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An Empirical Study on Impact of Crude Oil Price and Real Exchange Rate on Economic Growth of Nigeria

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Abstract
The study empirically examines the impact of crude oil price and exchange rate on economic growth in Nigeria covering the period of 1970 to 2016. Time-series data source from Central Bank of Nigeria were used and analysed using Vector Error Correction Approach. The results from the unit root tests indicate that all the variables are integrated of order one I(1). Johansen cointegration test suggests the presence of a long-run economic relationship among the variables. The results estimate on VECM revealed GDP to be positively related to crude oil price and exchange rate in both the periods, while interest rate is positively related to GDP in short run and negatively related in the long-run and inflation is negatively related to GDP in both the period. All variables are statistically significant in both the periods except for interest rate and inflation which are statistically insignificant in both periods. The study further reveals a unidirectional causal relationship between COP and GDP. More so, it reveals bidirectional relationship between GDP and exchange rate. The study recommends effective diversification of the economy which will save the country from the imminent menace of over-reliance on petroleum. And there is need for government of Nigeria to develop sound exchange rate management in the country.

Keywords: Exchange Rate, Economic Growth, Nigeria, Oil Price
JEL classification: O15

1. Introduction

Crude oil is a major source of foreign exchange earnings and the dominant source of revenue for the Nigerian government. According to Yuan, Liu and Huang (2014) oil price shocks have had an attendant multiplier effect on crude oil and economic activity. The Nigerian economy has been completely reliant on oil and the basis upon which government budgeting, revenue distribution and capital allocations are determined. It is widely known fact among economists that international oil prices saw a sharp fall during the global economic crisis of 2008. This led to a fall in oil revenues and unfavourable exchange rate movements for major oil-exporting

economies especially those that were not well-diversified. The situation was worse for some OPEC economies with low levels of accumulated foreign reserves (Emmanuel, 2015). It is also argued that the attendant problems associated with fallen oil prices in Nigeria is inability of the government to finance its fiscal projects, decrease in standard of living and exchange rate. The current living standard in Nigeria showed that about 60% of her citizens live below one dollar per day. The resulting decline in the non-oil sector reinforces sharp decline in the economic growth rate when the price of crude oil falls (Akindele *et al.,* 2017).

An oil price shock may have real effects, as a higher oil price may affect output through the aggregate production function by reducing the net amount of energy used in the production. In addition, aggregate demand, of which investment is a major part, may also change in response to energy price changes (Agbede, 2012; Taiwo and Olumuyiwa, 2015). An oil price increase will typically lead to a transfer of income from the oil importing countries to the oil exporting countries. This reduction in income would cause rational consumers in oil importing countries to cut back on their consumption spending and investment, hence, reducing aggregate demand and output. However, to the extent that the increase in income in the oil exporting country will increase demand from the additional income transferred to them from the oil importing country, the global effect would be minimized (Ifeanyi and Ayenajeh, 2016).

Oil price spikes induce greater uncertainty about the future, which affects households and firms spending and investments decisions. Also changes in oil prices leads to reallocations of labor and capital between energy intensive sectors of the economy and those that are non-energy intensive sector (Ebele, 2015; Yusuf, 2015). Nigeria like other low income countries has adopted two main exchange rate regimes for the purpose of gaining balance both internally and externally. The purpose for this different practice is to maintain a stable exchange rate (Umar and Abdulhakeem, 2010). A fluctuating real exchange rate stemming from volatile oil prices are damaging to non – oil sector, capital formation and per capita income. The consequences of substantial misalignments of exchange rate can lead to shortage in output and extensive economic hardship. There is reasonably strong evidence that the alignment of exchange rate has a substantial influence on the rate of growth of per capita output in low income countries (Khuram *et al.,* 2015). The recent shock in crude oil prices which started in July 2014 has adversely affected Nigeria, especially in the areas of foreign reserves, currencies crisis, declining government revenue, and ultimately, threat in terms of ability to meet financial obligations as at when due. Brent oil price declined by 24 percent to a four-year low of USD81 as at November 11, 2014. The price of Brent fell from USD114.91 on January 31 to USD102.12 on May 31, and stood at USD57.8 and 67.6 on March 31, 2015 (AEA, 2016; Akindele, 2017).

One factor in the global economy that has continued to pose a big challenge to policy makers across countries is the increasing spate of fluctuations in the price of oil and exchange rate. The recent crashing of global oil prices and of exchange rate attracting heated debate among policy makers and academics because of the effect on global output, inflation and economic stability. Nigeria represents a good case study for exploring the effect of exogenous oil price shock on oil exporting countries because of her dependence on crude oil earnings, and the challenges currently confronting the government. Even though various studies have been conducted on this area, it is observed that the impact of crude oil price and exchange rate on economic growth in Nigeria has been subjected to several debates in empirical studies. This research is not without observed gaps which this study intends to fill for example:

The study conducted by *Ani et al.,* (2014) on the effect of oil price on economic growth in Nigeria suffered from both theoretical and methodological problem in which the authors did not relate their study to any theory as well as spearman rank correlation method of analysis and granger causality test were used in the study. These statistical techniques may not be appropriate in drawing useful conclusion. Thus, their study may prone to spurious result. Similarly, they failed to investigate long run relationship between the variables and their impact on the dependent variable. This may lead to spurious result which may not be reliable for prediction in which rigorous statistical techniques and diagnostic test are require to examine the trend of the variable control in the model. More so, this study will also serve as an update to the previous studies more especially that of Emmanuel (2015); Musa (2015); Isma'il (2016); Jarumeh *et al.,* (2016). The previous studies suffered from both theoretical and methodological problem. None of the study investigate the causality relationship between the variables. Also there was a problem of omitted variable bias due to omission of relevant variables in the study, like work conducted by Emmanuel (2015) neglected the role of crude oil price and exchange rate on economic growth, neglecting important role of this variable may lead to spurious result which may not be reliable for prediction. Furthermore, most of the previous studies did not properly check for the problem of non-stationarity associated with time series data. This indeed affects the quality of their results. Some of this previous studies include that of Musa (2015) and Isma'il (2016) Therefore, modern statistical time series procedure like unit root test will be used to know the nature of the series whether they are stationary or not in order to choose appropriate model for the study.

Again this background, this paper intends to examine the impact of oil price and real exchange rate on Nigeria's economic growth. Also to determine the long-run relationship between oil price and real exchange rate and economic growth in Nigeria, and to determine the direction of causality between oil price and real exchange rate and Nigeria's economic growth. The significance of the study therefore is its contribution to literature as well as methodology, and the economic importance of oil price uncertainty to growth for oil exporting countries like Nigeria. It will also provide the government with relevant information on the need for diversified economy and

ensure that the benefits of the Nigerian oil industry are broadly shared and that sustainable revenues from these natural deposits elevate the Nigerian society.

2. Literature Review

2.1 Empirical Reviews

Adeniran, Yusuf and Adeyemi (2014) examined the impact of exchange rate on Nigeria economic growth from 1986 to 2013. Employing the correlation and regression analysis, the ordinary least square (OLS) analyze the data. The result revealed that exchange rate has positive and insignificant impact on Nigeria economic growth and recommended that government should encourage the export promotion strategies in order to maintain a surplus balance of trade and also conducive environment, adequate security, effective fiscal and monetary, as well as infrastructural facilities should be provided so that foreign investors will be attracted to invest in Nigeria. More so, Jerumeh *et al.,* (2016) study the effect of currency fluctuations on the economic growth in Nigeria using the Johansen co integration tests and ECM. The result from Johansen co integration tests shows the presence of long run relationship between variables. The Error Correction Model (ECM) results suggest that exchange rate has a negative significant impact on GDP in the short run and long run. The study therefore recommends that the competitiveness and stability of the exchange rate should be given due consideration as this will increase economic growth through increased investment.

Dada and oyeranti (2012) examines exchange rate and macroeconomic aggregates in Nigeria. The result shows that there is no evidence of a strong direction between changes in the exchange rate and GDP growth. Rather, the country's growth has been directly affected by fiscal and monetary policies and other economic variables particularly the growth of exports which is majorly oil. More so, Manalo, Perera and Rees (2014) examine the effects of exchange rate movements on the Australian economy using the structural vector auto-regression model using seasonally adjusted data at quarterly frequencies for the period of 1985Q1 to 2013Q2. They found out that a temporary 10 per cent appreciation of the real exchange rate that is unrelated to the terms of trade or interest rate differentials lowers the level of real GDP over the subsequent one-to-two years by 0.3 per cent and year-ended inflation by 0.3 percentage points.

Attah-Obeng, Enu, Osei-Gyimah and Opoku (2013) examined the relationship between GDP growth rate and exchange rate in Ghana from the period 1980 to 2012. The study employed the graphing of the scatter diagram for the two variables which are GDP growth rate and exchange rate, establishes the correlation between GDP growth rate and exchange rate using the Pearson's Product Moment Correlation Coefficient (PPMC) and finally estimates the simple linear regression using OLS. Which confirms to the theory that undervaluation (high exchange rate) stimulates economic growth in the short run. Therefore, policy makers should 207ointegra monetary and fiscal policies in the long run. More so, Al-Mulali, (2010) examines the

impact of oil price shocks and real exchange rate on the gross domestic product in Norway using time series data from 1975 to 2008. The vector auto-regressive has been implemented using the co-integration and the granger causality test. The results of the study show that the increase in oil price is the reason behind Norway‟s GDP i.e there is positive relationship between oil price and GDP. More so, exchange rate is positive to GDP. The result further reveals a unidirectional relationship between oil price, exchange rate and GDP. More so, Aliyu (2009) assesses the impact of oil price shock and real exchange rate on the real gross domestic product in Nigeria using quarterly data that span the period 1986-2007. He used the Johansen VAR-based co integration technique to examine the sensitivity of real GDP to change in oil prices and real exchange rate in the long-run while the vector error correction model was used in the short-run. The result of the long-run analysis indicated that a 10.0 per cent permanent increase in crude oil prices increases the real GDP by 7.72 per cent, similarly a 10.0 per cent appreciation in exchange rate increases GDP by 0.35 per cent. The short-run dynamic was found to be influenced by the long-run equilibrium condition. He recommended the diversification of the economy and infrastructural diversification.

2.2 Theoretical Framework

International trade has received considerable attention from researchers and policy-makers around the world. The standard growth theories focus on primary inputs, while failing to recognize the role of primary energy inputs such as; oil deposits. However, natural scientists and some ecological economists have made efforts at evolving some theories which capture the role of oil price on economic growth, thus incorporating the linkage between energy resources; its availability and economic growth. Therefore, the theoretical underpinning of this study is situated based on Linear/Symmetric relationship theory of growth and The Renaissance growth theory.

2.2.1 The Linear/Symmetric Relationship Theory of Growth: The Linear/Symmetric relationship theory of growth which has as its proponents, Hamilton (1983), Hooker (1986) and Laser (1987) postulated that volatility in GNP growth is driven by oil price volatility. They hinged their theory on the happenings in the oil market between 1948 and 1972 and its impact on the economies of oil-exporting and importing countries respectively. Hooker (2002), after rigorous empirical studies demonstrated that between 1948 and 1972 oil price level and its changes exerted influence on GDP growth significantly. Laser (1987), who was a late entrant into the symmetric school of thought, confirms the symmetric relationship between oil price volatility and economic growth. After an empirical study of her own, she submitted that an increase in oil prices necessitates a decrease in GDP, while the effect of an oil price decrease on GDP is ambiguous, because its effects varied in different countries.

2.2.2 The Renaissance Growth Theory: The Renaissance growth theory/model was an off-shoot of the symmetric and asymmetry in effect schools. Lee (1998) who was a leading proponent of this school focused her theoretical work on attempting to

distinguish between oil price changes and oil price volatility. Lee (1998) defined volatility as the standard deviation in a given period. She submitted that both have negative impacts on economic growth, but in different ways: Volatility has a negative and significant impact on economic growth immediately, while the impact of oil price changes delays until after a year. She concludes by stating that it is volatility/change in crude oil prices rather than oil price level that has a significant influence on economic growth‖.

3. Methodology

As for methodology, the study empirically examines the impact of crude oil price and real exchange rate on economic growth in Nigeria within a time frame of 45 years (1970-2016) within Multivariate Vector Error Correction Framework. The data employed for this study was secondary data and source from the publications of The data was sourced from Central Bank of Nigeria Statistical bulletin, Organization of the Petroleum Exporting Countries (OPEC) annual statistical bulletin, and the Nigerian National Petroleum Corporation (NNPC) annual statistical bulletin. The justification for selection of this period would ensure conformity to sample requirement for a minimum of 30 observations i.e. central limit theorem (Gujarati, 2007). The data collected for the study has been analyzed using Johansen Cointegration test, Vector Error Correction Model and VEC Granger Causality/Block Exogeneity Wald Test for the specified econometric model. Since time series data are notably not stationary overtime, this study applied a conventional Augmented Dickey Fuller and Phillips-Perron tests for stationarity to test for unit root in order to avoid spurious results. Diagnostic tests for serial auto correlations, normality and 209ointegration209city was carry out for the estimated model. The result was analyzed with the aid of EVIEWS 9 Software.

1.1 Model Specification

In trying to assess the impact of crude oil price and real exchange on economic growth in Nigeria, the following model was adopted and modified from the works of Ifeanyi and Ayenajeh (2016) and Isma'il (2016) is expressed in linear econometric equation. This is represented thus:

RGDP = f (COP, EXR, INF, INTR)…….……..……..1

Where the stochastic form as Real Gross Domestic Product (GDP), Crude Oil Price (COP), Real Exchange Rate (EXR), Inflation (INF) and Interest Rate (INTR)

In order to estimate the equation empirically, the above equation was transformed into an econometric equation stated as follows:

$GDP_t = \alpha_0 + \alpha_1 COP_t + \alpha_2 EXR_t + \alpha_3 INF_t + \alpha_4 INTR_t + \varepsilon_t$ …….……..……2

α_0 = Constant Term, $\alpha's$ = the parameters to be estimated, ε_t = disturbance term

3.2 Techniques of Estimation

To estimate this model, Vector Error Correction Model will be use. As stated by Engle and Granger (1987) that there is an existence of both Short-run and long-run equilibrium in VECM once the variables are cointegrated of order 1(1). The VECM specifications employed in this study are presented in the equations below.

$$\Delta(\text{GDP})_t = \alpha_0 + \alpha GDP\phi_{t-1} \sum_{i=1}^{g_1} \alpha_{1i}\Delta(GDP)_{t-1} + \sum_{i=1}^{h_1} \rho_{1i}\Delta(\text{COP})_{t-1} + \sum_{i=1}^{r_1} \lambda_{1i}\Delta(EXR)_{t-1}$$
$$+ \sum_{i=1}^{v_1} \gamma_{1i}\Delta(INTR)_{i-1} + \sum_{i=1}^{s_1} \vartheta_{1i}\Delta(INF)_{i-1} + \varepsilon_{1t} \quad \ldots\ldots 3$$

$$\Delta(\text{COP})_t = \rho_0 + \rho COP\phi_{t-1} \sum_{i=1}^{g_2} \alpha_{1i}\Delta(GDP)_{t-1} + \sum_{i=1}^{h_2} \rho_{1i}\Delta(\text{COP})_{t-1} + \sum_{i=1}^{r_2} \lambda_{1i}\Delta(EXR)_{t-1}$$
$$+ \sum_{i=1}^{v_2} \gamma_{1i}\Delta(INTR)_{i-1} + \sum_{i=1}^{s_2} \vartheta_{1i}\Delta(INF)_{i-1} + \varepsilon_{2t} \quad \ldots\ldots 4$$

$$\Delta(\text{EXR})_t = \lambda_0 + \lambda EXR\phi_{t-1} \sum_{i=1}^{g_3} \alpha_{1i}\Delta(GDP)_{t-1} + \sum_{i=1}^{h_3} \rho_{1i}\Delta(\text{COP})_{t-1} + \sum_{i=1}^{r_3} \lambda_{1i}\Delta(EXR)_{t-1}$$
$$+ \sum_{i=1}^{v_3} \gamma_{1i}\Delta(INTR)_{i-1} + \sum_{i=1}^{s_3} \vartheta_{1i}\Delta(INF)_{i-1} + \varepsilon_{3t} \quad \ldots\ldots 5$$

$$\Delta(\text{INTR})_t = \gamma_0 + \gamma INTR\phi_{t-1} \sum_{i=1}^{g_4} \alpha_{1i}\Delta(GDP)_{t-1} + \sum_{i=1}^{h_4} \rho_{1i}\Delta(\text{COP})_{t-1} + \sum_{i=1}^{r_4} \lambda_{1i}\Delta(EXR)_{t-1}$$
$$+ \sum_{i=1}^{v_4} \gamma_{1i}\Delta(INTR)_{i-1} + \sum_{i=1}^{s_4} \vartheta_{1i}\Delta(INF)_{i-1} + \varepsilon_{4t} \quad \ldots\ldots 6$$

$$\Delta(\text{INF})_t = \vartheta_0 + \vartheta INF\phi_{t-1} \sum_{i=1}^{g_5} \alpha_{1i}\Delta(GDP)_{t-1} + \sum_{i=1}^{h_5} \rho_{1i}\Delta(\text{COP})_{t-1} + \sum_{i=1}^{r_5} \lambda_{1i}\Delta(EXR)_{t-1}$$
$$+ \sum_{i=1}^{v_5} \gamma_{1i}\Delta(INTR)_{i-1} + \sum_{i=1}^{s_5} \vartheta_{1i}\Delta(INF)_{i-1} + \varepsilon_{5t} \quad \ldots\ldots 7$$

α_0 = Constant parameter

Δ =Denoted the difference operators

$\sum$ =Vector of coefficient variable in the model

Y_t =Represent the dependent variable at time t

$\rho_0\ \gamma_0\ \lambda_0\ \vartheta_0$ =Are slops coefficient of independent variables

3.3 Estimation Procedure

The econometric technique adopted is based on the Johansen maximum likelihood estimation procedure, the vector error correction model (VECM); while the former enables to determine 211ointegration rank of our model, the later helps to ascertain possibility of error correction as the model approaches it long run equilibrium path. The choice of a 211ointegration technique over the ordinary least square techniques lies on the following; most time series data are not stationary, implying that the assumption of a constant mean, a constant variance and a constant auto variance for every successive lag is mostly violated, so the use of the OLS method of estimation could only yield a spurious result. More also, 211ointegration approach is a convenient approach for the estimation of long run parameters. The 211ointegration approach provides a direct test of the economic theory and enables utilization of the estimated long run parameters into the estimation of the short run disequilibrium relationships. The traditional approach is criticized for ignoring the problems caused by the presence of unit roots variables in the data generating process. However, both unit root and 211ointegration have important implications for the specification and estimation of dynamic models and lastly, Granger Causality Block Exogeneity Wald test to be use. This procedure has been found to be superior to ordinary Pairwise Granger causality tests since it does not require pre-testing for the cointegrating properties of the system and thus avoids the potential bias associated with unit roots and 211ointegration tests as it can be applied regardless of whether a series is I (0), I (1) (Johansen, 1995; Dickey and Fuller 1981; Granger, 1986).

4. Data Presentation and Analysis

4.1 Result of Unit Root Test

Table 4.1 Result of Unit Root Test ADF (Augmented Dickey Fuller)

Variables Series	Level Value	First Difference	Order of Integration
LRGDP	-2.12405	-5.69963***	I(1)
LCOP	-2.33975	-6.612043***	I(1)
LEXR	-0.34919	-5.824958***	I(1)
LINF	-1.34918	-6.871509***	I(1)
LINTR	-1.17201	-6.405912***	I(1)

*Note that *** indicate significant at 1% level.*
Source: Author's Computation

Table 4.2 Result of Unit Root Test PP (Phillips and Perron's)

Variables Series	Level Value	First Difference	Order of Integration
LRGDP	-2.171057	-5.647133***	I(1)
LCOP	-2.184657	-5.739175***	I(1)
LEXR	-0.412324	-5.855425***	I(1)
LINF	-1.033958	-8.874458***	I(1)
LINTR	-1.324779	-6.408982***	I(1)

*Note that *** indicate significant at 1% level.*
Source: Author's Computation

The result of unit root test is presented in table 4.1 and 4.2. The tables observe the null hypothesis of the unit root using Augmented Dickey Fuller (ADF) and Phillips and Perron's (PP) tests respectively. The null hypotheses were accepted at the level value because the absolute table value is greater than the absolute statistical value for both the ADF and PP. That is to say, the series have unit root at their level values. Based on the results therefore, the variables became stationary at first difference. This revealed that the series are integrated of order I(1) and significant at 1% for both ADF and PP tests. The optimal lag length applied in ADF was based on Schwarz Information Criteria (SIC). For PP test, Bandwidth was chosen using Newey-West Method automatically. All tests include constant and linear trend.

4.2 Optimum Lag Test Result

Table 4.1: Result of Optimum lag Test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-121.478	NA	8.34e-01	1.95676	1.57834	1.346345
1	24,5747	187.8952	4.57e-03	7.46773	3.38553	2.547362
2	52.4885	53.05416*	5.63e-07*	6.78575*	7.34585*	1.653272
3	148.374	26.48543	5.46e-03	4.25464	7.36535	4.574556*
4	172.574	41.47467	4.47e-29	5.46478	4.25538	2.343436
5	241.364	25.75670	3.46e-16	6.35746	5.3533	5.256454

*Note that * indicate lag order selected by the criterion, LR: sequential modlified LR test statistic (each test at 5% level), FPE: Final Prediction Error, AIC: Akaike Information Criterion, SC: Schwarz Information Criterion and HQ: Hannan-Quinn Information Criterion.*
Source: Author's Computation

Haven conducted the ADF and PP unit root test, and the result confirm the stationarity of the series variable at the same level I(1) which is one of the basic requirement for 212ointegration, so it is important to determine the number of lag to be included in the regression. As presented in table 4.3, optimum lag order selection was carried out to

determine the number of lag(s) to be included in the model prior to 213ointegration test. The maximum lag for the model was selected based on the five different information criteria. It evident from the table 4.3 that only for Hannan-Quinn Information Criterion which agreed at 3 lag, all the remaining agrees at lag 2. Hence, the study adopted 2 lag as the maximum for the model.

4.3 Result of Johansen Cointegration Test

Table 4. 4 Result of Johansen Cointegration Rank Test (Trace Statistics)

Hypothesized No. of CE(s)	Eigen Value	Trace Statistics	0.05%Critical Value	Prob.
None*	0.5232	72.41095	69.81889	0.0306
At Most 1	0.3606	39.82151	47.85613	0.2290
At Most 2	0.2199	20.14269	29.79707	0.4132
At Most 3*	0.1126	15.21676	9.49471	0.0247
At Most 4*	0.0861	3.961659	15.49471	0.0346

*Note that * donate rejection of hypothesis at 5% significant and Mackinnon P-Value accordingly. Trace test indicates 3 cointegrating eqn(s) at the 0.05 level*
Source: Author's Computation

Table 4.5 Result of Johansen Cointegration Rank Test (Maximum Eigen Value Statistics)

Hypothesized No. of CE(s)	Eigen Value	Max-Eigen Statistic	0.05% Critical Value	Prob.
None	0.5232	32.5894	33.8769	0.7006
At Most 1	0.3606	19.6788	27.8843	0.3638
At Most 2	0.2199	10.9259	21.1316	0.6547
At Most 3*	0.1126	14.2551	5.26460	0.0794
At Most 4*	0.0861	3.19166	3.84147	0.0465

*Note that * donate rejection of hypothesis at 5% significant and Mackinnon P-Value accordingly. Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level*
Source: Author's Computation

Table 4.4 and 4.5 indicates that Johansen cointegration test was applied to determine whether the variables of the series are cointegrated or not. The results were authenticated through Johansen and Julius trace test and Maximun Eigen value approach to provide the number of cointegrating vectors. This provides the number of cointegrating equations and estimates of all cointegrating vectors in the multivariate circumstances. But trace test statistics and maximum-eigen statistics results in table 4.4 and 4.5 revealed the presence of two cointegrating equations at 5% significance level. In addition, the normalized cointegrating coefficients show that the variables in the equations are relatively important. The consistency in the test results confirms the existence of long run relationship among the dependent and independent variables in the model. Both the trace and the maximum eigenvalue tests results in Tables 4.4 and 4.5 respectively reject the null hypothesis of no cointegration. The implication is that

there is a long run relationship between the dependent variable GDP and its regressors.

4.4 Result of Vector Error Correction Model

When there is existence of the cointegration from the Johansen test, construction of VECM model becomes imperative for modelling the dynamic relationship and the speed of adjustment from short-run equilibrium to the long run equilibrium. The greater the coefficient of the parameters the higher the speed of the model from short run to the long-run and vice-versa.

Table 4. 2: Result of Vector Error Correction Model

Variables	Coefficient	
	Short-run	Long-run
ECM	-0.254532*** [0.02907] (-1.87566	5.959125
Δ(-1)LRGDP	0.026015** [0.17714] (0.14686)	1.000000
Δ(-1)LCOP	0.335550*** [0.24666] (1.36037)	2.700428*** [0.88017] (3.06809)
Δ(-1)LEXR	0.021221*** [0.33030] (0.00370)	0.295639*** [0.33781] (0.87515)
Δ(-1)LINTR	0.094082 [0.27952] (0.33659)	-2.889066 [0.87874] (-3.28773)
Δ(-1) LINF	-0.111921 [0.088030] (-0.13541)	-0.282057 [1.48211] (-0.19031)
R-squared	0.681419	
Adjusted R-square	0.526438	
F-Statistic	6.103688	
Durbin-Watson stat	2. 207327	

Note that ***, ** and * indicate level of significant at 1%, 5% and 10% respectively; *ECM = size of the error correction terms;* Δ *= indicate changes in the first difference*

Source: Author's Computation

The results shows that the error correct term ECM(-1) is correctly specified. The estimated coefficient value of ECM (-0.254532) in Table 4.6 indicate that our variables are well defined as it observes the usual negative sign of which enables it to adjust to equilibrium position whenever the system is out of equilibrium. The

estimated coefficient indicates that about 26% of this disequilibrium is corrected annually. The negative sign confirms our earlier conclusion that economic growth and its regressors are indeed cointegrated. The negative sign is an indication of the fact that any short-term fluctuations between the independent variables and the dependent variables will give rise to a stable long run relationship between variables, and the value is statistically significant at 1%. Nearly 26 percent of the disequilibrium of the previous year's shock adjusts back to the long-run equilibrium in the current year. The result further revealed short run positive relationship between COP and EXR with the dependent variable which is significant at 1% respectively.

The coefficient of COP is 0.33555, means that holding other variables constant, 1-unit increase in COP will lead to 33.555 million naira increase in RGDP and the value is statistically significant at 1% evident from the probability value of (0.0000), The coefficient of EXR means that 1 naira appreciation in the value of the naira against the US$, without the influence of other variables, leads to an increase in GDP by 2.1221 million naira with probability value (0.000) indicate significance positive influence of real exchange rate to real GDP in Nigeria. In addition, the result revealed negative short run relationship between inflation and economic growth. The coefficient of interest rate is negatively signed at -0.11921, this indicate a unit increase in interest rate will affect the GDP negatively, it will lead to a reduction in GDP by 11.921 million naira, But the result is not statistically significant given it insignificant probability value. More also, the interest rate result reveals positive relationship with GDP, the interest rate coefficient of 0.094082 indicate a unit increase in interest in will lead to 9.4-million-naira increase in RGDP, But the result is not statistically significant given it insignificant probability value.

The VECM long-run impact of the estimated model is show that holding all variables constant, GDP will be positively influence by 5.95125. The coefficient of COP and EXR are positively related to GDP in the long run and statistically significant at 1% respectively. The coefficient of Interest rate is negatively related to GDP in the long-run but insignificant. The coefficient of inflation reveals insignificant negative long run relationship with economic growth. The coefficient of determination R^2, account for 0.68149 (68%) of the variation of RGDP between the year 1970 to 2016 are explained by the variables controlled in the model while the remaining 32% percent are explained by other variables not captured by the model (that is, error term). Moreover, the result proves F- statistic to be 6.103688, indicated joint effect of independent variables on GDP.

4.5 Result of VEC Granger Causality Block Exogeneity Wald Test

The result from table 4.7 shows that there is unidirectional causality between RGDP and COP evident from X^2 -values of 2.1324 which is significant at 1%, that is to say COP granger cause RGDP. More also, there is bidirectional causality between RGDP and EXR with X^2 –values of 0.2562 and 0.0453 which are significant at 10% level. More so, this test provides some reason to believe that no causal relationship between

INF, INTR and RGDP in Nigeria give there insignificant X^2 values of 2.9086, 2.2260, 3.9838 and 0.5543 respectively. More also, the joint test causality suggests that the three variables RGDP, COP and EXR are not exogenous, because of the significant X^2-values of the joint test for each equation of those variables 8.6881, 8.2536 and 12.7622 which are significant at 5%, 5% and 1% respectively. The test also provides evidence that we reject the null hypothesis of excluding almost all variables except one case, we fail to reject the null hypothesis of excluding INTR and INF because the joint test further suggests that two variables INTR and INF are exogenous, because of their insignificant X^2-values of the joint test for each equation of those variables are 7.0197 and 5.5835 respectively.

Table 4. 3: Granger Causality/Block Exogeneity Wald Test

Dependent Variable	X^2-statistics of lagged 1st different term [p-value]				
	Independent Variables				
	$LRGDP\phi_{t-1}$	$\Delta(\text{LCOP})_{t-1}$	$\Delta(LEXR)_{t-1}$	$\Delta(LINF)_{i-1}$	$\Delta(LINTR)_{i-1}$
$\Delta LRGDP$	-	3.9731	0.0453*	1.9121	0.2528
$\Delta LCOP$	2.1324**	-	0.5853	4.6513*	0.8876
$\Delta LEXR$	0.2562*	1.9556		1.2696	5.3816*
$\Delta LINF$	2.9086	0.7802	- 2.0417		0.5543
$\Delta LINTR$	0.2260	0.0032	0.5981	- 3.9838	
Joint Test Causality	8.6881**	8.2536**	12.7622***	7.0197	- 5.5835

*Note that ***, **and * indicate 1%, 5% and 10% significant*
Source: Author's Computation

4.6 Diagnostic Tests Result

Table 4. 8: Diagnostic Test Result for VECM

Tests	Coefficient	P-Value
Serial Correlation LM Test	32.2186	0.1518
Jarque-Bera Residual Normality Test	165.839	0.8423
Residual Heteroskedasticity Test	328.809	0.5082

Source: Author's Computation

From table 4.8, the model passes the normality test through the joint Jarque-Bera statistics the result from the test shows residual have normal and identical distribution.

this prove the normality of the series variables, the VEC residual normality test confirmed that we cannot reject the null hypothesis of normality properties given the insignificant p-value of tests conducted (0.8423) This provides some support for the hypothesis that residuals from our VEC model have a normal distribution. VEC residual serial correlation LM test shows that we accept the null hypothesis of no autocorrelation at lag 2, given the insignificant P-value of 0.1518 for the lag order 2. This proved that there is no serial correlation of residual among the selected lag. Furthermore, heteroskedasticity test was carried out and the null hypothesis which says that the model homoscedastic could not be rejected going by its p-value (0.5082) this indicate that the model is not heteroskedastic and not serially correlated. This gives support to the assumptions of our model about white noise residuals and proved the adequacy of the selected VECM.

5. Conclusion and Recommendations

This study looked at impact of crude oil price and exchange rate on Nigerian economy. Based on the findings of this study, the paper concludes that; both crude oil price and exchange rate are positively to economic growth in Nigeria in both the short run and long run, while, inflation has not been friendly to growth because it has hampered economic growth in both periods, while that of interest rate is important and friendly to economics growth in the short run but induced growth in the long run. For causality relationship, bidirectional causal relationship exists between RGDP and EXR. Furthermore, COP granger cause RGDP without feedback. By implication, the Nigerian economy is vulnerable to both internal shocks and external shocks. Since the oil price significantly impacts on all the variables considered, it is a major source of macroeconomic in Nigeria. Hence, fluctuations in oil price and exchange rate bring about instabilities in the Nigerian economy.

The general findings of this study have necessitated some policy directions which may be useful recommendations for policy authorities and for the purpose of contribution to knowledge, it is necessary for other developing countries like Nigeria faced with a budget constraint to undertaken specific policy recommendations. Based on the findings of this research, the following recommendations are proffered:

i. The need for a national technology development plan. Apart from the undiversified structure of the Nigerian economy and declining oil prices, a critical technology gap predisposes the country to external shocks. Concerted effort towards mass skills acquisition in the form of technology transfer is imperative for global competitiveness.
ii. there is a need to encourage the manufacturing of high-end, value added goods and services in Nigeria which if implemented, will reduce the demand for dollar for importation purposes. This in turn will limit the necessity for intervention of the CBN in the foreign exchange market and the depletion of the nation’s foreign reserves will be curtailed.

iii. Given the importance of crude oil to the Nigerian economy, therefore, the greater diversification of the economy through judicious investment in the productive sectors of the economy such as the agricultural sector and the industrial sector in order to reduce overdependence on the oil sector.

iv. Also it is a known fact that exchange rate in Nigeria is primarily anchored by the country's level of excess reserves. Exchange rate stability could, therefore, be achieved even in the face of dwindling oil revenue through a conscious effort aimed at infrastructural development and diversification of the export-base of the economy.

v. The government should diversify from the oil sector to other sectors of the economy hereby dwindling the impact of crude oil as the mainstay of the economy and overcome the effect of incessant changes in crude oil prices which often culminate into macroeconomic instability.

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