Forecasting Foreign Institutional Investors' (FII) Investment Flows in India : An Autoregressive Model

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Abstract

India is considered as one of the fastest emerging economies in the world and a leading nation in attracting foreign investments. The country offers huge investment opportunities to reap benefits for both domestic and foreign institutional investors (FIIs) in its equity market. India's FII investments are characterized by positive net inflows in most of the years since its inception in 1992. Only during 1998-99 and 2008-09, FII outflows were higher than inflows. Many earlier studies have concluded that FII flows were largely influenced by the Indian stock market returns. Considering the volatile nature of FII investment flows, this study attempted to forecast FII flows in Indian stock market using an autoregressive model. Net FII investments and stock market returns data from July 2013 to December 2015 were used to estimate an autoregressive model. Net FII flows from January 2016 to June 2016 were forecasted based on the formulated estimation. The forecasted values were then compared with the actual values to verify the model's reliability. The autoregressive model used in the study was an acceptable model as forecast errors were minimal, and it captured the investment trends correctly. Forecasting the FII investments can help in better policy formulation and are useful for making strategic decisions in the capital market.

Keywords: **FII investments, forecasting, Nifty returns, regression, ARCH test**

JEL Classification : C150, C530, F 210

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The Government of India's grave balance of payments (BOP) position in 1991 compelled the policymakers and legislators in India to reconsider their policies and stance of allowing foreign investment into the country. Subsequently, foreign investments, in particular, FIIs have exhibited a steady growth. Now, FIIs play a pivotal role in enhancing market turnover, liquidity, and price stability. In spite of numerous beneficial investment opportunities, FIIs are focusing upon India as a most favoured destination for making their investments. Earlier studies carried out by Batra (2003) and Ray (2009) proved that returns from the Indian stock market lead FII investments in India. Considering the economic benefits owing to FII investments in India, this study focuses on forecasting of FII investment flows in the Indian stock market.

FIIs are allowed to invest in all securities traded on primary and secondary markets, comprising of shares, debentures, and warrants of listed or to be listed companies on stock exchanges in India. FIIs are also allowed to

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Table 1. BSE and NSE Turnover in Cash Segment

Year	Turnover				
	BSE		NSE		
	Value (₹ in crores)	Percentage of Total Turnover	Value (₹ in crores)	Percentage of Total Turnover	Total Turnover (₹ in crores)
2008-09	11,00,074	28.6	27,52,023	71.4	38,52,097
2009-10	13,78,809	25.0	41,38,023	75.0	55,16,833
2010-11	11,05,027	23.6	35,77,410	76.4	46,82,437
2011-12	6,67,498	19.2	28,10,893	80.8	34,78,390
2012-13	5,48,774	16.8	27,08,279	83.2	32,57,054
2013-14	5,21,664	15.6	28,08,488	84.1	33,41,337
2014-15	8,54,845	16.5	43,29,655	83.5	51,84,500
2015-16	7,40,089	14.9	42,36,983	85.1	49,77,278

Source: Compiled from SEBI Annual Report, 2014 & 2016

Table 2. World Economic Outlook Projections (% Changes)

Economies	Actual	Projections	
	2015	2016	2017
World Output	**3.1**	**3.2**	**3.5**
Advanced Economies	**1.9**	**1.9**	**2.0**
United States	2.4	2.4	2.5
Germany	1.5	1.5	1.6
Japan	0.5	0.5	-0.1
United Kingdom	2.2	1.9	2.2
Emerging and Developing Economies	**4.0**	**4.1**	**4.6**
China	6.9	6.5	6.2
India	7.3	7.5	7.5
Brazil	-3.8	-3.8	0.0
Mexico	2.5	2.4	2.6
Nigeria	2.7	2.3	3.5
South Africa	1.3	0.6	1.2
ASEAN-5#	4.7	4.8	5.1

Note. # Indonesia, Malaysia, Philippines, Thailand, and Vietnam.

Source: World Economic Outlook: Too slow for Too Long, April 2016, published by IMF

invest in schemes introduced by domestic mutual funds. FII investments are volatile by nature and are often labelled as 'hot money'. Available empirical evidence also identifies that FII inflows and outflows are, by and large, influenced by the action of stock markets and macroeconomic aggregates of the host country. Thus, FII investments are dragged towards an economy with strong macroeconomic factors, high returns, lesser risk, and rising stock markets in terms of increasing market capitalization and turnover.

India, one of the major emerging markets, is now a notable destination for FDI and FII inflows. FII investments are considered as an enormous source of funds in the Indian stock market. Arrival of FIIs makes the market more competitive and assists the financial system of the host country to come in line with the international standard. At

the same time, FII investments in stock markets are highly volatile. The total turnover of the FIIs in the cash segment of the stock market dropped sharply from 21.5% in March 2015 to 6% in December 2015. Adding to the benefits, the FIIs also help in achieving a high degree of liquidity in stock markets. Though FIIs usually focus on secondary markets, they also assist the competent firms to price their new issues at a reasonable premium.

Among the Indian stock market, the National Stock Exchange (NSE) is very prominent and NSE's NIFTY 50 is considered to be a benchmark index. NSE was founded in 1992 and started trading from 1994 with the objective of establishing a nationwide trading facility for all types of securities and to provide equal access to all investors across the country and thereby achieving international standards. NSE Nifty is also a benchmark index of a country. An and Brown (2010) stated that NSE's NIFTY 50 represents more than 62% of the stock market turnover. Another noticeable NSE index is S&P CNX 500, which represents about 96% of the total market capitalization and about 93% of the total turnover on the NSE.

Looking at the trends in the turnover of NSE and BSE, one finds that decline in turnover on the exchanges started in 2010-11 and continued till 2013-14, mainly on account of the crisis and the uncertainties in global financial markets. Both NSE and BSE registered a lower value of trade during that period. It is also observed that NSE is doing far better than BSE in terms of turnover value (Table 1).

Apart from the domestic factors like economic growth, inflation, ease of doing business, policy framework, etc., major economic realignments also affect prospects differentially across countries and regions. These include slowdown in China, decline in oil prices, investment and trade, and declining capital flows to emerging markets and developed economies. These macroeconomic factors along with a host of non - economic factors like geopolitical tensions, political discords, etc., are generating substantial uncertainty.

The fact that India is the fastest-growing economy in the world attracts FII investments from other parts of the world, especially from developed economies (Table 2). This underlines the significance of FII investments in India. Many research studies have been carried to know the impact and relationship between FII investments and the Indian stock market.

Literature Review

Batra (2003) made an effort to understand the dynamics of the trading behaviour of FIIs and returns in the Indian equity market using both daily and monthly data from 1994 to 2002. The study confirmed the strong evidence of FIIs chasing market trends and adopting positive feedback trading strategies at the aggregate level on a daily basis. Chakraborty (2007) threw light on the direction of causality between FII flows and the Indian stock market returns using monthly data from April 1997 - March 2005.The outcome revealed that BSE Sensex return series showed greater variability than net FII flows. FII flows were an effect than a cause of stock market returns in India. Ray (2009) strived to identify whether there existed a causal relationship between net investment made by FIIs and the stock market returns by using daily data from January 2006 to June 2008. The Granger causality test confirmed that equity returns Granger-caused FII investments, but not the reverse. Ghosh (2015) analyzed the trend and determinants of FDI flows in India since 1980-81. The research found that lagged FDI inflows, inflation rate, interest rate, and per capita income were the significant determinants of current FDI inflows in India. Singh (2015) modelled and forecasted FDI investment in India using univariate ARIMA model. The outcome of the forecasted model indicated that higher FDI investment will be made in India during 2020.

Other Indian researchers who studied the relationship between FII investments and stock market movements include Khan, Rohit, Goyal, Ranjan, and Agarwal (2010) ; Dhiman (2012) ; Kumar (2007), Chittedi (2011) ; Bhora and Dutt (2011) ; Chandra (2012) ; Arora and Baluja (2013) ; Kumar (2011) ; Dua and Garg (2013) ; Mohan (2008) ; and Dasgupta (2014). The foreign researchers who investigated the relationship between FII investments and stock market movements are : Frenkel and Menkhoff (2004) ; Bae, Yamada, and Ito (2006) ; and Froot and Ramadorai (2008). They analyzed the relationship between institutional cross-border portfolio flows

and equity returns. Most of the studies revealed that FIIs' current investments followed market trends and their own past investment patterns.

Research Gap, Data, and Methodology

Though, there are many studies related to FIIs, almost all the studies reviewed by us focused on finding out the relationship between FIIs, stock markets, and macroeconomic variables. This research is unique as it attempts to forecast FII flows in India by considering its own past lags and stock market returns as an explanatory variable. In this study, monthly FII investments and monthly returns on Nifty index data are used. The time period considered for this forecasting analysis is from July 2013 to June 2016. This is because any prior data before this period are assumed to be too old and may not have any significant bearing on the period of forecast.

Brooks (2014) forecasting can be carried on either in a cross-sectional or a time series context. This research uses time series data and applies quantitative form of empirical research method. We used selective sampling method for choosing the stock index. In this study, monthly FII investments and return on Nifty index (RN) data are used, and the time period considered for this forecasting analysis is from July 2013 to June 2016. This is because any prior data before this period are assumed to be too old and may not have any significant bearing on the period of forecast. Among the time period for forecast analysis, July 2013 to December 2015 (30 observations) monthly data of FII investments and return on Nifty index are in-sample period data, which are used for estimating the regression equation and based on this estimated output, the FII investments for the next six months, which is known as out-of-sample period data, that is, from January 2016 to June 2016 are forecasted. The Figure 1 depicts the in-sample and out-sample periods. The data were obtained from sebi.gov.in, nsdl.co.in, and nseindia.com (Table 3).

The monthly data from July 2013 to December 2015 (30 observations) has been used for forecasting FII flows from January 2016 to June 2016 (6 observations). The autoregressive model framed for forecasting net FII investments is shown in the equation :

$$FII_t = \beta_0 + \beta_1 RN + \beta_2 FII(-1) + U_t$$

where, β_0 is the constant ; β_1 and β_2 are the coefficients; *RN* is Nifty returns ; *FII* (-1) is the first lag of FII investments, and U_t is the error term. The model is called as autoregressive model because it includes lagged values of the dependent variable among its explanatory variables. If the chosen model is correct, the forecast errors will be fewer. The forecasting errors widen usually due to wrong method and level of incorrectness in information is used to forecast the future.

The forecasted observations are then compared with the actual FII investments to check the accuracy of the forecast model. The data series considered for forecasting needs to be examined for stationarity. The stationarity property of the data is essential for forecasting. Upon confirming this, the suitable model of forecasting may be chosen. The estimated model should include the necessary dependent and independent variables related to forecasting. There are numerous forecasting methods and techniques available in practice. Forecasting the financial time series is commonly assumed to be a very tough job. Popular time series forecasting models are : Box - Jenkins (ARIMA) approach, Exponential smoothing method, Simple linear method, and ARCH family models (used in the presence of heteroscedasticity).

The selected estimate model is considered to be fit and good, only if the model has no statistical error. The term 'no statistical error' denotes that the regression model used for forecasting should have reasonable R^2, no serial correlation, no heteroscedasticity, and the residuals should be normally distributed. In this study, the regression forecast equation estimated has been put to test for all these diagnostic checking before the model is used for forecasting. After fulfilling all diagnostic tests, the estimated model is ready for forecasting. There are two types

Figure 1. In - Sample and Out - Sample Periods for Forecast Analysis

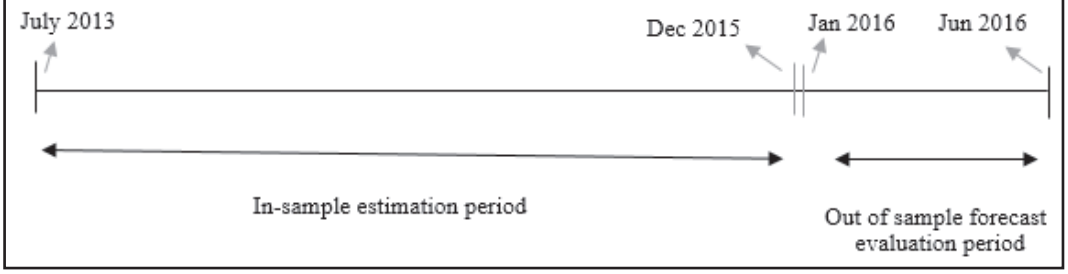


Table 3. Data Description for Forecasting Net FII Investments

Variables	Frequency	Unit of Measurement	Source cited
Net FII Equity Investment (FII)	Monthly	Indian Rupees (₹) crore	www.sebi.gov.in, www.nsdl.co.in
Return of Nifty Index (RN)	Monthly	Percentage (from Index, Base 1995 = 1000)	www.nseindia.com

of forecasting methods available namely, static forecast and dynamic forecast. Static forecast calculates a sequence of one-step ahead forecasts by using actual data instead of forecasted data based on lagged dependent variables. On the other hand, dynamic forecast computes forecasts for time periods after the first period in the sample by using the formerly forecasted values of the lagged left-hand variable. Dynamic forecasts are also known as *n* - step ahead forecasts. Dynamic forecasts are used in this research study.

Forecasting evaluation is required to ensure the reliability of the selected forecast model. One good way to do this is by laying both actual and forecasted values in a graph and observe how closely these two are moving together. If the forecast line captures all the upward and downward movements of the data and is closely moving along with the actual line, then it is considered that the estimated model is good. The ideal forecast model should have minimum forecast error. The forecast error is the gap between the actual data and the forecasted data. Statistically, this gap is known as root mean squared error (RMSE). Thus, the research framework outlines the procedure followed in analyzing the time-series data and is the base upon which all the analyses are carried out.

Analysis, Results, and Discussion

(1) Stationarity Test : The data distribution of a time-series can be laid in a graphical form to see whether the time series possesses the characteristics of constant mean, median, and covariance. The Figures 2 and 3 show the distribution of net FII investments and returns on Nifty data.

The movement of FII investments does not signal any clear trend and is mostly moving on the positive side. The returns on Nifty seems to be moving around the constant mean and does not indicate any trend. Further to this graphical inspection, the stationarity characteristics of monthly FII investments and return on Nifty data are probed using ADF test, and the result is given in the Table 4.

The null hypothesis 'Data series has a unit root' is rejected as the *t* - statistics of -3.1799 and -5.6224 are found to be significant at the 5% and 1% levels, respectively. As a result, the alternative hypothesis 'Data series has no unit root' is accepted. This means that data series is stationary for both FII investments and Nifty returns.

(2) Regression Model : The regression equation model having FII investments as a dependent variable and return on Nifty *(RN)* along with first lag of FII investments as independent variables is framed and the same model has been estimated. The result of the autoregressive estimation is shown in the Table 5.

The estimated autoregressive model has *RN* significant at the 1%. The *FII* (-1) is less than 5% significance

Figure 2. Net FII Investments

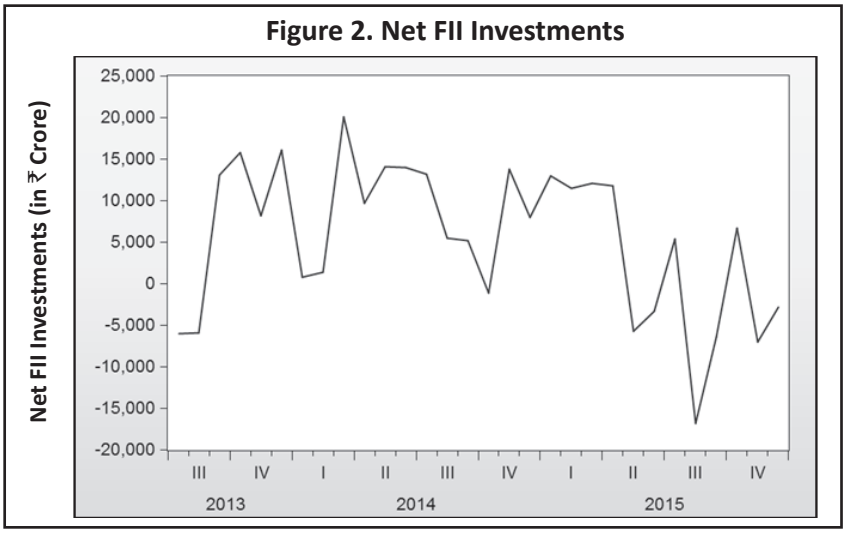


Figure 3. Returns on Nifty

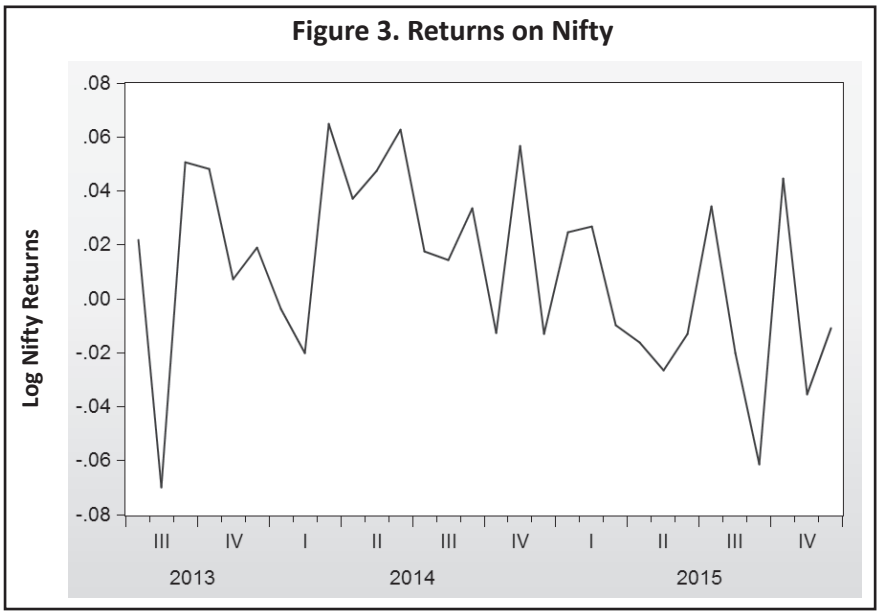


Table 4. ADF Test for Stationarity

H_0: Data series has Unit root				
Unit Root Test	**FII Investments**		**Nifty Returns**	
	***t* - statistics**	**Prob.**	***t* - statistics**	**Prob.**
Augmented Dickey-Fuller test statistic	-4.4180	0.0078*	-5.9296	0.0002*
Test critical values:	1% level	-4.3098		
	5% level	-3.5742		
	10% level	-3.2217		

Note. *, ** represents significant at 1% and 5% levels, respectively.

level. The model has *R*-squared value of 63.14%, and the *F*-statistic is significant at the 5% level. The Durbin-Watson statistic is close to the ideal value of 2. Hence, the model is accepted.

Table 5. Regression Results for FII Investments

Dependent Variable : FII Investments			
Included Observations: 14 After Adjustments			
Variable	**Coefficient**	***t* - statistic**	**Prob.**
C	3084.22	2.43359	0.0221
RN	2809.18	5.8421	0.0000*
FII (-1)	0.17538	2.126068	0.0464**
R-squared	0.63144	*F*-statistic	9.3408
Durbin - Watson stat		1.8869	

Note. *, ** Significant at 1% and 5% levels, respectively.

Before moving towards forecasting, it is essential to investigate the features of the residuals. If the residuals are uncorrelated and have constant mean and variance, then the study can use homoscedasticity models such as ordinary least square (OLS) and ARIMA to forecast the time series. If the residuals are found to have varying mean and variance, then there is a presence of heteroscedasticity in the time series. In such a case, ARCH and GARCH models prove to be valuable in forecasting the time series. Thus, before forecasting, the estimated model has been subjected to various diagnostic tests.

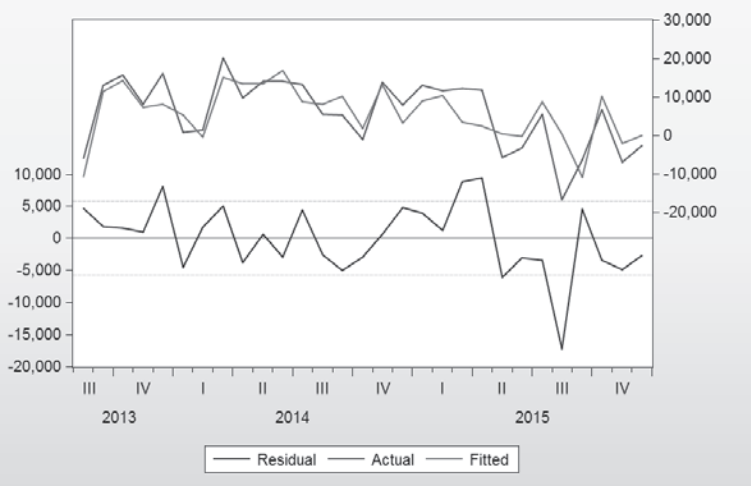
(3) Diagnostic Tests

(i) Serial Correlation Test : The presence of autocorrelation (also known as serial correlation) in the residuals is tested through Breusch - Godfrey serial correlation LM test. The Table 6 presents the results of the serial correlation test.

Table 6. Breusch - Godfrey Serial Correlation LM Test

H_0: No Serial Correlation.			
F-statistics	0.218843	Prob. *F*(2, 24)	0.8050
Obs**R*-squared	0.519399	Prob. Chi-square	0.7713

Figure 4. Residuals of the Regression Model



The *p* - value of *F*-statistics and observed *R*-square are very well higher than 0.05, which gives direction to accept the null hypothesis of 'No serial correlation'. Thus, the residuals of the model are free from serial correlation issue. So, the series as such is desirable for forecasting.

(ii) Graphical Inspection of Residuals : One of the initial ways to verify the characteristics of residual is to plot it in a graph and observe its pattern over a period. The Figure 4 depicts the residuals of monthly FII investments. The *X*-axis shows time period and the *Y*-axis reveals FII investments in ₹ crore.

Looking into the residuals, it is perceived that the residuals are moving around the constant mean of '0'. However, the variance seems to be not constant throughout the period. There is no evidence for volatility clustering (the larger movements are followed by series of large movements and the smaller movements are followed by series of small movements). The residuals of the model seem to be homoscedastic in nature. However, suitability in applying homoscedastic models such as OLS and ARIMA model has been further verified by appointing the ARCH test.

(iii) ARCH LM Test : The presence of any heteroscedasticity characteristics in residual is further examined through the ARCH LM test. The outcome of the test is shown in the Table 7.

Both the *F*-statistic and residual (Obs**R* - squared) are not significant as the *p* - value is much greater than 0.05, which point out that the null hypothesis 'No ARCH effect in residuals' is accepted and the alternative hypothesis 'ARCH effect in residuals' is rejected, that is, there is no heteroscedasticity issue in the estimated regression model. Thus, the ARCH test ensures that the data series is suitable for running OLS and ARMA models.

Table 7. ARCH LM Test for Residuals

H_0: There is no ARCH effect in residuals.			
Heteroscedasticity Test: ARCH			
F-Statistic	0.35461	Prob. *F*(1, 26)	0.6530
Obs**R* - squared	0.38184	Prob. Chi-square (1)	0.6107

(iv) Normality Test : Prior to forecasting, it is essential to test the normality condition of the residuals in order to find whether they are normally distributed or not. The normal distribution of the residuals is appropriate for forecasting. The Figure 5 shows the histogram.

↳ **H_0:** Residuals of the model are normally distributed.

The *X* - axis represents the residual values and the *Y* - axis represents the number of observations. The probability value of Jarque - Bera test is 33.17%, which is not significant at the 5% level. Therefore, null hypothesis 'Residuals of the model are normally distributed' is accepted.

(v) Forecasting FII Investments : After the diagnostic tests are over and the estimated model satisfies all the requirements for forecasting, the model is considered to be good and fit. The model is statistically stable to forecast the future values of FII investments. The estimated model has been forecasted using dynamic forecasts. As discussed, dynamic forecast computes forecast value for time periods after the first period in the sample by using the formerly forecasted values of the lagged left-hand variable. Dynamic forecasts are also known as *n* - stepahead forecasts.

First, the forecast is done for the intended period of six months. The period considered for forecasting is from January 2016 to June 2016. The Figure 6 presents the forecast output. The forecast of FII investments for the

Figure 5. Histogram of FII Investments

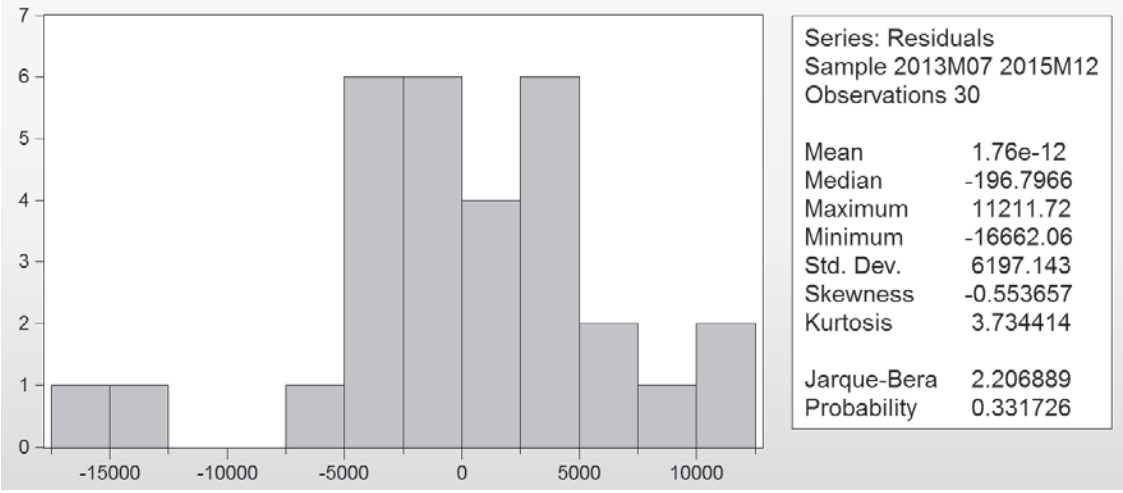


Figure 6. Forecast Output for Net FII Investments

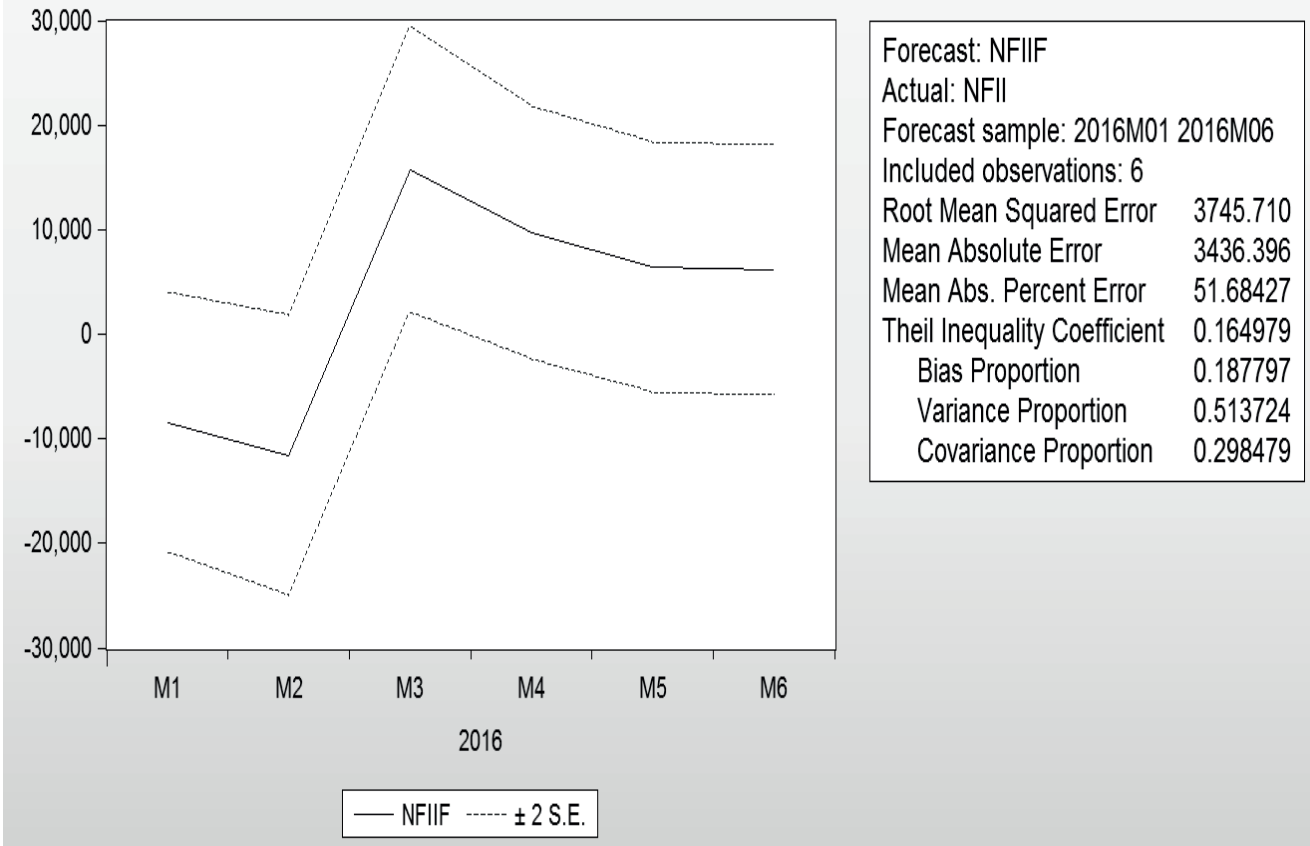


Figure 7. Actual and Forecasted Net FII Investment Movements

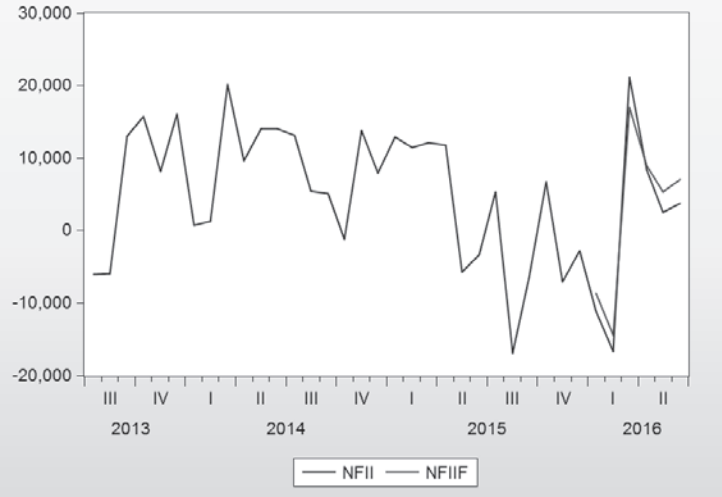


Table 8. Actual and Forecasted Net FII investments

Month & Year	Actual Net FII	Forecasted Net FII
Jan-16	-11126.4	-8706.33
Feb-16	-16647.8	-14441.8
Mar-16	21142.92	16958.24
Apr-16	8415.73	8911.47
May-16	2542.89	5329.21
Jun-16	3712.88	6987.83

period from January 2016 to June 2016 demonstrates that the value of FII investments was around ₹ -9,000 crore in January 2016 and this increased in March before registering a marginal decline in June 2016.The right side box information in the Figure 6 gives information regarding the forecast evaluation.

The root mean squared error (RMSE) indicates the forecast error of this model, which is 3745.71. This is the average gap between the actual FII investments and the forecasted FII investments. The bias proportion of 0.18 shows the error in mean. In general, the bias proportion closer to zero is desired. Zero bias proportion indicates absolutely no error in mean estimation. The forecasted model has a bias proportion of 0.18, which is lower. Most of the forecast errors are in variance and covariance proportion. Theil inequality coefficient is 0.16, which is lower and closer to zero. All these forecast evaluations inform that the forecast model is fairly good and the result of the model is accepted.

The forecasted FII investments are compared with the actual FII investments to further evaluate how accurately the developed forecast model predicts the FII investments. The Figure 7 and Table 8 compare the forecasted value with the actual value.

The forecast line (EQ1_F) and the actual line (FII) are moving in the same direction throughout the forecast period. This indicates that the forecast model used captures the correct direction of net FII investments in each of the six months taken for the study. The gap between the two lines indicates the forecast error. The forecast error is not huge as the two lines are closely associated. The Table depicts the actual and forecasted net FII values during the study period. Though there exists a difference between forecasted values and actual values, it is to be noted that both values increase and decrease together during the course of the study period barring February 2014. This

represents that our model captures almost all the direction of the movements, even though there is a shortfall in capturing the magnitude of the movement. It is understandable that there is no single forecast model which can exactly capture the actual data over a period of time.

Policy Implications

Forecasting FIIs' investments in the Indian equity market enables the policy makers, capital market investors, and other stakeholders to take informed decisions. Prior knowledge on FIIs' investment behaviour in the stock market helps the regulator to stabilize the market in case of any extreme fluctuations. Investment decisions of FIIs affect the exchange rate of Indian rupee vis-à-vis other currencies, particularly US$. So, forecasting FII flows will assist the Central bank to manage the exchange rates in a better way by formulating suitable strategies. Overall, forecasting FII investments may bring more stability in the Indian financial market and helps in better management of risks associated with it.

Conclusion

Thus, to conclude, FII investments can be forecasted with reasonable accuracy through the estimated dynamic regression model. The findings reveal that the direction and quantum of FII investments can be predicted with reasonable accuracy. The policy makers can effectively use such forecasting techniques, which may help them in effective policy framing. This is particularly important in managing foreign exchange reserves and keeping current account deficit under control.

Limitations of the Study and Scope for Further Research

Investment behaviour of FIIs depend upon a host of economic and financial factors. However, in this study, FII investments are predicted purely based on their own investment patterns and Indian stock market behaviour. Past investment patterns of FIIs may not reflect in the future. The market or external shocks have the potential to alter the behaviour of FIIs. Macroeconomic indicators like FII investments are subject to regulation, taxation, and interest rate changes. Thus, any pragmatic shift in such policies will force FIIs to behave differently. Therefore, the study holds good only under the normal circumstances which are free from the economic shocks and policy changes.

Though ample research has already been done on the FIIs, still there exists a knowledge gap. The role of FIIs in equity derivatives segment is much higher than cash segment, but hardly studies have been conducted in this context. The FII investments in the debt market are on a rise, and hence, research studies can be carried out to examine the impact of such a rise in the debt market. It is also important to study the degree of FIIs' participation, which has helped in lowering the cost of capital to Indian business firms.

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