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Foreign Investments in the Indian Stock Market: An Empirical Analysis

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Abstract

Foreign Direct Investments (FDI) and Foreign Institutional Investors (FII) provide capital for the growing Indian economy, to develop her infrastructure, such as sea ports, railways, roadways, airports, telecommunication, and other services. The present pace of industrialisation in India has also accelerated the need for foreign capital in the Indian context. The Indian stock market is continually responding to the changes in the foreign investment policies from time to time. This research analyses the impact of foreign capital investment inflow on the Indian stock market, with special reference to BSE Sensex and CNX Nifty. Statistical techniques such as correlation and multi-regression are used. The regression method used is Ordinary Least Squares (OLS) method or Auto-Regressive Distributed Lag (ARDL) Cointegration method, depending on whether the data is stationary, at level or not, with further analysis on long-run and short-run relationship among the variables studied. The research finds that there exists a weak negative correlation between FDI and Sensex, whereas a strong positive correlation exists between FDI and Nifty, as well as between FII and Sensex and FII and Nifty. Further, the variable FII shows a significant relationship with Sensex, whereas the relationship between FDI and Sensex is insignificant. FII also showed a significant positive relationship with Nifty, but the relationship between FDI and Nifty is insignificant. In summary, FII only showed a positive relation to stock movements, whereas with FDI, it was insignificant. Based on the empirical findings, FDI shows only long-run relationship towards the Indian Stock markets. It is recommended that the government must attract more FDI for economic growth, through industrial growth, infrastructural developments, technological upgradations, competitive advantages, and more. On the other hand, FII are directly connected to the stock market movements and also help in the growth and development of the country, in short-run as well as the long-run. This indicates that the government must adopt appropriate measures to attract more foreign institutional investors, in order to strengthen the economic development. This research contributes to the decision-making by the government regarding the promotion of FII or FDI in short-run or long-run, for accelerating growth in the economy. This finding is highly relevant in the contemporary context, as this relationship is derived for India based on recent data.

Keywords: India, Time Series, FDI, FII, ARDL, OLS, CNX Nifty, BSE Sensex

Introduction

Any investment which flows from one country to another is known as foreign investment. One of the major policy initiatives during the economic reform of 1991 was of promoting foreign investments. During the post-reform period, the government took various measures to promote foreign investments in India. Steps were also taken to promote foreign investments from time to time.

In an emerging economy like India, foreign capital investments play a significant role in measuring the growth of the economy. Over the decades, the level and popularity of foreign investments has dramatically risen because of increased globalisation in the business world. Being a developing economy, foreign investments are integral to the Indian economy. The main routes of foreign investments are: Foreign Direct Investments (FDI) and Foreign Institutional Investments (FII). Foreign investments were introduced in India under the FEMA Act 1991. FDI are a direct form of investments, where foreign companies bring in physical investments into a country, such as purchasing lands, buildings, factories, equipment, and more. FII are those investments where foreign companies invest in financial assets of other companies through the stock markets. These investments also encourage innovation and competition by bringing new services and technologies. Foreign capital is the preferred source to bridge the gap between the investments savings and domestic savings of the country.

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As opposed to the common belief that FDI promotes growth, the truth based on previous research is that although FDI promotes growth, the evidence is mixed and ambiguous. As per Neoclassical growth theory, the FDI inflow aids the capital formation that promotes economic growth (Mello & Luiz, 1997). Earlier studies empirically report that the FDI has a direct effect on economic growth (Levine & Renelt, 1992; Borensztein, de Geogorie & Lee, 1998; Gunaydin & Tatoglu, 2005; Ray, 2012; Zhang, 2014). There are examples like Indochina and Vietnam that are very successful in attracting FDI, achieving substantial growth in exports (Xuan & Xing, 2008). Greece is another example; a small open economy where FDI increase fostered economic growth in the long-run, but registered slow growth in exports in the short-run (Tsitouras, 2016). Positive long-run relationships, as well as short-run, was established between FDI and economic growth in Sri Lanka during 1980-2016, with 37 observations as per data by the World Development Index of World Bank (Reza et al., 2018; Lee & Chang, 2009; Naveed et al., 2013).

The economic development of the country is determined by industrial, agricultural, and service sector activities. For initiating and sustaining these activities, foreign capital investments are needed. Capital investments generate income and increase the gross national product or the national income of the country. Currently, FDI plays an important role in global businesses. It plays a key role in the internationalisation of business. FDI help accelerate the process of economic development in the host countries. Developing countries view FDI as a means of modernisation, income growth, economic development, and employment generation. The important benefits of FDI are that they bring in important factors of production, such as capital, foreign exchange, and skilled labour; they promote a willingness to take risks, help in economic growth, technology transfer, human resource development, employment generation, promotion of a competitive environment, boosting the international trade, improving the balance of payment, and also provide social and environment benefits. FDI are usually carried out through joint ventures, mergers and acquisitions, and collaborations.

FII are short-term in nature and are unstable. Institutional investments are mostly determined by the performance of stock markets of the respective countries in relation to other global markets. The flow of FII has been strongly correlated with the stock market returns. India opened the stock market to foreign investments in 1992 as part of the economic reform. The amount of investments were insignificant earlier, but in recent years there has been a significant increase. The strong FII investment has been one of the factors that contributes to the bullish trend in the Indian stock market. FII includes the following categories of institutions: Pension Funds, Mutual Funds, Investment Trusts, Endowment Funds, Insurance Companies, Asset Management Companies, Banks, and so on. The investment provides liquidity to the domestic stock markets and helps in raising valuation of securities in markets.

There are differences between FDI and FII; FDI are more stable. In addition, FII are considered as hot money capital, as they are not stable. FDI help create a competitive environment, bringing new investments in technologies and improved social conditions. India now liberalises their foreign policies for attracting more foreign investors into the country. The Indian government's attitude towards the foreign investments has also been changed during the past decades. The Indian stock markets have already experienced the differences after the changes made in foreign investment policies. Today, FDI and FII have become an instrument for economic integration and stimulation. FDI and FII are also becoming an important source of finance in India. The growing Indian economy needs more foreign capital in the form of FDI and FII for the development of infrastructures such as sea ports, railways, roadways, banking services, and other services. Industrialisation in India has also further strengthened the need for foreign capital inflow across industries.

As a growing country India is always in need of funds to financially support the development of infrastructure. FDI is a major source of foreign investment, as it makes the economy strong and resilient (Aritra & Andre, 2019). The foreign investments strongly influence the growth of Indian economy, and the growth of national economy is driven by technological and economic factors influenced from other economies (Satyanarayana et al., 2017). The government must make more efforts to attract FDI for smooth and rapid development of the economy, as well as the Indian markets (Naveen et al., 2019). Ekta and Pankaj (2014) showcased the benefits of FDI, which include economic growth, increasing trade, employment, better technology, and knowledge transfer. The growth of economy promotes the development of stock exchanges, and therefore, it has become essential to analyse the impact of FDI on the Indian stock exchanges (Honey, 2017). It is evident from literature review that FII also helps in improving the capital markets and corporate governance; however, it has negative impacts, such as potential capital outflow and inflation, causing problems to small investors, and having an adverse impact on exports (Karan et al., 2012).

FII follows market trend in India, as depicted by earlier research. There exists a direct relationship between FII and stock markets, i.e., higher the returns in the stock market, the more the foreign investments, and vice versa (Mohanasundaram et al., 2016). Another study showcased the impact of FDI on stock markets: an evidence from Pakistan concluded by adding some suggestions such as improving transparency and efficiency of the primary market, encouraging FDI in stock market to enhance competition, and also creating new job opportunities (Mouhamed et al., 2012). A different study highlighted that both foreign investments provide an impact for industrial and economic expansion. India is always considered a favourable location for foreign investors because of the availability of highly skilled labours and low manufacturing cost. FDI and FII bring capital to the economy; however, FDI is preferred because they are stable and there exists no causal relationship between the variables, except FII and GDP, which showed the relationship at a log of two years (Shikha, 2013).

The merits of FDI are development, employment, source for earning foreign exchange, export and import, and management. The demerits are vulnerability, inflation, and uncompetitive exports. India has been seen as the second-most popular FDI destination, after China, for transitional corporations. However, India still needs to go a long way for further growth in foreign investments. Though both foreign investments welcome economic growth, FDI plays an important role compared to FII. FDI help in the creation of assets in the manufacturing and infrastructure sectors. India still needs to go far to open up the market and to improve the lack of clear policy in foreign investments. It is better to work smart rather than work hard to attract foreign investments (Sumi & Mohit, 2015).

Data Methodology

The study is based on the impact of foreign investments on the Indian stock markets. The variables are Foreign Direct Investments (FDI), Foreign Institutional Investments (FII), BSE Sensex, and CNX Nifty. The data of the mentioned variables are collected through a secondary source. The source of data collection are the official websites of the Bombay Stock Exchange, National Stock Exchange, Reserve Bank of India Bulletins, and publications of the Department for Promotion of Industry and Internal Trade (DPIIT). The present study considers the data for 14 years, from 2006 (January) – 2019 (July). The data was collected on a monthly basis, with a total of 163 observations. The hypotheses are as follows:

$H0_1$: FDI has no significant impact on SENSEX movements.

$H1_1$: FDI has a significant impact on SENSEX movements.

$H0_2$: FII has no significant impact on SENSEX movements.

$H1_2$: FII has a significant impact on SENSEX movements.

$H0_3$: FDI has no significant impact on NIFTY movements.

$H1_3$: FDI has a significant impact on NIFTY movements.

$H0_4$: FII has no significant impact on NIFTY movements.

$H1_4$: FII has a significant impact on NIFTY movements.

In order to analyse the data, statistical techniques such as correlation and multi-regression are used. The regression method used is Ordinary Least Square (OLS) for level data and Auto-Regressive Distributed Lag (ARDL) in the case of lagged data, with corresponding further analysis for long-run and short-run relationships among variables.

If all the variables in the unit root test are stationary, then the OLS method can be used to analyse the relationship between the variables. This method is used to analyse the relationship between FDI, FII, and SENSEX.

Dependent Variable: SENSEX

Independent Variables: FDI and FII

The model can be estimated as:

$$SENSEX = C(1) + C(2)*FDI + C(3)*FII$$

However, when there exists a mix of stationary and non-stationary series, the ARDL method is used to analyse the cointegration between the variables. This method is used to analyse the relationship between FDI, FII, and NIFTY.

Dependent Variable: NIFTY

Independent Variables: FDI and FII

The model can be estimated as: NIFTY = α + β*FDI + γ*FII + e_t

The standard ARDL model is: ΔNifty = c + β_1*FDI + β_2*FII + $\sum \alpha_{1i} \Delta FDI_{t-1} + \sum \alpha_{2i} \Delta FII_{t-1} + \varepsilon_t$

Empirical Results and Discussion

The preliminary analysis of the variables is done through analysing the unit root test of FDI, FII, Sensex, and Nifty. The characteristics of time series data is determined by doing a regression analysis, to examine the relationship between the variables. Before carrying out regression analysis, one needs to check whether the time series data is stationary or not. Statistical test is used to determine the stationarity of the series. Unit root test is used as the statistical test for stationarity of the series. Unit root test gives statistical evidence for the stationarity of the mentioned series.

Unit Root Test for FDI

H0: FDI has a unit root.

H1: FDI has no unit root.

Table 1: Unit Root Test for FDI

Null Hypothesis: FDI has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 0 (Automatic-based on SIC, max lag = 13)				
			t-Statistic	*Prob.**
Augmented Dickey-Fuller test statistic			−9.698201	0.0000
Test critical values:	1% level		−4.015700	
	5% level		−3.437801	
	10% level		−3.143138	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(FDI)				
Method: Least Squares				
Date: 05/13/20 Time: 20:08				
Sample (adjusted): 2006M02 2019M07				
Included observations: 162 after adjustments				
Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
FDI(−1)	−0.744351	0.076751	−9.698201	0.0000
C	2037.549	1078.614	1.889043	0.0607
@TREND("2006M01")	111.2689	16.03521	6.939036	0.0000
R-squared	0.371690	Mean dependent var		176.7469
Adjusted R-squared	0.363787	S.D. dependent var		8419.926
S.E. of regression	6715.984	Akaike info criterion		20.48071
Sum squared resid	7.17E+09	Schwarz criterion		20.53789
Log likelihood	−1655.938	Hannan-Quinn criter.		20.50393
F-statistic	47.02988	Durbin-Watson stat		2.028695
Prob(F-statistic)	0.000000			

Table 1 (unit root test) shows that the probability of FDI is 0.0000. Since the p-value is less than 0.05 ($0.0000 < 0.05$), the null hypothesis (H0) is rejected and the alternative hypothesis (H1) is accepted. Hence, it is concluded that the variable FDI has no unit root or the series is stationary.

Unit Root Test for FII

H0: FII has a unit root.

H1: FII has no unit root.

Table 2: Unit Root Test for FII

Null Hypothesis: FII has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 0 (Automatic-based on SIC, max lag = 13)				
			t-Statistic	*Prob.**
Augmented Dickey-Fuller test statistic			−9.892602	0.0000
Test critical values:	1% level		−4.015700	
	5% level		−3.437801	
	10% level		−3.143138	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(FII)				
Method: Least Squares				
Date: 05/13/20 Time: 20:36				
Sample (adjusted): 2006M02 2019M07				
Included observations: 162 after adjustments				
Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
FII(−1)	−0.772502	0.078089	−9.892602	0.0000
C	3284.307	1574.601	2.085803	0.0386
@TREND("2006M01")	−2.612479	16.42654	−0.159040	0.8738
R-squared	0.381133	Mean dependent var		−119.9888
Adjusted R-squared	0.373348	S.D. dependent var		12350.71
S.E. of regression	9776.990	Akaike info criterion		21.23180
Sum squared resid	1.52E+10	Schwarz criterion		21.28897
Log likelihood	−1716.775	Hannan-Quinn criter.		21.25501
F-statistic	48.96054	Durbin-Watson stat		1.988647
Prob(F-statistic)	0.000000			

Table 2 (unit root test) shows that the probability of FII is 0.0000. Since the p-value is less than 0.05 (0.0000 < 0.05), the null hypothesis (H0) is rejected and the alternative hypothesis (H1) is accepted. Hence, it is concluded that the variable FII has no unit root or the series is stationary.

Unit Root Test for SENSEX

H0: SENSEX has a unit root.

H1: SENSEX has no unit root.

Table 3: Unit Root Test for SENSEX

Null Hypothesis: SENSEX has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 1 (Automatic-based on SIC, max lag = 13)				
			t-Statistic	*Prob.**
Augmented Dickey-Fuller test statistic			−4.544302	0.0018
Test critical values:	1% level		−4.016064	
	5% level		−3.437977	
	10% level		−3.143241	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(SENSEX)				
Method: Least Squares				
Date: 05/13/20 Time: 20:38				
Sample (adjusted): 2006M03 2019M07				
Included observations: 161 after adjustments				

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
SENSEX(−1)	−0.336335	0.074012	−4.544302	0.0000
D(SENSEX(−1))	−0.283460	0.076468	−3.706896	0.0003
C	32386.92	8390.930	3.859753	0.0002
@TREND("2006M01")	−86.98361	52.23592	−1.665207	0.0979
R-squared	0.296613	Mean dependent var		-179.3416
Adjusted R-squared	0.283173	S.D. dependent var		34517.01
S.E. of regression	29224.05	Akaike info criterion		23.42790
Sum squared resid	1.34E+11	Schwarz criterion		23.50446
Log likelihood	−1881.946	Hannan-Quinn criter.		23.45899
F-statistic	22.06858	Durbin-Watson stat		2.032907
Prob(F-statistic)	0.000000			

Table 3 (unit root test) shows that the probability of SENSEX is 0.0018. Since the p-value is less than 0.05 (0.0018 < 0.05), the null hypothesis (H0) is rejected and the alternative hypothesis (H1) is accepted. Hence, it is concluded that the variable SENSEX has no unit root or the series is stationary.

Unit Root Test for NIFTY

H0: NIFTY has a unit root.

H1: NIFTY has no unit root.

Table 4: Unit Root Test for NIFTY

Null Hypothesis: NIFTY has a unit root				
Exogenous: Constant, Linear Trend				
Lag Length: 1 (Automatic-based on SIC, max lag = 13)				
			t-Statistic	*Prob.**
Augmented Dickey-Fuller test statistic			−2.815644	0.1939
Test critical values:	1% level		−4.016064	
	5% level		−3.437977	
	10% level		−3.143241	
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(NIFTY)				
Method: Least Squares				
Date: 05/14/20 Time: 11:17				
Sample (adjusted): 2006M03 2019M07				
Included observations: 161 after adjustments				
Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
NIFTY(−1)	−0.142435	0.050587	−2.815644	0.0055
D(NIFTY(−1))	−0.345885	0.075697	−4.569328	0.0000
C	19102.29	12719.25	1.501841	0.1351
@TREND("2006M01")	411.5097	174.6172	2.356640	0.0197
R-squared	0.212104	Mean dependent var		3586.627
Adjusted R-squared	0.197048	S.D. dependent var		76668.86
S.E. of regression	68701.11	Akaike info criterion		25.13745
Sum squared resid	7.41E+11	Schwarz criterion		25.21401
Log likelihood	−2019.565	Hannan-Quinn criter.		25.16853
F-statistic	14.08826	Durbin-Watson stat		2.043087
Prob(F-statistic)	0.000000			

Table 4 (unit root test) shows that the probability of NIFTY is 0.1939. Since the p-value is greater than 0.05 (0.1939 > 0.05), we accept the null hypothesis (H0) and reject the alternative hypothesis (H1). Hence, it is concluded that the variable NIFTY has unit root or the series is non-stationary.

Summary of the Unit Root Test

A series with a positive unit root is said to be integrated and of order 1; it is represented as I(1). A stationary series with no unit root is said to be integrated and of order 0; it is represented as I(0). Here, the unit root test is carried out based on Augmented Dickey-Fuller Test (ADF). Table 5 depicts the summary of the unit root tests.

Table 5: Summary of Unit Root Tests

Variables	*Status*
FDI	I(0)
FII	I(0)
SENSEX	I(0)
NIFTY	I(1)

The results of the unit root test depicted that all variables included in the model are stationary, except NIFTY. The model, which includes only stationary series, is analysed by using the Ordinary Least Square (OLS) method, and the mix of stationary and non-stationary series is analysed by using the Auto Regressive Distributed Lag (ARDL) model.

Ordinary Least Square Method

If all the variables in the unit root test are stationary in nature, then the OLS method can be used to analyse the relationship between the variables. The method is used to analyse the relationship between FDI, FII, and SENSEX.

Dependent Variable: SENSEX

Independent Variables: FDI and FII

The model can be estimated as: SENSEX = C(1) + C(2)*FDI + C(3)*FII

Table 6: The Result of OLS

Dependent Variable: SENSEX				
Method: Least Squares				
Date: 05/14/20 Time: 18:55				
Sample: 2006M01 2019M07				
Included observations: 163				
Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
C	77590.71	5469.402	14.18632	0.0000
FDI	−0.306291	0.294367	−1.040509	0.2997
FII	0.630956	0.291673	2.163234	0.0320
R-squared	0.039089	Mean dependent var	75598.66	
Adjusted R-squared	0.027078	S.D. dependent var	37060.14	
S.E. of regression	36554.94	Akaike info criterion	23.86925	
Sum squared resid	2.14E+11	Schwarz criterion	23.92619	
Log likelihood	−1942.344	Hannan-Quinn criter.	23.89237	
F-statistic	3.254369	Durbin-Watson stat	0.799165	
Prob(F-statistic)	0.041175			

The regression table (Table 6) shows the relationship between the model and the dependent variables. Here, the R^2 value is 3.9089% (0.039089), which is undesirable, as a greater value of R^2 shows a strong relationship between the variables. The model explains 3.9089% variation. The independent variables, FDI and FII, jointly could result only in 3.9089% of variation in SENSEX. The FDI and FII can influence only 3.9089% of SENSEX; the remaining 96.0911% variation in SENSEX can be explained by other variables or external factors.

Here, the probability value of FDI is 0.2997 (0.2997 > 0.05) and the value of FII is (0.0320 < 0.05). The independent variable FDI is not significant, while the variable FII is significant. So both the variables, FDI and FII, cannot individually influence SENSEX. Only FII can influence SENSEX.

Here, the probability of F-statistic is 0.041175 (0.041175 > 0.05), which is less than 0.05; it shows that the value is significant. The independent variables jointly could influence the dependent variable. Both FDI and FII jointly can influence SENSEX.

The sign of coefficients also influences the SENSEX. The coefficient of FDI is −0.306291; the negative sign shows that when FDI goes up by 1 unit, on an average SENSEX will go down by 30.6291 units, provided other independent values are constant. The coefficient of FII is 0.630956; the positive sign shows that when FII goes up by 1 unit, on an average SENSEX will go up by 63.0956 units.

Since the regression analysis does not show goodness of fit, one more way of analysing the relation between the variables is to check for residuals in the regression. Analysis of residuals includes checking for:

- Serial correlation
- Heteroscedasticity
- Normal distribution

Serial Correlation using LM Test for Serial Correlation

Serial correlation is where the error term in the data is carried out from one period to another.

H0: There is no serial correlation.

H1: There is serial correlation.

Table 7: Breusch-Godfrey Serial Correlation LM Test for Serial Correlation

Breusch-Godfrey Serial Correlation LM Test:				
Null hypothesis: No serial correlation at up to 2 lags				
F-statistic	57.64793	Prob. F(2,158)		0.0000
Obs*R-squared	68.76513	Prob. Chi-Square(2)		0.0000
Test Equation:				
Dependent Variable: RESID				
Method: Least Squares				
Date: 05/14/20 Time: 20:05				
Sample: 2006M01 2019M07				
Included observations: 163				
Pre-sample missing value lagged residuals set to zero.				
Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
C	-1251.535	4194.767	−0.298356	0.7658
FDI	0.009819	0.225376	0.043565	0.9653
FII	0.247854	0.227592	1.089028	0.2778
RESID(−1)	0.437485	0.077136	5.671623	0.0000
RESID(−2)	0.289710	0.076259	3.799025	0.0002
				−1.21E−1
R-squared	0.421872	Mean dependent var		1
Adjusted R-squared	0.407236	S.D. dependent var		36328.59
S.E. of regression	27969.81	Akaike info criterion		23.34583
Sum squared resid	1.24E+11	Schwarz criterion		23.44073
Log likelihood	-1897.685	Hannan-Quinn criter.		23.38436
F-statistic	28.82396	Durbin-Watson stat		2.088966
Prob(F-statistic)	0.000000			

Here, as per Table 7, probability of chi-square is 0.0000 (0.0000 < 0.05), which is less than 0.05. Therefore, the null hypothesis (H0) is rejected and the alternative hypothesis (H1) is accepted. The variables have serial correlation. And each variable is dependent on one another.

Heteroscedasticity Test

Heteroscedasticity is a well ordered change in the spread of residuals over the measured values. Heteroscedasticity is an issue in OLS, because it assumes that all the residuals are taken from a population that has constant variance (homoscedasticity).

H0: There is no homoscedasticity.

H1: There is homoscedasticity.

Table 8: Breusch-Pagan-Godfrey Heteroscedasticity Test

Heteroscedasticity Test: Breusch-Pagan-Godfrey				
Null hypothesis: Homoscedasticity				
F-statistic	4.463462	Prob. F(2,160)		0.0130
Obs*R-squared	8.613717	Prob. Chi-Square(2)		0.0135
Scaled explained SS	30.16391	Prob. Chi-Square(2)		0.0000
Test Equation:				
Dependent Variable: RESID^2				
Method: Least Squares				
Date: 05/14/20 Time: 19:42				
Sample: 2006M01 2019M07				
Included observations: 163				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.52E+09	5.20E+08	2.921766	0.0040
FDI	−33221.22	27973.23	−1.187607	0.2367
FII	70711.56	27717.21	2.551179	0.0117
R-squared	0.052845	Mean dependent var		1.31E+09
Adjusted R-squared	0.041005	S.D. dependent var		3.55E+09
S.E. of regression	3.47E+09	Akaike info criterion		46.79312
Sum squared resid	1.93E+21	Schwarz criterion		46.85006
Log likelihood	−3810.639	Hannan-Quinn criter.		46.81624
F-statistic	4.463462	Durbin-Watson stat		1.793637
Prob(F-statistic)	0.012992			

Here, as per Table 8, the observed R-square is 8.613717 and the probability of chi-square is 0.0135 (0.0135 < 0.05), which is less than 0.05. The null hypothesis (H0) is rejected and the alternative hypothesis (H1) is accepted. There exists homoscedasticity in the model. The error terms in the model are normally distributed.

Normal Distribution Test

The relevance of the histogram and density trace of the residuals is to check whether the corresponding data are normally distributed. Since the sample is large, it is best to rely on an histogram for evaluating the normal distribution in the residuals.

H0: Residuals are not normally distributed.

H1: Residuals are normally distributed.

Here, the value of Jarque-Bera is 238.1772 and the probability value is 0.00000 (0.0000 < 0.05), which is less than 0.05. The null hypothesis (H0) is rejected and the alternative hypothesis (H1) is accepted. In the above model, residuals are normally distributed, as shown in Fig. 1.

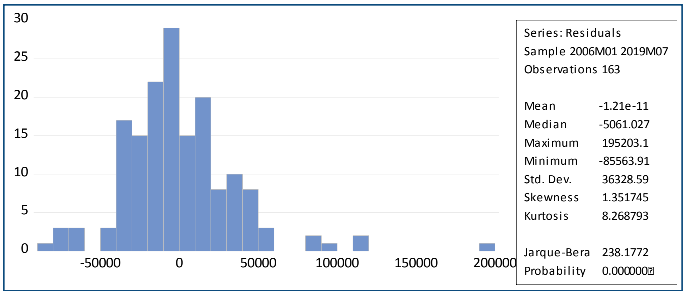

Fig. 1: Histogram of Residuals

Summary of OLS

The regression model which is chosen is not a good fit. Here, only the independent variable FII is significant and the other variable FDI is not significant. The variables are individually not significant, while jointly they are significant. The residuals in the model show that there exists a serial correlation and homoscedasticity in the model. However, the residuals are normally distributed. All the above evidence shows that the model is not a good fit, which means that FDI and FII are not the only variables that influence the SENSEX. Only 3.9089% of the independent variables can influence the SENSEX; the remaining 96.0911% is influenced by external or outside factors. In the above linear equation, 77590.7055669 is the constant term or the intercept which will exist, independent of FII and FDI. The constant term C(1) includes all the other or unobserved factors that influence SENSEX.

The Estimated Equation is:

Estimation Command:

LS SENSEX C FDI FII

Estimation Equation:

SENSEX = C(1) + C(2)*FDI + C(3)*FII

Substituted Coefficients:

SENSEX = 77590.7055669 − 0.306291101435*FDI + 0.630956008762*FII

FDI

The null hypothesis and the alternative hypothesis, with respect to FDI and BSE SENSEX, are:

$H0_1$: FDI has no significant impact on SENSEX movements.

$H1_1$: FDI has a significant impact on SENSEX movements.

The p value related to FDI is 0.2997 (0.2997 > 0.05), which is greater than 0.05. So, the null hypothesis is accepted and the alternative hypothesis is rejected. Hence, it can be concluded that FDI has no significant impact on SENSEX movements.

FII

The null hypothesis and the alternative hypothesis, with respect to FII and BSE SENSEX, are:

$H0_1$: FII has no significant impact on SENSEX movements.

$H1_1$: FII has a significant impact on SENSEX movements.

The p value related to FII is 0.0320 (0.0320 < 0.05), which is less than 0.05. So, the null hypothesis is rejected and the alternative hypothesis is accepted. Hence, it can be concluded that FII has a significant impact on SENSEX movements.

Auto Regressive Distributed Lag Method

Minimum Lag Order

The optimal lag model is chosen by selecting the lowest value for Akaike Info Criterion (AIC) and Schwarz Criterion (SC).

- When minimum lag order(p) = 6, the equation in EViews is written as:

D(nifty) c D(nifty(−1)) D(nifty(−2)) D(nifty(−3)) D(nifty(−4)) D(nifty(−5)) D(nifty(−6)) D(fdi(−1)) D(fdi(−2)) D(fdi(−3)) D(fdi(−4)) D(fdi(−5)) D(fdi(−6)) D(fii(−1)) D(fii(−2)) D(fii(−3)) D(fii(−4)) D(fii(−5)) D(fii(−6)) nifty(−1) fdi(−1) fii(−1)

The estimated result:

Table 9: Result for Lag Length 6

Dependent Variable: D(NIFTY)				
Method: Least Squares				
Date: 05/16/20 Time: 18:27				
Sample (adjusted): 2006M08 2019M07				
Included observations: 156 after adjustments				
Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
C	10784.24	15818.55	0.681746	0.4966
D(NIFTY(−1))	−0.422485	0.099853	−4.231075	0.0000
D(NIFTY(−2))	−0.108765	0.103425	−1.051636	0.2949
D(NIFTY(−3))	−0.063617	0.106232	−0.598846	0.5503
D(NIFTY(−4))	−0.002801	0.105419	−0.026569	0.9788
D(NIFTY(−5))	−0.230944	0.100405	−2.300118	0.0230
D(NIFTY(−6))	−0.021394	0.090677	−0.235940	0.8138
D(FDI(−1))	−1.941386	1.388532	−1.398157	0.1644
D(FDI(−2))	−1.368462	1.322656	−1.034632	0.3027
D(FDI(−3))	−1.952545	1.266150	−1.542111	0.1254
D(FDI(−4))	−1.956264	1.180370	−1.657331	0.0998
D(FDI(−5))	−0.607208	1.063139	−0.571146	0.5689
D(FDI(−6))	−0.732638	0.876158	−0.836194	0.4045
D(FII(−1))	1.476991	1.272757	1.160466	0.2479
D(FII(−2))	0.704301	1.174348	0.599738	0.5497
D(FII(−3))	−0.018977	1.075770	−0.017641	0.9860
D(FII(−4))	0.345329	0.941748	0.366689	0.7144
D(FII(−5))	0.090748	0.816298	0.111171	0.9116
D(FII(−6))	0.120783	0.623292	0.193783	0.8466
NIFTY(−1)	−0.129332	0.063484	−2.037222	0.0436
FDI(−1)	2.767248	1.337883	2.068378	0.0405
FII(−1)	−0.049521	1.355538	−0.036533	0.9709
R-squared	0.327382	Mean dependent var		3808.481
Adjusted R-squared	0.221972	S.D. dependent var		77444.74
S.E. of regression	68310.84	Akaike info criterion		25.23156
Sum squared resid	6.25E+11	Schwarz criterion		25.66167
Log likelihood	−1946.062	Hannan-Quinn criter.		25.40625
F-statistic	3.105787	Durbin-Watson stat		2.008663
Prob(F-statistic)	0.000039			

- When minimum lag order(p) = 4, the equation in EViews is written as:

D(nifty) c D(nifty(−1)) D(nifty(−2)) D(nifty(−3)) D(nifty(−4)) D(fdi(−1)) D(fdi(−2)) D(fdi(−3)) D(fdi(−4)) D(fii(−1)) D(fii(−2)) D(fii(−3)) D(fii(−4)) nifty(−1) fdi(−1) fii(−1)

The estimated result:

Table 10: Result for Lag Length 4

Dependent Variable: D(NIFTY)				
Method: Least Squares				
Date: 05/16/20 Time: 18:31				
Sample (adjusted): 2006M06 2019M07				
Included observations: 158 after adjustments				
Variable	*Coefficient*	*Std. Error*	*t−Statistic*	*Prob.*
C	16069.01	14491.46	1.108860	0.2694
D(NIFTY(−1))	−0.411873	0.094221	−4.371355	0.0000
D(NIFTY(−2))	−0.079726	0.100999	−0.789378	0.4312
D(NIFTY(−3))	−0.006375	0.099838	−0.063858	0.9492
D(NIFTY(−4))	0.098319	0.087421	1.124667	0.2626
D(FDI(−1))	−1.861049	1.220196	−1.525205	0.1294
D(FDI(−2))	−1.295039	1.155757	−1.120511	0.2644
D(FDI(−3))	−1.574267	1.032748	−1.524347	0.1296
D(FDI(−4))	−1.508986	0.848980	−1.777410	0.0776
D(FII(−1))	1.962647	1.022152	1.920113	0.0568
D(FII(−2))	1.354147	0.891780	1.518476	0.1311
D(FII(−3))	0.251424	0.788988	0.318666	0.7504
D(FII(−4))	0.569534	0.618175	0.921314	0.3584
NIFTY(−1)	−0.149562	0.057231	−2.613285	0.0099
FDI(−1)	2.868433	1.175628	2.439916	0.0159
FII(−1)	−0.598547	1.112424	−0.538056	0.5914
R-squared	0.290084	Mean dependent var		3236.785
Adjusted R-squared	0.215093	S.D. dependent var		77123.10
S.E. of regression	68327.20	Akaike info criterion		25.19777
Sum squared resid	6.63E+11	Schwarz criterion		25.50790
Log likelihood	−1974.624	Hannan-Quinn criter.		25.32372
F-statistic	3.868244	Durbin-Watson stat		1.962346
Prob(F-statistic)	0.000009			

- When minimum lag order(p) = 2, the equation in EViews is written as:

D(nifty) c D(nifty(−1)) D(nifty(−2)) D(fdi(−1)) D(fdi(−2)) D(fii(−1)) D(fii(−2)) nifty(−1) fdi(−1) fii(−1)

The estimated result:

Table 11: Result for Lag Length 2

Dependent Variable: D(NIFTY)				
Method: Least Squares				
Date: 05/16/20 Time: 18:33				
Sample (adjusted): 2006M04 2019M07				
Included observations: 160 after adjustments				
Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
C	15994.67	13363.58	1.196885	0.2332
D(NIFTY(−1))	−0.442661	0.087065	−5.084278	0.0000
D(NIFTY(−2))	−0.098144	0.083574	−1.174329	0.2421
D(FDI(−1))	−0.771442	0.997624	−0.773279	0.4406

D(FDI(−2))	−0.017012	0.832704	−0.020430	0.9837
D(FII(−1))	1.615983	0.745075	2.168887	0.0317
D(FII(−2))	1.214433	0.578870	2.097938	0.0376
NIFTY(−1)	−0.111099	0.051138	−2.172542	0.0314
FDI(−1)	1.917760	1.000515	1.916773	0.0572
FII(−1)	−0.389427	0.849406	−0.458469	0.6473
R-squared	0.257139	Mean dependent var		3146.412
Adjusted R-squared	0.212568	S.D. dependent var		76705.20
S.E. of regression	68066.19	Akaike info criterion		25.15481
Sum squared resid	6.95E+11	Schwarz criterion		25.34701
Log likelihood	−2002.385	Hannan-Quinn criter.		25.23286
F-statistic	5.769119	Durbin-Watson stat		2.001042
Prob(F-statistic)	0.000001			

By comparing Tables 9-11, it can be concluded that lag 2 has the lowest value of AIC and SC. So, lag 2 is a better model compared to other lag values.

Table 12: Shows the Optimal Lag Selection

Lag order	*AIC*	*SC*
6	25.23156	25.66167
4	25.197777	25.50790
*2**	*25.15481**	*25.34701**

Breusch-Godfrey Serial Correlation LM Test

Serial correlation is where the error term in the data is carried out from one period to another. Next, serial correlation for the estimated model, with optimal lag length 2, is checked.

H0: There is no serial correlation.

H1: There is serial correlation.

Table 13: Breusch-Godfrey Serial Correlation LM Test with Lag 2

Breusch-Godfrey Serial Correlation LM Test:				
Null hypothesis: No serial correlation at up to 2 lags				
F-statistic	0.441159	Prob. F(2,148)		0.6441
Obs*R-squared	0.948205	Prob. Chi-Square(2)		0.6224
Test Equation:				
Dependent Variable: RESID				
Method: Least Squares				
Date: 05/16/20 Time: 18:51				
Sample: 2006M04 2019M07				
Included observations: 160				
Pre-sample missing value lagged residuals set to zero.				
Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
C	−1935.848	15044.69	−0.128673	0.8978
D(NIFTY(−1))	−0.219170	0.441415	−0.496516	0.6203
D(NIFTY(−2))	0.070357	0.182902	0.384670	0.7010
D(FDI(−1))	0.014869	1.247109	0.011923	0.9905
D(FDI(−2))	0.184807	0.883639	0.209143	0.8346
D(FII(−1))	0.001448	0.761205	0.001902	0.9985
D(FII(−2))	0.258768	0.730230	0.354365	0.7236
NIFTY(−1)	0.009565	0.071740	0.133325	0.8941
FDI(−1)	−0.091095	1.281178	−0.071102	0.9434
FII(−1)	0.108709	0.867458	0.125319	0.9004

RESID(−1)	0.203434	0.482451	0.421669	0.6739
RESID(−2)	−0.222907	0.238211	−0.935754	0.3509
R-squared	0.005926	Mean dependent var		5.00E−12
Adjusted R-squared	−0.067958	S.D. dependent var		66111.73
S.E. of regression	68321.21	Akaike info criterion		25.17387
Sum squared resid	6.91E+11	Schwarz criterion		25.40450
Log likelihood	−2001.909	Hannan-Quinn criter.		25.26752
F-statistic	0.080211	Durbin-Watson stat		1.994366
Prob(F-statistic)	0.999970			

Here, the probability of chi-square is 0.6224 (0.6224 > 0.05), which is greater than 0.05. The null hypothesis is not rejected; rather, it is accepted and the alternative hypothesis is rejected. This means that the model has no serial correlation.

Next, CUSUM test is carried out to check for the stability of the model, since there is no serial correlation.

CUSUSM Test

CUSUM test is analysed when the line is between the red lines. Here, the CUSUM test results are within the two red lines, which implies that the model is stable.

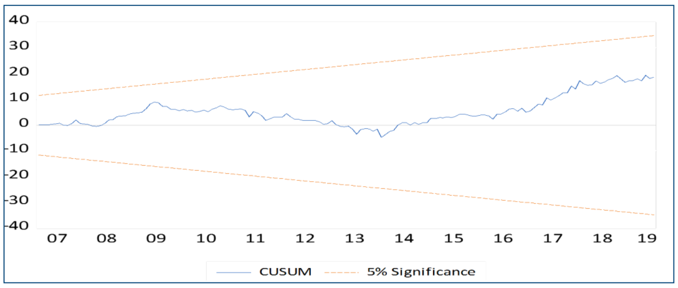

Fig. 2: CUSUM Plot

Since the model with lag length 2 has no serial correlation and the model is stable, bound test and long-run relation analysis are carried out.

Long-Run Bound Test for Cointegration Analysis

After analysing the optimal lag model, the ARDL Cointegration Bond test, using Wald test in EViews, is carried out.

Table 14 shows the sequencing of the variables.

Table 14: Sequencing of Variables in the Model with Lag 2

Constants	*Variable*
C(1)	C
C(2)	D(NIFTY(−1))
C(3)	D(NIFTY(−2))
C(4)	D(FDI(−1))
C(5)	D(FDI(−2))
C(6)	D(FII(−1))
C(7)	D(FII(−2))
C(8)	NIFTY(−1)
C(9)	FDI(−1)
C(10)	FII(−1)
C(11)	RESID(−1)
C(12)	RESID(−2)

The hypothesis is chosen in such a way as to analyse the long-run relationship between the variables. The coefficients for testing the hypothesis are C(8), C(9), and C(10). The null and alternative hypothesis are:

H0: C(8) = C(9) = C(10) = 0.

H1: C(8) ≠ C(9) ≠ C(10) ≠ 0.

Table 15: Wald Test

Wald Test:			
Equation: Untitled			
Test Statistic	Value	Df	Probability
F-statistic	4.955737	(3, 150)	0.0231
Chi-square	15.867211	3	0.0183
Null Hypothesis: C(8)=C(9)=C(10)=0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C(8)		−0.111099	0.051138
C(9)		1.917760	1.000515
C(10)		−0.389427	0.849406

Restrictions are linear in coefficients.

Here, in Table 15, the value of F-statistics is 4.955737, the chi-square is 15.867211, and the probability of F-statistics is 0.0231. The model is unrestricted intercept and no trend. Here, the F-statistic result is compared with the critical values provided in the Pesaran table (2001) (Case III), as in Table 16.

Table 16: Pesaran Table

Table CI(iii) Case III: Unrestricted intercept and no trend

	0.100		0.050		0.025		0.010		Mean		Variance	
k	*I*(0)	*I*(1)	*I*(0)	*I*(1)	*I*(0)	*I*(1)	*I*(0)	*I*(1)	*I*(0)	*I*(1)	*I*(0)	*I*(1)
0	6.58	6.58	8.21	8.21	9.80	9.80	11.79	11.79	3.05	3.05	7.07	7.07
1	4.04	4.78	4.94	5.73	5.77	6.68	6.84	7.84	2.03	2.52	2.28	2.89
2	3.17	4.14	3.79	4.85	4.41	5.52	5.15	6.36	1.69	2.35	1.23	1.77
3	2.72	3.77	3.23	4.35	3.69	4.89	4.29	5.61	1.51	2.26	0.82	1.27
4	2.45	3.52	2.86	4.01	3.25	4.49	3.74	5.06	1.41	2.21	0.60	0.98
5	2.26	3.35	2.62	3.79	2.96	4.18	3.41	4.68	1.34	2.17	0.48	0.79
6	2.12	3.23	2.45	3.61	2.75	3.99	3.15	4.43	1.29	2.14	0.39	0.66
7	2.03	3.13	2.32	3.50	2.60	3.84	2.96	4.26	1.26	2.13	0.33	0.58
8	1.95	3.06	2.22	3.39	2.48	3.70	2.79	4.10	1.23	2.12	0.29	0.51
9	1.88	2.99	2.14	3.30	2.37	3.60	2.65	3.97	1.21	2.10	0.25	0.45
10	1.83	2.94	2.06	3.24	2.28	3.50	2.54	3.86	1.19	2.09	0.23	0.41

Table 17: The F-Statistic for Testing the Long-Run Relation (k = 2, 5% Level of Significance)

Critical Value	*Lower Bound*	*Upper Bound*
1%	3.17	4.14
5%	3.79*	4.85*
10%	5.15	6.36

Comparing the F-statistic with the critical value provided in Table 17, the F-statistic is greater than the upper-bound value, at 5% level of significance, i.e., 4.955737 > 4.85; it can be concluded that there is a long-run relationship between Nifty and its determinants, namely FDI and FII. All the three variables move together in the long run. Hence, the null hypothesis is accepted.

Short-Run Error Correction Model (ECM)

Since the long-run relation between the variables has been estimated, the short-run relation between the variables have to be analysed. The ECM depicts the speed of the long-run equilibrium or the speed of adjustment.

The estimate equation with ECM model is:

D(nifty) c D(nifty(−1)) D(nifty(−2)) D(fdi(−1)) D(fdi(−2)) D(fii(−1)) D(fii(−2)) ECT(−1), where ECT(−1) refers to the error correction term.

The estimated result:

Table 18: Shows the Results of ECM Model

Dependent Variable: D(NIFTY)				
Method: Least Squares				
Date: 05/17/20 Time: 19:57				
Sample (adjusted): 2006M04 2019M07				
Included observations: 160 after adjustments				
Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
C	4845.470	5407.531	0.896060	0.3716
D(NIFTY(−1))	−0.456247	0.086455	−5.277262	0.0000
D(NIFTY(−2))	−0.106381	0.082933	−1.282739	0.2015
D(FDI(−1))	−0.233011	0.798402	−0.291847	0.7708
D(FDI(−2))	0.248495	0.765930	0.324436	0.7461
D(FII(−1))	1.214135	0.506411	2.397528	0.0177
D(FII(−2))	0.990507	0.506775	1.954531	0.0525
ECT(−1)	−0.098017	0.049166	−1.993588	0.0480
R-squared	0.247752	Mean dependent var		3146.412
Adjusted R-squared	0.213109	S.D. dependent var		76705.20

S.E. of regression	68042.80	Akaike info criterion	25.14237
Sum squared resid	7.04E+11	Schwarz criterion	25.29613
Log likelihood	−2003.389	Hannan-Quinn criter.	25.20480
F-statistic	7.151561	Durbin-Watson stat	1.993033
Prob(F-statistic)	0.000000		

The term ECT represents the speed of long-run adjustment and the other terms represent the short-run coefficients. The guideline is that the value of ECT should be negative and significant. Here, the value of the ECT term is −0.098017, which is negative, and the probability is 0.0480, which is less than 0.05. It can be concluded that the whole system can get back to long-run equilibrium at the speed of 9.8017%, based on Table 18.

Next, serial correlation and stability of the model is checked.

Serial Correlation using LM Test

Serial correlation is where the error term in the data is carried out from one period to another. To check for serial correlation for the estimated model, Error Correction Term is used.

H0: No serial correlation.

H1: Serial correlation.

Table 19: Shows LM Serial Correlation Test

Breusch-Godfrey Serial Correlation LM Test:				
Null hypothesis: No serial correlation at up to 2 lags				
F-statistic	0.363989	Prob. F(2,150)		0.6955
Obs*R-squared	0.772759	Prob. Chi-Square(2)		0.6795
Test Equation:				
Dependent Variable: RESID				
Method: Least Squares				
Date: 05/17/20 Time: 20:11				
Sample: 2006M04 2019M07				
Included observations: 160				
Pre-sample missing value lagged residuals set to zero.				
Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
C	828.0381	5842.633	0.141723	0.8875
D(NIFTY(−1))	−0.285522	0.485561	−0.588026	0.5574
D(NIFTY(−2))	0.026150	0.199724	0.130929	0.8960
D(FDI(−1))	−0.057423	0.944928	−0.060770	0.9516
D(FDI(−2))	0.137072	0.794815	0.172458	0.8633
D(FII(−1))	0.015958	0.562166	0.028387	0.9774
D(FII(−2))	0.364009	0.709964	0.512714	0.6089
ECT(−1)	−0.001358	0.072115	−0.018836	0.9850
RESID(−1)	0.287774	0.533833	0.539071	0.5906
RESID(−2)	−0.201944	0.239570	−0.842945	0.4006
R-squared	0.004830	Mean dependent var		−4.18E−12
Adjusted R-squared	−0.054880	S.D. dependent var		66528.15
S.E. of regression	68329.31	Akaike info criterion		25.16253
Sum squared resid	7.00E+11	Schwarz criterion		25.35473
Log likelihood	−2003.002	Hannan-Quinn criter.		25.24057
F-statistic	0.080886	Durbin-Watson stat		1.995260
Prob(F-statistic)	0.999836			

Here, as per Table 19, the probability of chi-square is 0.6795 (0.6795 > 0.05), which is greater than 0.05. The null hypothesis is not rejected; rather it is accepted and the alternative hypothesis is rejected. This means the model has no serial correlation.

Next, CUSUM test is carried out to check for the stability of the model, since there is no serial correlation.

CUSUM Test

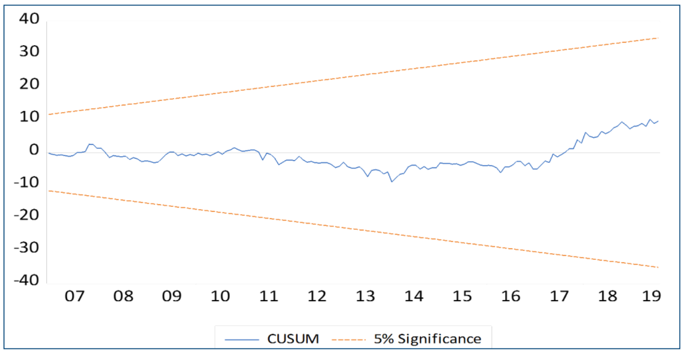

Fig. 3: CUSUM Test

Here, the CUSUM test results are within the two red lines, as shown in Fig. 3. This implies that the model is stable and has no serial correlation.

Next, short-run error correction model is checked, for analysing the speed of adjustment using Wald test.

The coefficients C(2), C(3), C(4), C(5), C(6), and C(7) represent the short-run coefficients in the model and these coefficients are computed using the Wald test.

Variable	*Coefficient*
C	C(1)
D(NIFTY(−1))	C(2)
D(NIFTY(−2))	C(3)
D(FDI(−1))	C(4)
D(FDI(−2))	C(5)
D(FII(−1))	C(6)
D(FII(−2))	C(7)
ECT(−1)	C(8)

- The hypothesis is chosen in such a way as to analyse the short-run relationship between the variables. The coefficients for testing the hypothesis are C(4) and C(5). The null and alternative hypothesis are:

H0: C(4) = C(5) = 0.

H1: C(4) ≠ C(5) ≠ 0.

Table 20: Wald Test Result

Wald Test:			
Equation: Untitled			
Test Statistic	Value	Df	Probability
F-statistic	0.172962	(2, 152)	0.8413
Chi-square	0.345923	2	0.8412
Null Hypothesis: C(4)=C(5)=0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C(4)		−0.233011	0.798402
C(5)		0.248495	0.765930
Restrictions are linear in coefficients.			

Here, as per Table 20, the value of F-statistics is 0.172962, the chi-square is 0.345923, and the probability of F-statistics is 0.8413. The model is unrestricted intercept and no trend. Here, the F-statistic result is compared with the critical values provided in the Pesaran Table (2001) (Case III).

Table 21: The F-Statistic for Testing the Long-Run Relation (k = 1, 5% Level of Significance)

Critical Value	*Lower Bound*	*Upper Bound*
1%	4.04	4.78
5%	4.94*	5.73*
10%	6.84	7.84

Comparing the F-statistic with the critical value provided in Table 21, the F-statistic is less than the lower-bound value, at 5% level of significance, i.e., 0.172962 < 4.94, and it can be concluded that there is no short-run relationship between NIFTY and FDI. The determinant FDI, with lag 1 and 2 jointly, cannot cause NIFTY. Hence, we accept the null hypothesis.

- The hypothesis is chosen in such a way as to analyse the short-run relationship between the variables. The coefficients for testing the hypothesis are C(6) and C(7). The null and alternative hypothesis are:

H0: C(6) = C(7) = 0.

H1: C(6) ≠ C(7) ≠ 0.

Table 22: Wald Test

Wald Test:			
Equation: Untitled			
Test Statistic	Value	Df	Probability
F-statistic	5.751437	(2, 152)	0.0352
Chi-square	6.842874	2	0.0327
Null Hypothesis: C(6)=C(7)=0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C(6)		1.214135	0.506411
C(7)		0.990507	0.506775
Restrictions are linear in coefficients.			

Here, as per Table 22, the value of F-statistics is 0.172962, the chi-square is 0.345923, and the probability of F-statistics is 0.8413. The model is unrestricted intercept and no trend. Here, the F-statistic result is compared with the critical values provided in the Pesaran Table (Pesaran et al., 2001) (Case III).

Table 23: F-Statistic for Testing the Long-Run Relation (k = 1, 5% level of significance)

Critical Value	*Lower Bound*	*Upper Bound*
1%	4.04	4.78
5%	4.94*	5.73*
10%	6.84	7.84

Comparing the F-statistic with the critical value provided in Table 23, the F-statistic is greater than the lower-bound value at 5% level of significance, i.e., 5.751437 < 4.94, and it can be concluded that there is a short-run relationship between NIFTY and FII. The determinant FII, with lag 1 and 2 jointly, can cause NIFTY. Hence, we reject the null hypothesis.

Summary of ARDL

The whole system is getting adjusted at a speed of 9.8017% in the long run equilibrium. In addition, the model is significant. The implication is that the present value of NIFTY will adjust to changes in FDI and FII in the long run. Further, the result shows that FDI and FII have a positive relationship in the long-run, whereas FII shows significance in the short-run and FDI shows non-significance in the short-run.

The estimate equation of ARDL long-run model, with minimum lag length 2, is:

Estimation Command:

LS D(NIFTY) C D(NIFTY(-1)) D(NIFTY(-2)) D(FDI(-1)) D(FDI(-2)) D(FII(-1)) D(FII(-2)) NIFTY(-1) FDI(-1) FII(-1)

Estimation Equation:

D(NIFTY) = C(1) + C(2)*D(NIFTY(-1)) + C(3)*D(NIFTY(-2)) + C(4)*D(FDI(-1)) + C(5)*D(FDI(-2)) + C(6)*D(FII(-1)) + C(7)*D(FII(-2)) + C(8)*NIFTY(-1) + C(9)*FDI(-1) + C(10)*FII(-1)

Substituted Coefficients:

D(NIFTY) = 15994.6748832 - 0.442660839462*D(NIFTY(-1)) - 0.0981437152288*D(NIFTY(-2)) - 0.771441905248*D(FDI(-1)) - 0.0170124577202*D(FDI(-2)) + 1.6159833944*D(FII(-1)) + 1.2144326742*D(FII(-2)) - 0.11109868157*NIFTY(-1) + 1.91776022466*FDI(-1) - 0.389426830894*FII(-1)

The estimate equation of short-run ECM is:

Estimation Command:

LS D(NIFTY) C D(NIFTY(-1)) D(NIFTY(-2)) D(FDI(-1)) D(FDI(-2)) D(FII(-1)) D(FII(-2)) ECT(-1)

Estimation Equation:

D(NIFTY) = C(1) + C(2)*D(NIFTY(-1)) + C(3)*D(NIFTY(-2)) + C(4)*D(FDI(-1)) + C(5)*D(FDI(-2)) + C(6)*D(FII(-1)) + C(7)*D(FII(-2)) + C(8)*ECT(-1)

Substituted Coefficients:

D(NIFTY) = 2803.62004594 - 0.0439367687332*D(NIFTY(-1)) + 0.0685284234293*D(NIFTY(-2)) + 0.733198300405*D(FDI(-1)) + 0.547741210913*D(FDI(-2)) + 1.4447376374*D(FII(-1)) + 0.620967129469*D(FII(-2)) - 0.51978545031*ECT(-1)

FDI

The null hypothesis and the alternative hypothesis, with respect to FDI and CNX NIFTY, are:

$H0_3$: FDI has no significant impact on NIFTY movements.

$H1_3$: FDI has a significant impact on NIFTY movements.

From the above short-run and long-run analysis, it can be concluded that FDI shows only long-run relationship towards NIFTY, and not short-run relation. Hence, there exists only a long-run relation between FDI and Nifty; it can be concluded that FDI has no significant impact on NIFTY movements.

FII

The null hypothesis and the alternative hypothesis, with respect to FII and CNX NIFTY, are:

$H0_4$: FII has no significant impact on NIFTY movements.

$H1_4$: FII has a significant impact on NIFTY movements.

From all the above short-run and long-run analysis, it can be concluded that FII shows both long-run and short-run relationship towards NIFTY; it can be concluded that FII has a significant impact on NIFTY movements.

Discussions of Result

FDI inflows show an increasing trend during the period under study, i.e., between 2006 and 2019. FII inflows did not show any particular trend during the period under study. The study adopted Ordinary Least Square (OLS) and Auto Regressive Distributed Lag (ARDL) methods to establish the relationship between the variables. There exists a weak negative correlation between FDI and SENSEX movements. There exists a strong positive correlation between FDI and NIFTY movements. There exists a positive correlation between FII and NIFTY movements. There exists a positive correlation between FII and SENSEX movements. The variables FDI, FII, and SENSEX show stationarity in the data, while NIFTY shows non-stationarity in data. FDI and FII can influence only 3.9089% of SENSEX; the remaining 96.0911% variation in SENSEX can only be explained by other variables or external factors. The speed of adjustment is estimated by the Error Correction Term (ECT) for FDI and FII in relation to the NIFTY movements; the results showed that NIFTY movements adjust moderately to changes to both FDI and FII. Only the independent variable, FII, is significant, and the other variable, FDI, is not significant to SENSEX. FDI and FII show a strong positive relationship with the NIFTY movements in the long run. FII shows a strong positive relationship with the NIFTY movements, but FDI shows non-significance in the short-run. There exists no relation between FDI and SENSEX, and FDI and NIFTY. There exists a positive relation between FII and SENSEX, and between FII and NIFTY.

It is evident from the study that FII largely influences the SENSEX and NIFTY movements. However, FDI only influences the movements in the short-run. As far as FDI is concerned, it does not show any relation toward the Indian stock markets. It is recommended that the government must attract more FDI investments for economic growth, such as industrial growth, infrastructural developments, technological upgradations, competitive advantages, and more.

On the other hand, FII is directly connected to the stock market movements and also helps in the growth and development of the economy. Furthermore, the government should adopt more and more appropriate measures to improve the foreign investments in order to strengthen the economic development.

Conclusions and Policy Recommendations

This study analysed the impact of foreign capital investment inflows on Indian stock markets. The flow of foreign capital plays a very important role in the development of the stock market, and thereby, the economy. The stock market in India acts as a key element for the market, based on the economy, as it serves as the channel for collecting money from the investors to borrowers. From this research, it can be concluded that FDI and FII both bring in capital to the economy; however, the FII is considered more stable in the analysis, compared to the FDI. The research concludes that FDI and FII show a positive long-run relationship with the Nifty movements, i.e., the variables can be fully adjusted and are in equilibrium. FDI shows a short-run relationship with the SENSEX, as there exists some constraints or other factors that influences SENSEX, and the market is not in equilibrium. Further, FII shows a long-run relation with the SENSEX. In India, it is easier to attract FII because of the fewer procedural requirements, compared to FDI. As far as FDI is considered, it is not at all directly linked with the stock markets, but provides an opportunity for the development of the economy. On the other hand, FII is directly connected to the stock markets, and is helpful in the growth and development of the Indian stock markets.

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