Foreign Direct Investment Inflows and Oil Exports in Nigeria: Cointegration and Vector Error Correction Model Approach

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Abstract: The aim of this paper is to examine the long run relationship between FDI inflows and oil exports in Nigeria. Data was collected from CBN Statistical Bulletin and UNCTAD investment report from 1990 to 2016, and various diagnostic tests such as Unit Roots and Johansen conitegration were estimated. Consequently, Vector Error Correction model was employed to address the objective of this study. It was established from this study that a long-run relationship between FDI inflows, oil exports, exchange rate and inflation existed in Nigeria, while the error correction term submits that about 38% error made in the previous year was corrected in the current year in the country. However, the findings that emerged in this work necessitated the following recommendations for the policy makers, investors and future researcher. The policy makers in Nigeria should see oil exports among others as the backbone behind the inflows of FDI in the country and should be sustained. In addition, the proceeds from oil exports should be diversified and invested in the non-oil sub sector of the economy in order to stimulate a favourable exchange rate which can further encourage further inflows of FDI in the country. Finally, it is needful to ensure that the policy measures are initiated and implemented without a delay for the desired effects to be reflected on time in the country.

Keywords: FDI Inflows; Oil Exports; Cointegration VECM and Nigeria

JEL Classification: F21; F23

1. Introduction

In the last four decades, the Nigerian economy has been largely depending on revenues from oil exports. Over 80% of foreign earnings in the economy has been coming from the oil sector (CBN, 2017). This statement is further validated by Odularu (2008) who corroborated that about 83% of revenue in Nigeria came from oil exports in 2000s. The critical roles in which oil sector occupied in the economy

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has made the country to be a mono cultural economy. This sector of the economy alone accounted for 90% of FDI inflows in the country in year 2005 (UNCTAD, 2006). In other words, one could conclude that FDI inflows in Nigeria is geared towards oil and gas.

However, it has been argued in different quotas that the connection between FDI inflows and exports in propelling nation building cannot be undermined. (Goldberg and Klein (1998), Calderón, Mortimore and Peres, 1996. Giles and Williams, 2000). In Nigeria, exports is divided into oil and non-oil exports. Consequently, the recent advocacy by the policy makers and scholars to diversify the economy from the oil and gas has made the research focus about the link between these crucial economic variables to be skewed towards non-oil exports of the country. See Olayiwola and Okodua (2013), Aderemi (2018), Aderemi and Aberu (2018), and Aderemi et al (2018). Similarly, the strategic position in which oil exports occupied in the survival of the country`s economy necessitated an urgent need to empirical examine how the impact of FDI inflows has been faring on the oil exports in the country in the last 26 years.

2. Literature Review

This section presents an account of past empirical studies concerning the nexus between FDI, exports and economic growth in Nigeria and Africa.

Akanni (2004) analyzed how oil rents increment could affect economic in African oil exporting countries. The estimated results from ordinary least squares regression shows that investment, oil rents and economic growth have a significant positive relationship with one another. The author submitted that oil rents did not bring economic growth in majority of oil-rich countries in the continent. Consequently, Odularu (2009) examined the link between crude oil and economic growth in Nigeria with the application of Ordinary Least Square regression alongside Cobb-Douglas production function. It could be established that the study asserted that crude oil production have a contributory effect on economic growth of the country, but not significant. However, Aderemi (2018) analyzed the impact of FDI on non-oil exports in Nigeria between 1980 and 2016 with the application of Johansen Co integration test and dynamic ordinary least square (DOLS). The author corroborated that a significant relationship between FDI and economic growth exists but non-oil exports show otherwise.

In addition, Aderemi and Aberu (2018) used granger causality technique to examine how FDI, non-oil exports and economic growth are related in Nigeria within 1980 and 2016. It was asserted by the authors that there is an existence of one way feedback effect runing from FDI to economic growth and non-oil exports. In another perspective, Okodua (2009) analyzed how FDI and economic growth are related in

Nigeria. The estimated results from the Johansen cointegration and a vector error correction model posited that a long run equilibrium relationship exists between FDI inflows and economic growth in the country. Also, the granger causality result indicated a unidirectional feedback relationship which runs from FDI to economic growth in the country.

Similarly, Akinlo (2004) used error correction model (ECM) to examine how FDI and economic growth are related in Nigeria from 1970 to 2001. The author validated that an insignificant relationship existed between both private capital and lagged foreign capital alongside with economic growth. Also, it was concluded from the paper that an insignificant direct link existed between exports and economic growth in the country.

Moreover, in analyzing the stochastics dynamic interaction of FDI, non-oil exports and economic growth in Nigeria, Aderemi et al (2018), adopted impulse response and variance decomposition tests to prove that the interactions among FDI, non-oil exports and economic growth appeared very weak and did not follow a predictable pattern in the country.

In a nutshell, a critical look at the above reviewed literature shows that past study on FDI inflows and oil exports are very limited in Nigeria in the recent times. Therefore, this study is very crucial to fill the gap in that regards.

3. Methodology

Secondary data from 1990 to 2017 were sourced from UNCTAD database published by World Bank and the Central bank of Nigeria Statistical Bulletin on. The goal of the paper is to ascertain if exchange rate volatility enhance investment and economic growth. The study adopted Vector Autoregressive model. This model is one of the most flexible and easy models for the analysis of multivariate time series. It is a natural extension of the univariate autoregressive model to dynamic multivariate time series.

3.1 Model Specification

FDI = F (OILEX, EXRT, INFR) ---------- (I)

Where: EXRT = Exchange Rate

OILEX = Oil Exports

INFR = Inflation Rate

FDI= Foreign Direct Investment

Equation (1) can be linearized as follows to derive equation (II)

$LnFDI_t = \propto_i + \beta 1 LnOILEX_t + \beta 2 EXRT_t + \beta 3 INFR_t + \varepsilon_t$---------- (II)

$\propto$ *is an intercept and* $\beta 1, \beta 2$ *and* $\beta 3$ *are slope parameters* to be estimated. ε_t denotes error term which is assumed to be stochastic and the subscripts, *t* stand for the dating of variables in time periods. The a priori expectations are as follows: $\beta 1$ *and* $\beta 2 > 0, \beta 3 < 0$

However, the long-run equilibrium relationship among the variables in model (II) would be estimated with the application of the Johansen cointegration technique. This technique is based on the vector autoregressive (VAR) models. (Brooks, 2008: 354).

The starting point for the estimation of a vector error correction model (VECM) is the examination of unit roots of the relevant variables. This is done by the application of the standard augmented Dickey Fuller test and Philips Perron test to determine the order of integration of the variables. The existence of a cointegrating relationship among the set of variables connotes the presence of a long-run equilibrium relationship among the variables. Therefore, a simple VAR model with i lags could be demonstrated below as the reference point for VECM estimation.

$$y_t = \alpha + \beta_1 y_{t-1} + \beta_2 y_{t-2} + ... + \beta_k y_{t-i} + \varepsilon_t \quad \text{(III)}$$

It is important to state here that the VECM is a case of unrestricted VAR modelling which requires the same number of lags for all the variables in all equations. However, some of the recently developed econometric softwares have facility for a multivariate information criterion which makes allowance for comparison across information criteria. Akaike's information criterion (*AIC*) is utilized to determine the appropriate lag lengths for the study.

3.3 Results and Discussion

Table 2. Unit Root Test

Variables	ADF Test			PP Test		
	Level	1st Difference	Remarks	Level	1st Difference	Remarks
LFDI	-2.98104***	-2.98623***	I (1)	-2.98104***	-2.98623***	I (1)
LOILEx	-2.98104***	-2.98623***	I (1)	-2.98104***	-2.98623***	I (1)
EXCHR	-2.98104***	-2.98623***	I (1)	-2.98104***	-2.98623***	I (1)
INFL	-2.98104***	-2.98623***	I(1)	-2.98104***	-2.98623***	I(1)

*** %5 level

Source: Authors` Computation (2018)

One of the problems associated with macroeconomic time series data are non-stationarity nature of the data (Granger, 1986, Engle and Granger, 1987). Any regression estimated based on the non-stationary data would produce a nonsense result which could impair the relatability of the study. In order to overcome this problem this paper estimated standard Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests to examine the existence or otherwise of stationarity of time series data in this study. However, the results presented in the table above indicated that the variables of interest are stationary after they were first differenced. The implication of this, is that these variables possess unit roots.

Table 3. Johansen Cointegration Test (Trace Statistics) and (Maximum Eigenvalue) Johansen Cointegration Test (Trace Statistics)

Null Hypothesis	Eigenvalue	Trace Statistics	P-value**
r=0*	0.810951	60.90910	0.0019
r≤1	0.406411	19.26542	0.4740
r≤2	0.175723	6.226226	0.6688
r≤3	0.054272	1.395014	0.2376

Johansen Cointegration Test (Maximum Eigenvalue)

Null Hypothesis	Eigenvalue	Maximum Eigenvalue	P-value**
r=0*	0.810951	41.64368	0.0004
r≤1	0.406411	13.03919	0.4486
r≤2	0.175723	4.831212	0.7630
r≤3	0.054272S	1.395014	0.2376

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Authors` Computation (2018)

All the variables adopted in this study are I (1), though they diverge in the short run but it is likely they show a long run equilibrium relationship. As a result of the above, Johansen and Juselius (1990) multivariate cointegration test was estimated. Consequently, the reported results of the trace statistics and the maximal eigenvalue statistics indicate that there is at most 3 cointegrating vectors in the systems. The implication of this is that the variables are possess a long run equilibrium relationship with one another which may likely show some adjustment to short run disequilibrium via one model. In order to ensure that a long run relationship among these variables is captured, Vector Error Correction Model is utilized in this study.

Table 4. Vector Error Correction Estimates for FDI inflows and Oil Exports in Nigeria

Dependent variable: FDI

Variable	Coefficient	t-statistics	P-value
C	0.034728	0.491835	0.6285
ECM(-1)	-0.376349	2.102595	0.0491
DL(FDI(-1)	0.051881	0.258806	0.7986
DL(OILEX(-1)	0.110978	0.677383	0.5063
D(EXCR(-1)	-0.001069	0.283114	0.7802
D(INFR(-1)	0.011540	2.420618	0.0257
R-Squared	0.650031		
Adjusted R-Squared	0.505302		
F-statistic	3.109481		
B-G Serial Correlation	F =1.234640 (0.2811)		

Source: Authors` Computation (2018)

The reported results in table 4 show that all the estimated variables have the expected signs. Suffice to say, the error correction term, ECM(-1) has a negative sign and

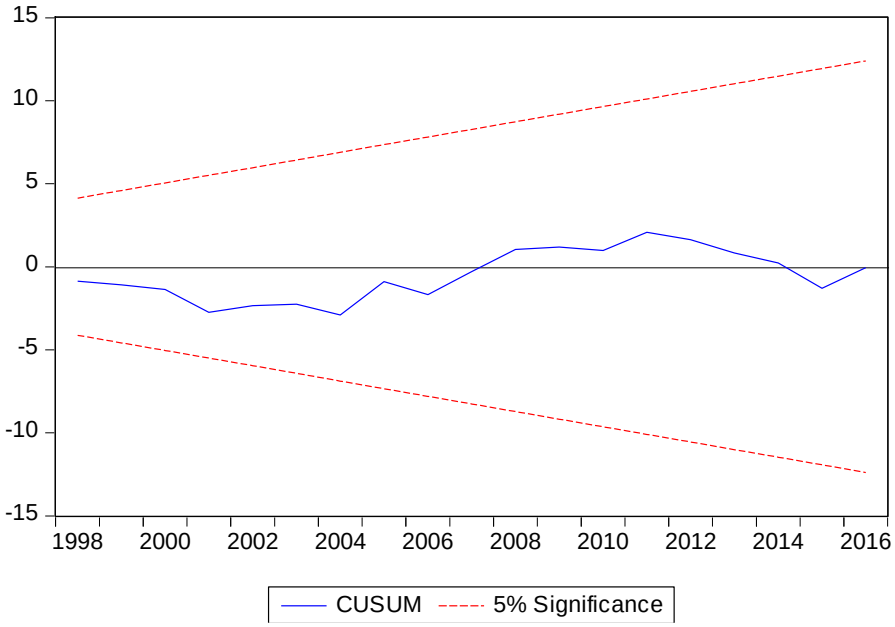
significant with the absolute value of 0.38. This implies that there is convergence among the variables in the long run as earlier confirmed by the cointegration test. The coefficient connotes that the speed of adjustment from the short run to long-run is about 38% error committed in the previous year is corrected in the current year. This was further reinforced by the first differenced lagged value of the dependent variable-DLFDI (-1) that is positive. This indicates that the inflows of FDI in the previous year positively affects the current year, though not significant.

Furthermore, the estimated explanatory variables revealed that FDI inflows and inflation rate have a significant positive relationship in Nigeria. Also, variable FDI has a positive but non-significant relationship with oil exports in Nigeria. However, FDI and exchange rate have a non-significant inverse relationship in the country. This submission is supported by the finding of Akinkugbe (2003) Udoh and Egwaikhide (2008) who corroborated that exchange rate volatility discourages inflows of FDI in Nigeria. Despite the fact that different methodologies were employed. Similarly, the R-squared value implies that about 65 % change in the dependent variable are explained by the variations in regressors signifying that the regression has a good fit and is reliable.

3.4 Diagnostic and Stability Tests

Table 4. Breusch-Godfrey Serial Correlation LM Test

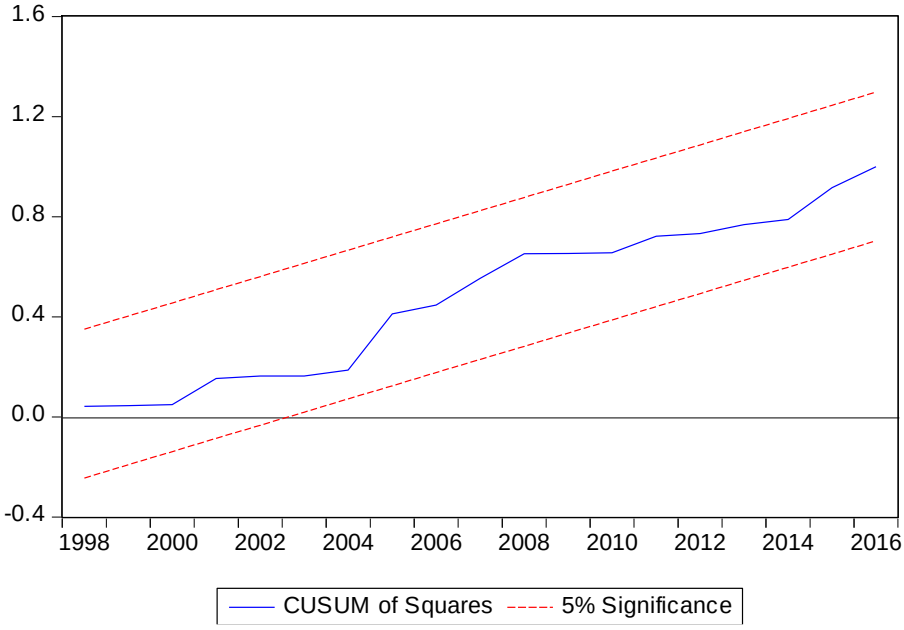
F-statistic	1.234640	Prob. F(1,18)	0.2811
Obs*R-squared	1.604709	Prob. Chi-Square(1)	0.2052



CUSUM SQUARE Stability Test

Figure 1. Stability Tests

CUSUM Stability Test



In order to establish the appropriateness of the short run (parsimonious) model, in this study further attempt was made to carry out diagnostic test (the Serial Correlation LM test) and stability tests (Cumulative Sum (CUSUM) and Cumulative Sum of squares (CUSUMSQ) on the residual of the short run model. From the results of the table 4, the F-statistics of the Serial Correlation LM test of the model was insignificant, this confirmed the absence of serial correlation in the residuals of the ECM regression estimate.

Similarly, the results of cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests in the above gap showed that the residuals of the error-correction model is within the critical bounds of five percent significant level. This connotes that the estimated parameters are stable over the period 1990-2017. Therefore, the model is considered to be reasonably specified as a result of the tests carried out above.

3.4 Conclusion and Recommendations

From the results discussed above, some crucial findings and implications could be drawn as follows: the test for cointegration establishes the existence of a long-run relationship between FDI inflows, oil exports, exchange rate and inflation in Nigeria, while the error correction term submits that about 38% error made in the previous year would be corrected in the current year in the country. Oil exports and inflation rate propel FDI inflows in Nigeria. However, FDI and exchange rate have a negative relationship in the country, though not significant. The implication of this is that exchange rate situation has not been favourable to FDI inflows in the country. Therefore, the findings that emerged in this work necessitated the following recommendations for the policy makers, investors and future researcher. The policy makers in Nigeria should see oil exports among others as the backbone behind the inflows of FDI in the country and should be sustained. However, the proceeds from oil exports should be diversified and invested in the non-oil sub sector of the economy in order to stimulate a favourable exchange rate which can further encourage inflows of FDI in the country. Finally, it is needful to ensure that the policy measures are initiated and implemented without a delay for the desired effects to be reflected on time in the country.

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