences of the time series because if a time series has a unit root, the first differences of such time series are stationary. The series being examined here have been tested using ADF test.

Further, Granger Causality Test has been applied on the series to examine the causal relationship and the direction of causality between the variables. A time series is assumed to Granger Cause another series if the historical values of the former contribute to the prediction of the latter series. However, it does not imply that variations in one variable cause fluctuations in another.

The dynamic behaviour of financial time series can be described and forecasted using the VAR (Vector Auto regression) model, an extension of the univariate autoregressive model. For estimation of the VAR model, symmetric lags need to be selected for all the variables in the model using statistical criterion such as AIC or SIC.

Making use of SIC and AIC for optimum lag length selection, time series of USD to INR has been taken at first difference as it has a unit root. All other series have been found to be stationary at level.

The regression model used is as follows:

$$VIX_t = \alpha + \sum_{n=1}^{m} \beta_n VIX_{t-n} : \sum_{n=1}^{m} \gamma_n FII_{t-n} + \sum_{p=1}^{m} \delta_p RET_t + \sum_{n=1}^{m} \mu_n ILLIQ_{t-n} + \sum_{p=1}^{m} \pi_p D(USD)_t + e_t$$

$$FII_t = \alpha' + \sum_{n=1}^{m} \beta'_n VIX_{t-n} + \sum_{p=1}^{m} \gamma'_p FII_{t-p} + \sum_{p=1}^{m} \delta'_p RET_t + \sum_{p=1}^{m} \mu'_p ILLIQ_t + \sum_{p=1}^{m} \pi'_p D(USD)_t + e'_t$$

Both the equations contain m lag values of all the variables.

ANALYSIS AND RESULTS

Descriptive Statistics

Table 1 represents the main features of the data series analyzed over the time period of our study. Distribution is positively skewed as analyzed from the results of the data. High Kurtosis values of all the data series except USD_INR indicate that they have flattened distribution representing extreme values on the tails. Jarque-Bera statistic for all the series are high representing that all series are not

normally distributed.

Table 1: Descriptive Statistics(April 2009 to March 2016)

	FII	ILLIQ	RET	USD_INR	VIX
Mean	177.30160	0.00000	0.04100	54.54633	21.68502
Median	138.23000	0.00000	0.02121	54.29075	19.79375
Maximum	17488.73000	0.00001	17.74407	68.77750	56.07000
Minimum	-5275.40000	0.00000	-5.91510	43.95000	11.56500
Std. Dev.	978.05190	0.00000	1.25484	7.60455	7.31643
Skewness	4.34476	4.89198	1.76473	0.13880	1.69019
Kurtosis	71.62689	25.02997	28.68567	1.55182	6.55612
Jarque-Bera	314225.40000	38155.31000	44141.85000	142.77790	1580.78900
Observations	1576	1576	1576	1576	1576

Augmented Dickey Fuller (ADF) Test

All the data series i.e. FII, ILLIQ, RET and VIX are stationary at level whereas USD_INR is stationary at first difference. In accordance, for further analysis, data series USD_INR is taken at first difference and rest of the variables are taken at level. ADF test results are represented in Table 2.

Table 2: Augmented Dickey Fuller Test

	t- statistic	Probability
FII	-13.11237	0.0000
ILLIQ	5.100699	0.0000
RET	-37.28915	0.0000
USD	-0.138199	0.9434
D(USD)	-18.35866	0.0000
VIX	-3.906964	0.0020

Granger Causality Test

This test is performed to explore the short-run dynamic causal relationship between the data series. While examining the causality from independent variables to FII, it has been observed that USD_INR granger causes FII flows, Return granger causes FII flows, VIX granger causes FII flows but Illiquity does not granger cause FII flows.

Table 3: Granger Causality Test

Dependent Variable: FII		
	F- Value	P- Value
USD	4.40037	0.0006
RET	21.0098	0.0000
VIX	5.17607	0.0001
ILLIQ	0.88207	0.4922
Dependent Variable: VIX		
	F- Value	P- Value
FII	0.45816	0.8075
ILLIQ	9.44555	0.0000
RET	3.3366	0.0053
USD	2.33134	0.0403

Optimum Lag length selection

While determining the optimal lag length for FII, both AIC and SC are considered and as per the results in table 4, lag length 5 is selected for FII equation. For the VIX equation also, lag 5 is selected as per the minimum value of Akaike Information

Table 4: Determination of Optimal Lag Length

Optimum Lag length selection		
Dependent Variable: FII		
	Akaike Information Creterion	Schwarz Information Creterion
Lag 1	-22.10332	-22.03498
Lag 2	-22.11111	-21.94881
Lag 3	22.17884	22.00117
Lag 4	-22.17614	-21.94379
Lag 5	-22.18114	-21.89411
Dependent Variable: VIX		
	Akaike Information Creterion	Schwarz Information Creterion
Lag 1	-8.884422	-8.816086
Lag 2	-8.943847	-8.820842
Lag 3	8.971677	8.794003
Lag 4	-8.976169	-8.743826
Lag 5	8.978073	8.691061

Criterion.

Vector Auto Regression:

From the results of the VAR model describing India VIX, it is evidenced that the Indian VIX is positively related to its own

Table 5: Vector Auto regression Estimates

Table 5.1: Vector Auto regression Estimates (Dependent Variable: FII)		
	Coefficients	Standard Error	t- statistic
FII(-1)	0.1256	-0.0274	4.5863
FII(-2)	0.1547	-0.0274	5.6401
FII (-3)	0.0765	-0.0276	2.7693
FII (-4)	0.0894	-0.0272	3.2867
FII(-5)	0.0607	-0.0261	2.3245
ILLIQ(-1)	-4796404	-160000000	-0.0293
ILLIQ(-2)	365000000	-230000000	1.5906
ILLIQ(-3)	-396000000	-240000000	-1.6863
ILLIQ(-4)	207000000	-240000000	0.8692
ILLIQ(-5)	-167000000	-170000000	-0.9963
D(USD(-1))	-123.5767	-80.1207	-1.54238
D(USD(-2))	8.873369	-107.697	0.08239
D(USD(-3))	-9.103851	-107.321	-0.08483
D(USD(-4))	-11.04228	-107.356	-0.10286
D(USD(-5))	132.5072	-80.0780	1.65471
RET(-1)	186.5051	-22.2696	8.37487
RET(-2)	-5.642509	-23.3802	-0.24134
RET(-3)	22.97353	-22.8644	1.00477
RET(-4)	-17.97564	-22.629	-0.79436
RET(-5)	-13.15802	-19.7566	-0.666
VIX(-1)	-4.026331	-19.7773	-0.20358
VIX(-2)	-15.57009	-28.3088	-0.55001
VIX(-3)	29.06749	-28.0817	1.0351
VIX(-4)	6.669225	-27.4204	0.24322
VIX(-5)	-20.08836	-19.1681	-1.04801
C value		300.4587	
R squared		0.224712	
Adjusted R square		0.212167	

Table 5.2: Vector Autoregression Estimates (Dependent Variable: VIX)			
	Coefficients	Standard Error	t- statistic
VIX(-1)	1.00335	-0.02968	33.80460
VIX(-2)	-0.06753	-0.04248	-1.58945
VIX(-3)	0.00571	-0.04214	0.13542
VIX(-4)	-0.02954	-0.04115	-0.71783
VIX(-5)	0.05128	-0.02877	1.78267
ILLIQ(-1)	-585991.7	-245416	-2.38775
ILLIQ(-2)	1849827	-343992	5.37754
ILLIQ(-3)	-804439.1	-352703	-2.28078
ILLIQ(-4)	-594252.2	-357955	-1.66013
ILLIQ(-5)	278558.9	-251929	1.10571
D(USD(-1))	0.01134	-0.12024	0.09428
D(USD(-2))	-0.11349	-0.16163	-0.70216
D(USD(-3))	0.38292	-0.16106	2.37192
D(USD(-4))	-0.19317	-0.16111	-1.19899
D(USD(-5))	-0.09743	-0.12018	-0.81068
RET(-1)	0.13019	-0.03342	3.89534
RET(-2)	0.00293	-0.03509	0.08358
RET(-3)	-0.02622	-0.03431	-0.76412
RET(-4)	0.00473	-0.03396	0.13932
RET(-5)	0.01439	-0.02965	0.49214
FII(-1)	-0.00004	-0.00004	-0.98309
FII(-2)	-0.00001	-0.00004	-0.15417
FII (-3)	0.00008	-0.00004	1.89781
FII (-4)	-0.00004	-0.00004	-1.09781
FII(-5)	-0.00001	-0.00004	-0.33774
C value	1.295604		
R squared	0.967983		
Adjusted R square	0.967464		

first lag, negatively related to second lag of its own, positively related to its third lag, negatively to fourth and positively to fifth. Estimates clearly show that Indian VIX is positively related to third lag of FII, first, second, fourth & fifth lag of Return, first and third lag of USD_INR and second & fifth lag of illiquidity. It is negatively related to first, second, fourth & fifth lag of FII, third lag of Return, second, fourth & fifth lag of USD_INR and first, third & fourth lag of illiquidity.

The model has high explanatory power in explaining the Indian VIX as the value of adjusted R square is 0.967464 (approx. 1) as represented in Table 5.2.VAR model describing the FII does not have high R squared value (0.212167) hence it does not significantly explain the FII flows.
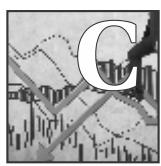
CONCLUSION

A plethora of studies is available signifying the multi directional relationships between stock market returns, FII investment patterns, exchange rates, volatility of indices and so on. But only a handful of literature has been presented on the expected volatility and its relationship with FII investments in a country. This paper is an attempt to explore the same with reference to the Indian stock market.

The present study indicates that VIX is an imperative constituent in explaining the current FII flows into the Indian stock markets. However, the reverse i.e. the direction of causality from FII flows to the expected volatility of the markets does not hold true. This is contrary to the common perception that the increased FII participation in equity markets could lead to considerable volatility in markets.

Strong linkages between explanatory variables: USD exchange rate, Nifty returns, Illiquidity and dependent variables: expected volatility & FII flows have been found. While explaining the FII patterns in Indian markets, USD exchange rate has been found to be a vital component of the model; stock market returns adding further weights to the effect. Applying the VAR model on the FII flows and the Indian VIX, results present that the model significantly explains the Indian VIX but not the FII flows.

Principally, on the basis of the results, this study infers that: (1) FII flows into the Indian market tend to be caused by expected volatility and not the other way round; (2) exchange rate of USD/INR is a significant factor that impacts FII flows into the country; (3) returns in the Indian stock market is also a contributing factor in influencing the FII flows, and finally, (4) exchange rate of USD/INR also affects the expected volatility.

These findings suggest that foreign institutional investments (FIIs) affect the economy of a country through its effect on the factors such as exchange rates and foreign exchange reserves. Similarly, exchange rate movements are also understood to affect the FII inflows into the country. Performance of stock markets is affected by exchange rate movements though the magnitude of impact varies from one country to another. On a micro level, a change in the exchange rates would affect a firm's profits & overseas operations in turn affecting its stock prices and on a broader level, all such variations in stock prices lead to increased volatility of the stock markets.

Globally, derivative products are being offered based on the volatility indices and they provide a mechanism to hedge against volatility. In India also, NSE now offers NVIX, futures on India VIX and a lot lies ahead to be explored in continuance of the present study.

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