Impact of foreign direct investment on economic growth of Nigeria: An examination using vector auto regressive (VAR) model

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Abstract
The study assesses the impact of foreign direct investment on economic growth of Nigeria. Annual time series data from 1980-2014 was employed for the study. Three variables were used in the study namely, foreign direct investment as a percentage of Gross Domestic Product (GDP), real Gross Domestic Product (GDP) and exchange rate as a control variable. Augmented Dickey–Fuller test (ADF) or. DF-GLS unit-root test was used to identify the order of integration of the variables. The three variables are integrated of order one. i.e I (1). Hence, a Panthula principle of testing co-integration through Lindqvist, O., Johansson, K., Bringmark, L., Timm, B., Aastrup, M., Andersson, A. and Meili, M. [1] revealed a maximum of two co-integrating vectors. The impact between the two variables was assessed through impulse response function in a Vector error correction Model. However, the result reveals that foreign direct Investment has a positive relationship with Gross Domestic Product (GDP) throughout the 10 periods forecasted. The study concludes that Foreign Direct Investment (FDI) impact positively on Gross Domestic Product (GDP) of Nigeria and hence the need for the Nigerian government to set out more business-friendly policies that will attract more Foreign Direct Investment (FDI) in the country.

Keywords: foreign direct investment, gross domestic product, exchange rate, economic growth

1. Introduction

Developing nations are experiencing low savings which affect investment as well as growth. Therefore, Foreign Direct Investment (*FDI)* is one of the derivers that help in addressing this vicious cycle. Foreign Direct Investment (*FDI)* is a variable that help in capital formation, hence very important determinant of "C" in the neo-classical theory. Foreign Direct investment is seen as booster to economic growth due to its prospects in employment generation which in turn lead to increase in demand and consequently, trigger a supply, hence growth and development [1]. By and large, Foreign Direct Investment (*FDI)* is associated with different pros and cons imposed on the host country. A copious amount of advantages of Foreign Direct Investment (*FDI)* are often reported by researchers which include employment generation, transmission of technology, sharing of skillful ideas as well as prodigious increase in a capital formation. Contrariwise, Foreign Direct Investment (*FDI)* may inflict problems to a recipient country. These, include, Dutch disease, fungibility, suppressing and overriding of domestic firms.

The global Foreign Direct Investment (FDI) in 2014 stood at $1.23 trillion, this amount was forecasted by United Nations Conference on Trade and Development (UNCTAD) to hit $1.5 trillion by the end of 2016, and $1.7 by the end of 2017, with china being the highest recipient of Foreign Direct Investment (FDI) globally [2]. Sector wise, Foreign Direct Investment (FDI) to service sector accounted for 63 percent of the global Foreign Direct Investment (FDI) stock, more than twice the share of manufacturing sector, while primary sector represents less than 10 percent of the total stock. Foreign Direct Investment (FDI) to Africa remains at $54 billion in 2014, however, in Africa, service sector only

accounted for 48 percent of the total stock in the region which is lower than the global average. There is variegated amount of Foreign Direct Investment (FDI) in the region of Africa [3].

South Africa for example receives the highest stock of Foreign Direct Investment (FDI) in African continent, in 2014, amounting to $6.9 billion, followed by Angola who receives a prodigious amount of $2.1 billion, while Nigeria receives the third highest of the stock amounting to $1.6 billion all in 2014. Due to outbreak of Ebola disease in West Africa in 2015, the amount of the Foreign Direct Investment (FDI) stock had declined by 10 percent. Some companies in Sierra Leone suspended their services in the region [4]. Foreign Direct Investment (FDI) in Nigeria has a long history, Nigeria used to be the highest producer and exporter of agricultural farm produce in Africa before 1970's, virtually, all Foreign Direct Investment (FDI) stock were invested in agricultural sector. With the discovery of crude oil in late 1970's in commercial quantity attention of investors had been diverted to oil and gas sectors, which today have the highest investment of Foreign Direct Investment (FDI) stock [4]. The total amount of Foreign Direct Investment (FDI) in Nigeria in 1976 was only 212 million Nigerian Naira (local currency), and had reached 5.7 billion Nigerian Naira in 2006 [5].

Similarly, in terms of percentage to GDP, Foreign Direct Investment (FDI) forms only 0.7 percent of Nigeria's Gross Domestic Product (GDP) in 1976, 0.79 in 1980, 1.8 percent in 1990, 2.3 percent in 2006 and 3.3 percent in 2006 [6]. The tremendous increase in the share of Foreign Direct Investment (FDI) to Gross Domestic Product (GDP) might not be unconnected with political stability in Nigeria from 1999 to date. It could be recalled that, Nigeria had a series

of military disturbances which lasted for more than 20 years; this bizarre situation had grossly affected flow of Foreign Direct Investment (FDI), because investors felt the sinister to invest in Nigeria due to instability [7].

A number of studies have been conducted in an effort to relate Foreign Direct Investment (FDI) with economic growth. The earliest work in this area is the work of Singer, H [8]. Thereafter, many researchers follow suit. For example in the case of Nigeria anumber of researches are on ground, these include the of works of Alfaro, L., A. Chandra, S. Kalemli-Ozcan, and S. Sayek [9], Balasubramanyam, V.N., M. Salisu and D. Dapsoford [10], Aitken, B.J., and A. Harrison [11], Haddad, M., and A. Harrison [12], Mamatzakis, E. C [13], Engle, R. F & Granger, C.W.H [14], Greenaway, D. & Morrissey, O [15], Harrigan, J. & Mosely, P [16], Harrod, R. F [17], Johansen, S. & Juselius.K [18], Adegbike, E. O. & Owulabi, S.I [19], Akpokodje, G [20], Baghebo, M. & Edoumiekumo, S [21], Chibber, A. & Daailami, M [22], Collier, P [23], Kalu, Christopher U. Mgbemena O. Onyinye [24] and Yaqub, J. O., Adam, S. L., & Ayodele, J. [25], they all used Ordinary Least Square (OLS) model to study the relationship between Foreign Direct Investment (FDI) and Growth. Awe, A.A [26] had used simultaneous equation model to find out the relationship between the two series. The problem associated with the above studies is that the models used are simple static in nature and therefore they could not capture the dynamic interaction of the series in the model [27]. The objective of this paper is to reexamine all the above studies and incorporate a more advanced Model to study to relationship between Foreign Direct Investment (FDI) and Growth.

1.1 Empirical Model
Vector autoregressive model is a model which is first introduced by sims in 1980. The model was the outcome of serious criticism suffered by regression as well as simultaneous equation models for being static. One of the criticisms in this regard was the famous Lucas critique of 1976. Unlike regression and simultaneous equation, Vector autoregressive model (VAR) model treat all variables as endogenous variables in the system while the lags of all the variables as exogenous variables.

For a set of k time series variables $y_t = (y_{1t}\ldots y_{kt})$, the model tries to capture the dynamic interactions of the variables in the system. The basic VAR model of order P, i.e. Vector autoregressive model (VAR) (p) has the following specification:

$$y_t = A_1 y_{t-1} + A_2 y_{t-2} \ldots + A_p y_{t-p} + e_t \ldots \ldots \ldots \ldots (1)$$

Where Ai's are (K X K) coefficient of matrices and $e_t = (U_{it}\ldots\ldots\ldots U_{kt})$, is unobservable error term. Which is assumed to be Gaussian white noise and positive definite

covariance matrix $E(u_t u_t^i) = \sum_u$. Since the above model accommodates variables that are stable, is therefore not suitable for a model requiring co-integration relation, we therefore have a VECM Specification below:

$$\Delta y_t = \prod y_{t-1} + \Gamma \Delta y_{t-1} + \ldots \ldots + \Gamma_{p-1} \Delta y_{t-p+1} + U_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (2)$$

Where $\prod = \alpha\beta^i$, α is n X m, it is a loading matrix.

While β is an M x N matrices and it is a co-integration matrix. Therefore equation (2) is a model where by both level and differenced variable are included, since we are interested in both short run and long run information due to the presence of co-integration.

1.2 Data and Strategy
This study has been conducted with three variables. These variables include Gross Domestic Product (GDP), Foreign Direct Investment (FDI), and Exchange rate for the case of Nigeria. The three variables were collected from the annual statistical Bulletin released by central bank of Nigeria. The main variables of the study are Gross Domestic Product (GDP) and Foreign Direct Investment (FDI); however, Exchange rate was taken as control variable in the study. GDP is an annual growth rate from 1980 t0 2014 and it was taken it is without natural log conversion. Similarly, among the series of Foreign Direct Investment (FDI) available we select Foreign Direct Investment (FDI) as a percentage of Gross Domestic Product (GDP), this will make a close contact with Gross Domestic Product (GDP) since we are trying to find out the relationship between the two. Foreign Direct Investment (FDI) unlike Gross Domestic Product (GDP) has been converted to natural log. Exchange rate and Gross Domestic Product (GDP) have not been converted to natural log because they are all in rates. Most econometricians criticized the conversion of those variables already in rates to natural rate as such we tried to avoid such criticisms. Foreign Direct Investment (FDI) and exchange rate also have the same frequency and span with Gross Domestic Product (GDP).

1.3 Empirical Results
In this section of the study, we present the result of the analysis. We first begin by reporting the stationary test; table 1.1 below presents the result for the unit root test. The idea behind it, is to determine the stochastic properties of the series or the order of integration of the series which is a necessary condition for the selection of the right model. According to econometric procedure, when all series are found to be stationary at level, a level Vector Auto Regressive (VAR) model can directly be applied, however, when all variables are found to be stationary at first difference, then a multivariate unit-root test should be applied [28, 29].

Table 1: Univariate Unit-root Test

Variables	Augmented Dickey–Fuller test (ADF).	Decision	Variables
	Level	First Difference	
Gross Domestic Product (GDP)	-2.1393	-3.4755	I (1)
Foreign Direct Investment (FDI)	-1.3436	-8.1539	I (1)
Exchange Rate	-1.9366	-5.4641	I (1)

Source: Computed

The Johansen Co integration Test, when there is a mixture of level of first difference and level stationary series Auto Regressive Distributed

Lag (ARDL) bound testing approach should be applied [30]. For the sake of this study, trend and intercept assumption was selected. The variables are found be stationary at first

difference I (1) as indicated in table 1.1 above. The calculated F- statistic is greater than critical

value for the three variables at the conventional confidence levels.

Table 2: Pantula principle of Co-Integration

Assumption	Methods	Level of significance		
		10%	5%	1%
No intercept or trend in co integrating equation or test Vector Autoregressive	Trace	1	1	1
	Max. Eigen Value	1	1	1
No intercept or trend in co integrating equation or test Vector Autoregressive	Trace	1	1	1
	Max. Eigen Value	1	1	1
No intercept or trend in co integrating equation or test Vector Autoregressive	Trace	1	1	1
	Max. Eigen Value	1	1	1
No intercept or trend in co integrating equation or test Vector Autoregressive	Trace	1	1	1
	Max. Eigen Value	1	1	1
No intercept or trend in co integrating equation or test Vector Autoregressive	Trace	2	2	2
	Max. Eigen Value	1	1	1

Source: Computed

A Pantula principle (i.e A variable is stationary even if one of the cases shows that. It is a good strategy to start with the model containing both a constant and. a trend, because this model is the least restricted. If a unit root is rejected here, due to a significant p, there is no need to continue testing) is method by which all the five assumptions of Johansen co-integration will be applied and subsequently select an assumption that has the highest co-integrating vectors. Here, the No intercept or trend in co integrating equation or test Vector Autoregressive assumption has 2 co-integrating vectors, the highest co-integration among the five assumptions. Therefore, this assumption will is used while running the model.

Table 3: Long run Co-integrating equation

Variables	Coefficient Value
Gross Domestic Product (GDP)	1.0000
Foreign Direct Investment (FDI)	-0.922936^{NS} (0.40424)
Exchange Rate	-0.048656** (0.03720)

Source: Computed
Note: Figures in parentheses represent t-value
NS-Not Significant, ** Significant at 5 per cent level

Next, we have extracted the long run co-integrating equation from the above Johansen [31] test of co-integration. While normalizing on Gross Domestic Product (GDP), it appears that, both

Foreign Direct Investment (FDI) and exchange rate have a negative correlation with Gross Domestic Product (GDP) in the long run. Meaning that, increase in Foreign Direct Investment (FDI) or Exchange rate will bring down Gross Domestic Product (GDP) in the long run and vice versa.

Table 4: Speed of adjustment/loading Factor

Variables	Lags	Error Correction Term (ECT)
Gross Domestic Product (GDP) equation	3	-0.882** (0.04)
Foreign Direct Investment (FDI) equation	3	-0.412^{NS} (0.16)
Exchange Rate equation	3	0.0009* (0.98)

Source: Computed
Note: Figures in parentheses represent t-value
NS-Not Significant, ** Significant at 5 per cent level * Significant at 1 per cent level

Table 1.4 presents the result for the speed of adjustment/loading factor/short run dynamics. The idea is to find out which of the three equation's short run dynamics satisfies the assumption of being negative, less than and significant. The above result indicated that only Gross Domestic Product (GDP) equation has a loading factor (–0.882) which satisfies all the expected assumptions, hence only this equation is qualified to be subjected to Wald test for long run causality analysis.

Table 5: Short run Granger causality

Null Hypothesis	Observations	F-Statistics	Probability
Foreign Direct Investment (FDI) does not Ganger cause Gross Domestic Product (GDP)	24	4.70529	0.1145
Gross Domestic Product (GDP) does not Ganger cause Foreign Direct Investment (FDI)	24	10.1283	0.0411
Exchange Rate Ganger cause Gross Domestic Product (GDP)	24	1.37776	0.4406
Gross Domestic Product (GDP)Ganger cause Exchange Rate	24	0.50147	0.8211
Exchange Rate Ganger cause Gross Foreign Direct Investment (FDI)	24	0.03027	1.0000
Gross Foreign Direct Investment (FDI)Ganger cause Exchange Rate	24	6.01378	0.0833

Source: Computed

Since all our variables are stationary at first difference, the result obtained through granger causality becomes a short run. Here we test a null hypothesis of Y does not granger cause X against an alternative that Y does Granger cause X. we accepted alternative hypothesis that Gross Domestic

Product (GDP) does granger cause Foreign Direct Investment (FDI) at 4 percent and Foreign Direct Investment (FDI) does granger cause Exchange rate at 8 percent level of significance, while in all other cases we fail to reject null hypothesis.

Table 6: Long Run Causality

Equation/Variables	Gross Domestic Product (GDP)
Foreign Direct Investment (FDI)	0.4145^{NS} (0.744)
Exchange Rate	0.2027^{NS} (0.893)

Source: Computed

Note: Figures in parentheses represent t-value NS-Not Significant

We earlier indicated that only Gross Domestic Product (GDP) equation did satisfy the assumptions needed in order to test for the long run causality. The equation was verified through Wald test, restricting Foreign Direct Investment (FDI) and Exchange rate series. the F statistic value for Foreign Direct Investment (FDI) is 0.41 and Exchange rate is 0.20, these values are less than the calculated F critical values, meaning that Gross Domestic Product (GDP) does cause any of the two variables in the long run. The probability values for both are indicated in the parenthesis.
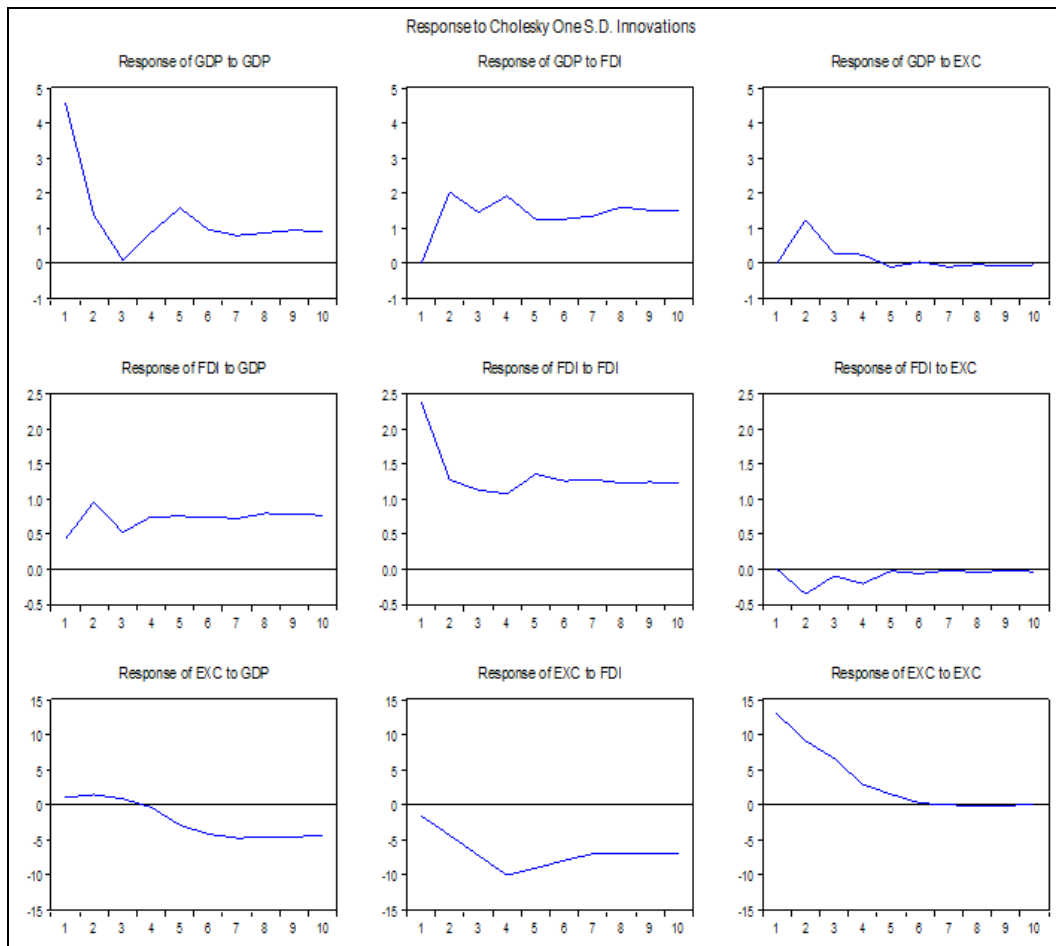
Fig 1: Forecast Error Impulse Response Function (FEIRF)

The above figures indicate the Forecast Error Impulse Response Function (FEIRF) for the three variables under consideration. Our main objective is to find out the level of impact Foreign Direct Investment (FDI) has on Gross Domestic Product (GDP). This is shown in the first box of the second column. The response of Wald test to Foreign Direct Investment (FDI) for all the forecasted period is positive. This means that Foreign Direct Investment (FDI) inflict a positive effect on Wald test, hence more Foreign Direct Investment (FDI) should be encouraged in Nigeria.

1.4 Conclusion

This study has been conducted using Nigeria's time series data to find out the relationship between Gross Domestic Product (GDP) and foreign Direct Investment. The study used three variables, Gross Domestic Product (GDP), Foreign Direct Investment (FDI) and Exchange rate which are taken as control variable. The three variables were stationary at first difference, which implies the need to check the existence of co-integration. The co-integration test was applied using Johansen multivariate procedure. The result reveals 2 co integrating vectors. A short run causality was also applied which find that only Gross Domestic Product (GDP) causes Foreign Direct Investment (FDI) and not vice versa. Similarly, in the long run, Gross Domestic Product (GDP) does not cause Foreign Direct Investment (FDI) nor vice versa. The impact analysis is conducted using Vector Error Correction Model (VECM). The result of the 10 periods forecasted reveals that FDI has a positive relationship with Gross Domestic Product (GDP) for all the periods. This means that Foreign Direct Investment (FDI) is a blessing to Nigeria as it leads to growth, which consequently has a potential for development. It is therefore recommended that, despite the positive impact Foreign Direct Investment (FDI) has on Nigeria's growth, government should not be carried away by the external

growth which is not permanent. Rather, indigenous firms should be relied upon and be protected to ensure permanent growth through patriotism.

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