Interrelationship and Interdependence Among Macroeconomic Variables in India

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Abstract

India is actively performing on the economic front since the inception of the new economic policy. As it is an open economy, it allows other countries to be a part of its economy. It is pivotal for a country to have coordination among the factors which affect its growth. The study explored the trend and interrelationship among the macroeconomic variables (FDI, FPI, sensex, ER (USD), GDP, and BOP). The quarterly data of six macroeconomic variables were used for the purpose of this study. Trend chart, Augmented Dickey - Fuller Test (ADF), correlation, and regression were put into use to meet the objectives. The results showed that sensex, ER (USD), and GDP were highly correlated. The study also examined the impact of other variables and went on to analyze the impact of other variables on those highly correlated variables. For the data collected, the results showed that GDP and sensex were highly influenced by the FDI, ER (USD), FPI, and BOP ; whereas, ER (USD) had no significant impact on the BOP, FDI, and FPI. ER (USD), however, was influenced by GDP and sensex.

Keywords: **BOP, ER (USD), FDI, FPI, GDP, sensex, macroeconomic variables**

JEL codes: F15, F21, F63, P45

Paper Submission Date : September 28, 2018 ; Paper sent back for Revision : January 12, 2019 ; Paper Acceptance Date : February 25, 2019

The driving force of a country's growth is predominantly the development of various sectors such as the manufacturing sector, service sector, etc. The key factors for economic development are the existing pattern of trade, the potential of the country to attract new firms, the interrelationship among governments, meeting the variegated demands of a multifarious society, creating sustainable employment opportunities, and ensuring a stable politico-economic system. Strengthening the relationships amongst various economic factors is one of the major priorities of a country as it can contribute to the greater growth of an economy (Archibald & Sleeper, 2008).

As we become a part of a global village, relationships between countries reflect on the economic transactions among the countries. Stronger the countries, the greater competitive they become. Hence, it is necessary for a country to know its strength to face challenges (Vijayasri, 2013).

To further this understanding, there are several factors such as foreign direct investment (FDI), foreign portfolio investment (FPI), foreign reserves, exchange rate, and unilateral transfers which are associated with the

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DOI : 10.17010/aijer/2019/v8i1/142714

day to day functions of an economy. A minor change in any of these factors affects economic growth (Kravis & Lipsey, 1978). Hence, it is important to know their trends and the extent to which exchange rate, foreign direct investments (FDI), foreign portfolio investments (FPI), gross domestic product (GDP), stock market index (Sensex) are interrelated, and if they are highly correlated, then how these factors are impacted by the rest of the factors of the study.

Conceptual Framework

India is one of the fastest growing economies which is creating a positive environment for investment. It thus attracts capital within the country and overseas. Many economic development programmes are contributing to the transformation of the country. Any initiative taken by the country will have an impact on economic growth. Hence, it is important to know the variables which influence economic functions.

(i) The Balance of Payment (BOP) : BOP is a statement which quantifies the potential of a country to face foreign competition which is measured by all its economic transactions with other nations. Due to developmental projects, imitating the consumption pattern or natural calamities will cause disequilibrium that is either deficit or surplus (Hymavathi & Kalpana, 2017). BOP shows the country's health and brings all the international transactions on a single platform.

(ii) Foreign Direct Investment (FDI) : An individual (foreign investor) or overseas entity has controlling power on its host country's business which is facilitated by transferring both managerial and technical know-how (Škuflić & Botrić, 2006). The contribution of FDI to an economy is by starting a new business entity by the host country and owning 10% or more shares of the domestic company.

(iii) Foreign Portfolio Investment (FPI) : Foreign portfolio investment is where a foreign investor possesses financial assets and other securities in the host country's capital market. It is more volatile and is known as "hot money" because it can leave the country anytime due to uncertainties (Waqasa, Hashmi, & Nazir, 2015). Foreign capital flows to a country through the stock market. Hence, the performance of the stock market is very important to encourage more inflows.

(iv) Exchange Rate (ER) : Is the rate at which one currency is converted into another currency. Value of foreign currency represented in domestic currency is called exchange rate (Catao, 2007). Fluctuations in the exchange rates will decide the country's quantity of imports and exports and it does impact the internal economic system.

(v) Gross Domestic Product (GDP) : There are many indicators of the country's growth ; one among them is gross domestic product (GDP), which measures growth based on the output of goods/services of the nation (Feldman, Hadjimichael, Lanahan, & Kemeny, 2015). A country with sufficient required resources, better standard of living, sustainable employment, new initiatives, high literacy rate, etc. altogether contribute to economic growth.

Research Problem

India is becoming a tough competitor for most of the countries as it is the best investment hub for the investors. The county is enjoying the benefits of democratic dividends. Inflow of foreign investments influences economic growth. Such economic transactions will have an impact on macroeconomic variables, which determine the performance of the country. This study will help us in understanding the trend, fluctuations, and the

interrelationship of macroeconomic variables such as FDI, FPI, sensex, ER (USD), GDP, and BOP. Hence, this study will support the regulatory authorities to look into the key factors which affect the performance of the country, and to have a control over them.

Literature Review

Many studies have taken place to determine how various economic factors influence economic growth. The country's performance varies when there is any change in its determinants such as FPI, FDI, GDP, exchange rate, domestic institutional investment, sensex, etc. George (2016) emphasized on the great necessity to know the causes of huge flow of foreign capital to a country which contributed to greater portion to development. He concluded that FPI and repatriation of capital gain or dividend were inversely related. Gurloveleen and Bhatia (2015) and Hattari and Rajan (2011) found that the daily routine of the stock market influenced and affected the performance of the economy because of the movements in the stock market. Thus, capital market performance helped in the allocation and better utilization of investments irrespective of whether it was foreign inflow of capital or domestic investments. Rahman (2016) concluded that FPI was just a component of growth factors, and equal importance should be given to FDI as well because FDI has larger impact on growth. Sehgal and Tripathi (2009) focused on the route of FPI and its importance. According to them, the imitation of a group of people (hurdle behaviour) influenced FPI the most. Bose and Coondoo (2004) discussed an array of the secondary market. Kumar (2005) clearly mentioned that other than liberalization, locational advantage of a country was another motivational factor which alarmed foreign investors investing in a country's assets.

Pal (1998) mentioned that FPI had an impact on the profit earning capacity of a firm, and it also benefitted foreign institutional or individual investors. He further stated that financial assets with less risk premium were dominators of the Indian stock market. He also warned that due to drawbacks of the stock market such as speculation, optimism/pessimism of investors, FPI may not lead to economic development. Adebisi and Arikpo (2017) mentioned that financial market performance attracted more foreign investors. A country had a strong financial market when it gave equal preference to domestic investors and held strong policies with sound regulatory bodies. Anayochukwu (2012) described that FPI alone did not have an impact on stock market returns ; a healthy financial market of a country would address the investors to either withhold or withdraw their investment and held confidence level of an investor to sustain foreign investment. Barguellil, Ben - Salha, and Zmami (2018) highlighted that any changes in the exchange rate had a macroeconomic impact which slowed down or boosted performance. Countries with flexible exchange rate and liberalized financial transaction had to face the uncertainties caused by exchange rate fluctuation. According to Kandil (2009), currency fluctuations would condense the domestic benefit but motivated international investments, which increased exports, and it had a short-term impact on countries' growth. Rabin and Yeager (1982) found that when exchange rate swung, it mirrored on domestic prices, which affected business cycle (inflation or deflation).

There are other factors which change the domestic price but the exchange rate remains the major aspect to control. Sharma and Raju (2013) found how the exchange rate fluctuations affected the stakeholders associated with international business and found speculation as the major cause of exchange rate fluctuations. Jacob (2015) stressed on currency stability and found that the economy also got affected by the unpredictable changes in exchange rate. Every international transaction happens through USD. Currency stability will help a country to have untroubled trade relationship and invigorate exports and contribute to its growth. Kandil (2009) observed that economic fluctuations led to a currency crisis; this was due to liberalization of rules. The agents involved in the currency exchange predict changes in currency rates. When the domestic currency appreciates, the imports increase and vice versa. Thus, it creates an imbalance in the BOP. Hence, it is also important to know the impact of exchange rate on the BOP. Dean and Sabastia (2004) in their report discussed that over a period of time, the trade amongst several countries increased three folds ; whereas, the output of these countries had just doubled. This is

because of the interrelationship of the countries as well as of domestic industries. Commerce and growth were positively related as trade contributed to a greater portion of the GDP of the country. Mathew, Vijaykumar, and Jacob (2013) said that there were few factors which caused a deficit in the country's BOP. The nation should, therefore, take an action to overcome these problems. Sun and Heshamti (2010) identified that in international trade, countries promoted the product for which resources were available abundantly with them. India being an open economy can avail this facility of cost advantage by purchasing a final product instead of producing at home. Through this, a developing nation like India can enjoy economies of scale but the country should also independently invest in research and development.

Research Gap

From the literature review, it is understood that though various studies have been conducted on checking the interrelationship among macroeconomic variables, the studies checking the interrelationship and interdependence of different macroeconomic variables (BOP, FDI, FPI, sensex, ER, and GDP) are limited. This study is focused on checking the trend and interrelationship among the BOP, FDI, FPI, GDP, sensex, and exchange rate, and is also aimed at checking their interdependence.

Objectives

- To analyze the trend of FDI, FPI, sensex, ER (USD), GDP, and BOP.
- To check if FDI, FPI, sensex, ER (USD), GDP, and BOP are correlated.
- To check if the variables with high correlation are impacted by other variables also.

Research Methodology

Different macroeconomic variables ere considered for this study. Each variable is an indicator of different aspects of economic development. GDP is an indicator of economic growth. Sensex was used to represent the capital market. Exchange rate for rupee and U.S. dollar represent he forex market. FDI and FPI represent international economic interaction. This study based on secondary data collected rom RBI website, India Stats and Bombay Stock Exchange website.

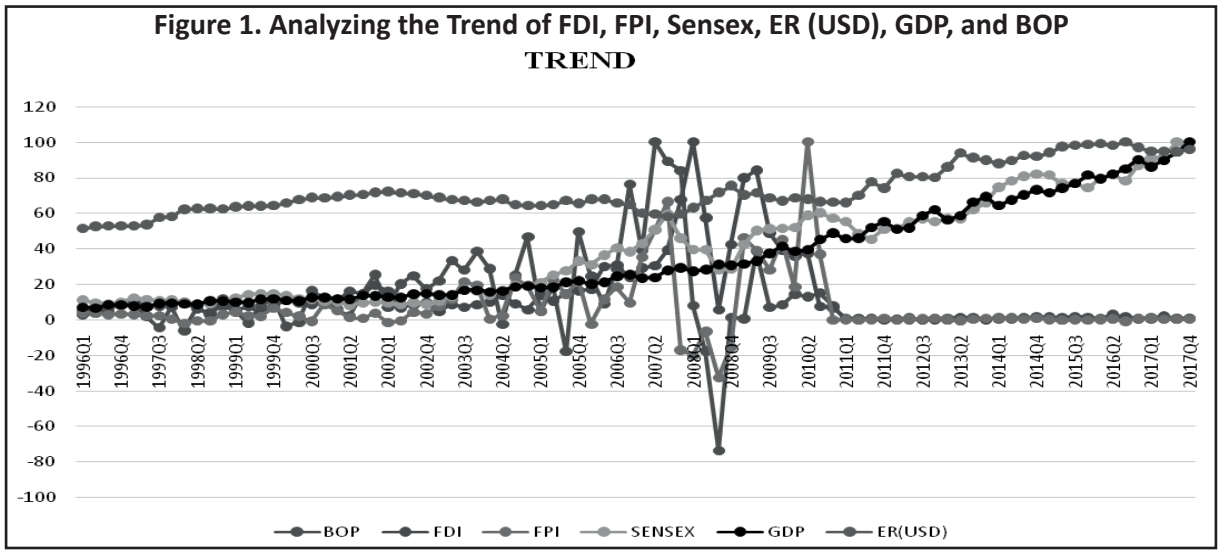
Due to non - availability of quarterly data of GDP prior to 1996, the study period startd from 1996.Quarterly data for all the variables were collected from 1996 t 2018. Correlation and regression analysis a conducted to check the interrelationship and interdependence among the variables. Analysis as one using EViews 9SVsoftware.

Data Analysis and Results

- **Objective 1:** To analyze the trend of FDI, FPI, Sensex, ER (USD), GDP, and BOP.

The Figure 1 examines the movements of the economic variables FDI, FPI, sensex, ER (USD), GDP, and BOP. The horizontal axis represents the time period (quarters) and the vertical axis represents the deviations from maximum values in percentage. Since all the variables are presented in different denominations, it was necessary to bring them under the same scale to see the trend. For this purpose, maximum values for each variable were identified and every quarter results for individual variables were compared with maximum value of the particular

Figure 1. Analyzing the Trend of FDI, FPI, Sensex, ER (USD), GDP, and BOP



variable. So every variable's plot was calculated as (present quarter/maximum value)*100. After seeing the trend, it can be said that BOP was fluctuating greatly, it reached the peak during 2007 quarter 2 and started declining in the next quarter. In 2008 quarter 3, the only variable which reached the lowest level was BOP (this could be an outcome of the great recession), and it showed a recovery from 2009 quarter 1. It was almost stagnant from 2011 quarter 1. FDI was at its highest during 2008 quarter 1, but in the same year in quarter 3, it declined and FPI was also low during quarter 3 of 2008. This is because of the sub prime crisis. FDI and FPI were also stagnant after 2011 quarter 1. This shows that foreign investment promotion schemes were not very effective. Sensex, GDP, ER (USD) showed an increasing trend. GDP and exchange rate were increasing constantly. This shows that the economy was growing constantly, and on the other hand, ER (USD) also increased from 1996 quarter 1 to 2017 quarter 4, which was a bad sign for the economy as the country's currency was losing its value against U.S. dollar.

It is always recommended to check the stationarity of data before conducting any statistical tests. Unit root test for the variables is imperative. Augmented Dickey - Fuller Test with trend and intercept is used to test the unit root. The results are shown in Table 1. BOP and FPI are stationary at level, and the remaining all variables become stationary at the 1st difference.

Table 1. Augmented Dickey - Fuller Test with Trend and Intercept

Variables	Level	1st Difference	2nd Difference	Null Hypothesis (H0)	Result
BOP	-4.925344 (0.0006)	-	-	Reject at level	Variable is stationary at level.
FDI	-	-11.84961 (0.0000)	-	Reject at the 1st difference	Variable is stationary at the 1st difference.
FPI	-5.467252 (0.0001)	-	-	Reject at level	Variable is stationary at level.
ER(USD)	-	-8.719393 (0.0000)	-	Reject at the 1st difference	Variable is stationary at the 1st difference.
Sensex	-	-7.785671 (0.0000)	-	Reject at the 1st difference	Variable is stationary at the 1st difference.
GDP	-	-4.612225 (0.0019)	-	Reject at the 1st difference	Variable is stationary at the 1st difference.

Note. Null hypothesis (H0): Variable is not stationary.

Alternative hypothesis (H1): Variable is stationary.

Table 2. Descriptive Statistics

	BOP	ER_USD_	FDI	FPI	GDP	SENSEX
Mean	13072.74	49.34328	5217.885	6460.935	15923.68	13290.33
Median	4876.500	46.34275	2884.000	897.5000	10928.61	12763.26
Maximum	118479.0	67.90043	37353.00	87213.00	45336.38	34056.83
Minimum	-87193.00	34.98240	56.00000	-28380.00	3007.920	2811.600
Std. Dev.	27024.32	9.028125	7280.582	15532.21	12138.65	9353.590
Skewness	1.303442	0.711425	2.463344	2.383486	0.803968	0.480975
Kurtosis	8.836450	2.415538	9.230347	11.55247	2.324247	1.957863
Jarque-Bera	149.8200	8.675697	231.3281	351.5188	11.15436	7.375127
Probability	0.000000	0.013065	0.000000	0.000000	0.003783	0.025033
Sum	1150401.	4342.208	459173.9	568562.3	1401284.	1169549.
Sum Sq. Dev.	6.35E+10	7091.113	4.61E+09	2.10E+10	1.28E+10	7.61E+09
Observations	88	88	88	88	88	88

From the Table 1, we can infer that the BOP and FPI are stationary at 5% significance level, but *p*-value of rest of the variables is more than 5% at level. FDI, sensex, ER (USD), and GDP are stationary at the 1st difference. Therefore, further tests can be run indisputably.

The Table 2 shows the descriptive statistics. It is clear that there are 88 observations for each variable. Overall, there are 528 observations. The mean and median of the BOP are 13072.74 and 4876.500, respectively. The maximum value of the BOP is 118479.0 and the minimum value is -87193.00. Mean of ER (USD) is 49.34328 and median is 46.34275, its maximum and minimum values are 67.90043 and 34.98240, respectively. FDI mean value is 5217.885 and the median value is 2884.000. FDI maximum value is 37353.00 and the minimum value is 56.00. Mean and median of FPI are 6460.935 and 897.5000 with maximum and minimum values of 87213.00 and -28380.00, respectively. The mean value of GDP is 15923.68 and the median value is 10928.61. GDP maximum value is 45336.38 and the minimum value is 3007.920. Sensex mean value is 13290.33 and the median value is 12763026. The maximum and minimum values of sensex are 34056.83 and 2811.600, respectively.

Ä Objective 2. Analyzing the interrelationship among FDI, FPI, Sensex, ER, GDP, and BOP.

The Table 3 shows the correlation results. It is evident that BOP and ER (USD) are negatively related (-0.319831). FDI and FPI are positively related to BOP (0.0321615 and 0474739, respectively). There is no significant relationship ; whereas, GDP and sensex have a negative relationship (-0.244742 and -0.098717). ER (USD) has a negative relationship with FDI and FPI (-0.328779 and -0.236297, respectively). GDP and sensex are positively related (0.904153 and 0.803081, respectively). They have a significant relationship with ER (USD). FDI and FPI are positively related (0.327005) but are not significant. FDI is negatively related with the GDP and sensex

Table 3. Correlation Test

	BOP	ER_USD_	FDI	FPI	GDP	SENSEX
BOP	1.000000	-0.319831	0.321615	0.474739	-0.244742	-0.098717
ER_USD_	-0.319831	1.000000	-0.328779	-0.236297	0.904153	0.803081
FDI	0.321615	-0.328779	1.000000	0.327005	-0.238165	-0.073895
FPI	0.474739	-0.236297	0.327005	1.000000	-0.110908	0.058257
GDP	-0.244742	0.904153	-0.238165	-0.110908	1.000000	0.959915
SENSEX	-0.098717	0.803081	-0.073895	0.058257	0.959915	1.000000

(-0.238165 and -0.073895, respectively) values. FPI is negatively related to GDP (-0.110908) but has a positive relationship with sensex, however, it is not significant (0.058257). GDP and sensex are positive and significant (0959915). Overall, ER (USD), GDP, and sensex are highly correlated. Further analysis will help us to know how these individual variables get impacted by the rest of the variables used in the study.

Ä Objective 3. To check if the variables with high correlation impact are impacted by other variables.

The Table 4 shows the regression analysis having GDP as a dependent variable. One unit of increase in BOP causes a decrease of 0.019 unit in GDP, which is also statistically significant as shown by the probability value of 0.0174. One unit increase in ER (USD) antecedent increases GDP by 339.41 units, and it is statistically significant as its probability value is 0.0000. With respect to FDI, one unit of increase in FDI causes a decrease of 0.01147 unit in GDP, which is also statistically significant as shown by the probability value of 0.0001. To talk about FPI, one unit boost in FPI causes a decrease of 0.040698 unit in GDP, and it is statistically significant as shown by the probability value of 0.0057. When sensex goes up by one unit, the GDP also boosts up by 0.974466 units, and it is statistically significant as its probability value is 0.0000. Conclusively, adjusted *R*-square value is 0.980612 for the study as the probability of *F*-statistic is 0.0000000.

Table 4. Regression Analysis : *GDP* as a Dependent Variable

Dependent Variable: GDP
Method: Least Squares
Date: 09/04/18 Time: 09:06
Sample: 1996Q1 2017Q4
Included observations: 88

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BOP	-0.019326	0.007963	-2.427002	0.0174
ER_USD_	339.4132	41.62437	8.154193	0.0000
FDI	-0.114734	0.028519	-4.023105	0.0001
FPI	-0.040696	0.014321	-2.841811	0.0057
SENSEX	0.974466	0.037337	26.09923	0.0000
C	-12660.81	1762.604	-7.183011	0.0000

R-squared	0.981726	Mean dependent var	15923.68
Adjusted R-squared	0.980612	S.D. dependent var	12138.65
S.E. of regression	1690.205	Akaike info criterion	17.76883
Sum squared resid	2.34E+08	Schwarz criterion	17.93774
Log likelihood	-775.8287	Hannan-Quinn criter.	17.83688
F-statistic	881.0520	Durbin-Watson stat	0.905099
Prob(F-statistic)	0.000000		

The Table 5 shows the regression analysis having sensex as a dependent variable. It is understood that one unit of increase in BOP causes an increase of 0.019 unit in sensex, which is also statistically significant as shown by the probability value of 0.0127. One unit increase in ER (USD) antecedent decreases sensex by 209.05 units and it is statistically significant as its probability value is 0.0001. With respect to FDI, one unit of increase in FDI causes an increase of 0.124969 units in sensex, which is also statistically significant as shown by the probability value of 0.0000. One unit boost in FPI will increase sensex by 0.050413 units, and it is statistically significant as shown by the probability value of 0.0003. When GDP goes up by one unit, the sensex also boosts up by 0.915941 units, and it is statistically significant as its probability value is 0.0000. Conclusively, adjusted *R*-square is 0.969308 for the study, and the probability (*F*-statistic) is 0.0000000.

The Table 6 shows the regression analysis having ER (USD) as a dependent variable. One unit of increase in BOP causes an increase of 6.98 units in ER (USD), which is not statistically significant as shown by the probability value of 0.6684. One unit increase in FDI antecedent causes increase in ER (USD) by 2.76 units and it

Table 5. Regression Analysis : *Sensex* as a Dependent Variable

Dependent Variable: SENSEX
Method: Least Squares
Date: 09/04/18 Time: 09:13
Sample: 1996Q1 2017Q4
Included observations: 88

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BOP	0.019603	0.007694	2.547966	0.0127
ER_USD_	-209.0506	49.15380	-4.252988	0.0001
FDI	0.124969	0.026924	4.641544	0.0000
FPI	0.050413	0.013444	3.749733	0.0003
GDP	0.915941	0.035095	26.09923	0.0000
C	7786.356	2004.558	3.884326	0.0002

R-squared	0.971072	Mean dependent var	13290.33
Adjusted R-squared	0.969308	S.D. dependent var	9353.590
S.E. of regression	1638.663	Akaike info criterion	17.70690
Sum squared resid	2.20E+08	Schwarz criterion	17.87580
Log likelihood	-773.1034	Hannan-Quinn criter.	17.77494
F-statistic	550.5261	Durbin-Watson stat	0.901424
Prob(F-statistic)	0.000000		

Table 6. Regression Analysis: *ER (USD)* as a Dependent Variable

Dependent Variable: ER_USD_
Method: Least Squares
Date: 09/04/18 Time: 09:15
Sample: 1996Q1 2017Q4
Included observations: 88

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BOP	6.98E-06	1.62E-05	0.429951	0.6684
FDI	2.76E-05	6.14E-05	0.449571	0.6542
FPI	-2.67E-06	2.96E-05	-0.090222	0.9283
GDP	0.001319	0.000162	8.154193	0.0000
SENSEX	-0.000864	0.000203	-4.252988	0.0001
C	39.60674	0.737295	53.71902	0.0000

R-squared	0.871595	Mean dependent var	49.34328
Adjusted R-squared	0.863765	S.D. dependent var	9.028125
S.E. of regression	3.332282	Akaike info criterion	5.310938
Sum squared resid	910.5367	Schwarz criterion	5.479847
Log likelihood	-227.6813	Hannan-Quinn criter.	5.378987
F-statistic	111.3206	Durbin-Watson stat	0.487358
Prob(F-statistic)	0.000000		

is not statistically significant as its probability value is 0.6542. With respect to FPI, one unit of increase in FPI causes a decrease of 2.67 units in ER (USD), which is also not statistically significant as shown by the probability value of 0.9283. To talk about GDP, one unit boost in GDP causes an increase of 0.001319 unit in ER (USD), and it is statistically significant as shown by the probability value of 0.0000. When Sensex goes up by one unit, the ER (USD) decreases by 0.000864 unit, and it is statistically significant as its probability value is 0.0001. Conclusively, the adjusted R - square is 0.863765 for the study and probability (F-statistic) is 0.0000000.

Conclusion and Research Implications

This study analyzes the trend and scrutinizes the interrelationship among FDI, FPI, sensex, ER (USD), GDP, and BOP from 1996 -2018. The trend shows that BOP, FDI, FPI highly fluctuated during 2008 and 2009. This was due to the global crisis. On the other hand, ER (USD), GDP, and sensex had an upward trend. The results of the study are contradictory to the findings of Rahman (2016) about FDI, which showed an upward trend of growth over the study period. ADF test shows that the data is stationary. The correlation results show that GDP, sensex, and ER (USD) are highly correlated. Three regression models were run by considering GDP, sensex, and ER (USD) as dependent variables separately. The results show that all the dependent variables are highly influenced by other independent variables of the study. The study shows that the country is growing constantly but the exchange rate confined to U.S. dollars reaches extreme, which is not a good sign for the country. The results are similar to Kandil's (2009) study, where he concluded that currency fluctuations would condense the domestic benefits. GDP is highly influenced by FDI, ER (USD), FPI, sensex, and BOP, which indicates that for the growth of the economy, a major policy change is necessary, which increases the trust of foreign investors in the country. Also, India needs to work towards improvement of its balance of payment position to be able to reap the benefits from international business. Overall, the country needs to manage its ER (USD) and other macroeconomic variables for future growth and development.

This study will help the economists in framing various economic policies. Policy makers will be benefited as they will be able to predict economic fluctuations, as this paper focused on trends of BOP, exchange rate, FDI, FPI, sensex, and GDP. It will benefit researchers to do a detailed study on each of these variables (BOP, exchange rate, FDI, FPI, sensex, and GDP).

Limitations of the Study and Scope for Further Research

The present study is focused only on a few macroeconomic variables such as FDI, FPI, sensex, ER (USD), GDP, and BOP. There are many other variables like unemployment rate, corporate profit, inflation rate, and interest rate, etc., which are associated with economic performance. These variables can be included for future studies. Also, monthly data can be considered instead of quarterly data to gain more clarity.

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