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Oil Price Fluctuation and Exchange Rate Movement in Nigeria: 1980-2016

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Abstract

*This study is carried out to empirically examine oil price shocks and exchange rate movement in Nigeria. Three variables are used in this study which are exchange rate (EXR), oil price (OP) and oil export (OE). The variables were subjected to unit root test and they were all stationary at first difference I(1). Since the Variables were not all stationary at level but at the same order of I(1) the Johansen cointegration test was used to test for cointegration among the variables. Using the Johansen test, the variables were found to be cointegrated at 5% level of significance. Vector Auto regressive Model was used to determine the short-run relationship between the variables and the forth lag was selected based on the lag selection criterion. A Forcast Error Variance Decomposition (FEVD) was obtained using the cholesky decomposition of the VAR residual. The result obtained showed the proportion of the variations in exchange rate , oil price and oil export attributed to their respective lag values. Causality test indicated that there is bi causality between exchange rate and oil price. This means that oil price Granger cause exchange rate and exchange rate Granger cause oil price. Based on the findings the recommendations made include; that the government should **d**iversify the economy to reduce over-reliance on oil revenue. Diversification of the economy will reduce the vulnerability of the domestic economy towards adverse oil price shocks.*

Keywords: Fluctuation, exchange, Growth, price, movement, Rate
JEL Codes: G24

1. Introduction

Analysis of the impact of symmetric and asymmetric shocks occasioned by exchange rate and oil price variability on economic growth has been a major preoccupation of both academics and policy makers for some decades now (Mork, 2008). On the one hand, it has been recognized in the literature that depreciation of exchange rate tends to expand exports and reduce imports, while the appreciation of exchange rate would discourage exports and encourage imports (Bartleet and Grounder 2010). Thus, exchange rate depreciation leads to income transfer from importing countries to exporting countries through a shift in the terms of trade, and this affects the economic growth of both importing and exporting nations. On the other hand, there is perception that oil price spikes have a serious positive effect on the economies of oil exporting countries (Blanchard and Gali, 2007). While Greenspan (2004) noted that the impact of oil prices alone in modern market-based economies is difficult to infer in a way in which policy is automatically obvious, Omolola (2017) argued that higher oil prices promote economic growth for oil exporting countries, generate more foreign earnings and enhance foreign reserve, which eventually lead to monetary and financial stability. It will also lead to lower interest rates and augment domestic investment. The Nigerian oil and gas sector plays a very dominant role in the nation's economy with oil receipts accounting for 82.1%, 83% and about 90% of the nation's foreign exchange earnings in 1974, 2008 and 2010 respectively (Ihua,2013). As at 2012, 88.3% of foreign exchange earnings was attributed to oil industry and in 2016 it stood at 87 % (Omolola 2017). This is an economically precarious situation as confirmed by Oriakhi and Osaze (2013). The over reliance on this wasting resource over the years, has bedevilled Nigeria's economy as a mono-product economy with notable structural difficulties for the economy. It is worth noting that prior to 1956 when Crude Oil was discovered in commercial quantities, the mainstay of the Nigerian economy comprised of agricultural commodities such as palm oil, rubber, cotton, groundnut, cocoa etc. Since the discovery of oil, Nigerian's reliance on income from oil and Gas has further been buoyed by an almost consistent upward movement in the prices of crude oil reaching about $147 per barrel in 2008, before averaging $90 per barrel in 2010 and low at $60 per barrel in 2016 (Oriakhi and Osaze, 2013, Omolola, 2017). Volatility in oil prices was defined by Englama et al. (2010) as the rate of change in price over a given period. Volatility may as well be expressed as a percentage and computed as the annualized standard deviation of the percentage change in the daily price. By implication, the larger the magnitude and frequency of the change over time, the higher the incidence of volatility.

Apere and Ijomah (2013) succintly captured the nature of oil volatility as follows, 'price of oil oscillated between $17 and $26 at different times in 2002 hovered around $53 per barrel by October 2004 and moved further to $55 in 2005. They added that by July 2008, the price of oil rocketed to an all time record of $147 per barrel and thereafter, a sharp drop to US $46 a barrel and this is unending'. In 2015 and 2016 oil price averaged at $50 per barrel and $60 per barrel respectively (Omolola, 2017). In an attempt to situate the oscillation in oil price, the Organisation of Petroleum Exporting Countries (OPEC) attributed the current global crude oil price volatility to continued uncertainty, stemming from the slow pace of global economic growth, continued Eurozone debt crises, high unemployment in advanced economies and the risk of inflation in developing countries (*Oriakhi and Iyoha, 2013*).

There are severe implications of oil price fluctuation with regards to fall in oil price for the Nigerian economy given the current, wide swings in petroleum product prices in the international oil market. Oil price volatility are predominantly defined with respect to price fluctuations resulting from changes in either the demand or supply side of the international oil market (Hamilton, 1983). These changes have been traditionally traced to supply side disruptions such as OPEC supply quotas, political upheavals in the oil-rich Middle East and activities of militant groups in the Niger Delta region of Nigeria. The shocks could be positive (a rise) or negative (a fall). Two issues are identified regarding the shocks; first is the magnitude of the price increase which can be quantified in absolute terms or as percentage changes, second is the timing of the shock, that is, the speed and persistence of the price increase.

Going by the foregoing, four oil shocks can be observed in Nigeria. Each of the shocks had connections with some movements in key macroeconomic variables in Nigeria. For instance, the 1973-74, 1979-80, and 2003-2006 periods were associated with price increases while the oil market collapse of 1986 is an episode of price decrease. During the first oil shock in Nigeria (1973-74), the value of Nigeria's export measured in US dollars rose by about 600% with the terms of trade rising from 18.9 in 1972 to 65.3 by 1974. Government revenue which stood at 8 per cent of GDP in 1972 rose to about 20 per cent in 1975. This resulted in increased government expenditure owing largely from the need to monetize the crude oil receipts. Investment was largely in favour of education, public health, transport, and import substituting industries (Nnanna and Masha, 2003).

Despite this perceived benefit of oil price change, the macroeconomic environment in Nigeria during the booms was undesirable.

For instance inflation was mostly double digit in the 1970s; money supply grew steeply, while huge fiscal deficits were also recorded. A plausible explanation for the dismal performance of the indicators is the inefficient management of crude oil receipts by the government. It has been observed that there were weak institutions which were ill-equipped to conceive and implement major investment projects with the proceeds of the windfall.

Analysis of the impact of asymmetric shocks occasioned by exchange rate and oil price variability on economic growth has been a major preoccupation of both academics and policy makers for some decades now. When crude oil prices are low, occasioned by factors such as low demand, seasonality factors, excess supply, Nigeria experiences unfavorable terms of trade evidenced by budget deficit and slow economic growth (Englama and Omotunde, 2010). An example was a drop in the revenue from oil exports during the global financial crisis in 2009. According to OPEC statistical bulletin (2010/2011), oil export revenue dropped from US$74,033 million in 2008 to US$43,623 million in 2009 and the naira depreciated to N148.902 in 2009 from N118.546 in 2008. Given the above mentioned scenarios, this study is poised to examine the impact of oil volatility on exchange rate movement in the Nigerian economy. The period under consideration is from 1980- 2016 based on time series annual data and this forms the scope of the study. The scope is restricted to the above mentioned period due to data availability especially data on oil export revenue and also to examine recent trends and issues on oil price.

2. Literature Review and Theoretical Framework

Over the past twenty years, dozens of scholars have explored the relationships between oil volatility and the macroeconomic performance of national economies. Different methods of analysis have yielded different results, sometimes sharply different, sometimes modestly.

The empirical literature on the macroeconomic impacts of petroleum product pricing evolved as the new state of the oil market revealed itself gradually after 1973. One of the initial beliefs following the 1973-74 price shock was that the new, higher price of oil might be a permanent feature of a changed natural resource regime. Accordingly, one recurrent theme was the aggregate economy’s response to a sudden, permanent price shock. How would an economy adjust to the new circumstances? This assumption underlies Rasche and Tatom’s (1977, 1981) application of the potential GNP concept to the oil price shock problem and continues as late as the work of Bruno and Sachs (1982, 1985) on adjustment to supply shocks.

Analysis of the impact of asymmetric shocks caused by exchange rate and oil price variability on economic growth has been a major concern of both academics and policy makers for a long time now (Aliyu 2009). According to Amano and Norden (1998) many researchers suggest that oil fluctuations has a significant consequence on economic activity and the effect differ for both oil exporting countries and oil importing countries. It benefits the oil exporting countries when the international oil price is high but it poses a problem for oil importing countries. According to Plante (2008), theoretically the immediate effect of positive oil price shocks is the increase in the cost of production for oil importing countries, this is likely to reduce output and the magnitude of this will depends on the demand curve for oil. Higher oil prices lower disposable income which then leads to a decrease in consumption. Once the increase in oil price is believed to be permanent, private investments will decrease. But if the shocks are perceived as transitory, oil is used less in production and the productivity of labor and capital will decline and potential output will fall. Similarly, Patti and Ratti (2007) shows that oil price increases have a greater influence on the economy than a decrease in oil price.

Also, Rickne (2009) posits that political and legal institutions affect the extent to which the real exchange rate of oil exporting countries is affected by international oil price shocks. In a theoretical model succinctly espoused by literature, strong institutions protect real exchange rate from oil price volatility by generating a smooth pattern of fiscal spending over the price cycle. Empirical analysis carried out on 33 oil exporting countries show that countries with high bureaucratic quality, and strong and impartial legal system have real exchange rate that are affected less by oil price.

Also according to Mordi and Adebiyi (2010) the asymmetric effect of oil price changes on economic activity is different for both oil price increase and oil price decrease. Empirical research suggesting that oil price serves as a major determinant of real exchange rate has yielded somewhat puzzling results for oil exporting countries (Rickne, 2009). Korhonen and juurikkala (2007) showed that increasing crude oil prices cause a real exchange rate appreciation in oil exporting countries and this is not shocking, since they earn a significant amount from oil exportation. There is also a significant relationship between real oil prices and real exchange rates for oil importing countries; evidence has been seen for Spain (Camarero and Tamant 2002).

A study carried out on the Russian economy by Spatafora and Stavrev (2003) confirm the sensitivity of Russia's equilibrium real exchange rate to long run oil prices. Likewise, Suseeva (2010) verified a long run positive relationship between the real oil price and the real bilateral exchange rate against Euro in Russia. Lizardo and Mollick (2010) provided proof that between the year 1970s to 2008, movements in the value of the U.S dollar against major currencies was significantly explained by oil prices. They found that when oil prices increases, currencies of oil importers such as china suffer depreciation. On the other hand, in net-oil exporters such as Canada, Mexico and Russia, increase in oil prices leads to a noteworthy depreciation of the US dollar. But, Akram (2004) finds strong evidence of no linear relationship between oil prices and the Norwegian exchange rates. Using quarterly data from 1974 to 1992 comparing the United States of America to four different countries (Germany, United Kingdom, Japan and Canada), Clarida and Gali (1999) estimate the share of exchange rate fluctuations that is due to the different shocks in oil and found that more than 50 precent of the variance of real exchange rate changes over all the horizons was caused by real oil shocks.

Amano and Norden (1998) using data on real effective exchange rates for Germany, Japan and United States of America discovered that real oil price is the most important factor in determining real exchange rates in the long run. In the same manner, if the productivity of tradable relative to non-tradable is larger in other countries, it could lead to the appreciation of the real exchange rate. This is the Balassa-Samuelson hypothesis formulated by Balassa (1964) and Samuelson (1964). According to Coudert (2004), the Balassa-Samuelson effect is the mechanism by which an appreciation of the real exchange rate occurs owing to changes in relative productivity. We use the real oil price as a representation of the terms of trade and examine the influence of oil price fluctuations and productivity differentials on the real exchange rate given that oil price is the main export good driving the terms of trade in oil exporting countries. In practice, the price of the main exported good is often used as an indicator of the terms of trade (Sossounov and Ushakov, 2009).

Using a panel of 16 developing countries, Choudhri and Khan (2004) provided strong evidence of the workings of the Balassa Samuelson effects. Coudert (2004) survey provided evidence that the trend appreciation in the real exchange rate observed in countries of Central and Eastern Europe during the early 2000 stemmed, in fact, from the Balassa effect. The study concluded that even though other factors were just as responsible, the estimated Balassa effect goes some way in explaining the real appreciation. Kutan and Wyzan (2005) using an extended version of the Balassa-Samuelson model finds evidence that changes in oil prices had a significant effect on the real exchange rate during 1996 to 2003 and that the Balassa- Samuelson working through productivity changes may be present though its economic significance may not be large. Cashin et al., (2004) carried out a study on over 50 commodities exporting developing countries and found a long-run relationship between exchange rate and the exported commodity's price in one third of their sample.

In a recent study, Ozsoz and Akinkunmi (2011) also demonstrated the positive effects of international oil prices on Nigeria's exchange rate. Using monthly panel of G7 countries, Chen and Chen (2007) investigated the long run relationship between real oil price and real exchange rates and found that real oil price is a dominant cause of real exchange rate movements. Olomola (2006) investigated the impact of oil price shocks on aggregate economic activity in Nigeria using quarterly data from 1970 to 2003. He discovered that contrary to previous empirical findings, oil price shocks do not affect output and inflation in Nigeria significantly. However oil price shocks were found to significantly influence the exchange rate. In Bahrain Johansen co-integration test is used to examine the co-integrating relationship among the real GDP, real effect exchange rate and real oil price of a country. Real GDP of Bahrain is more elastic to changes in international oil prices than real exchange rate (Al-zee, 2011). Research conducted on Vietnam from the period of 1995 to 2009 using the vector autoregressive model (VAR) produce results that suggest that both oil prices and the real effective exchange rates have strong significant impact on economic activity.

Habib and Kalamova (2007) investigated the effect of oil price on the real exchange rate of three countries namely; Norway, Saudi Arabia and Russia. In case of Russia, a positive long run relationship was found between oil price and exchange rate and no impact of oil price on exchange rate was found for Norway and Saudi Arabia. Aliyu (2009) and Rickne (2009) believe that this is due to lack of strong institutions and total dependency on oil exports. Aliyu (2009) recommends larger divergence of the economy through the investment in top prolific sector to reduce the adverse effect of oil price shocks and the exchange rate volatility.

Theoretical Framework

The theoretical framework for this study is the oil speculation as a driver of oil price theory. The role of speculation in driving the price of crude oil has been the object of renewed interest recently. The speculation theory of oil price is adopted as the theoretical framework because it explains the link between oil price and macroeconomic variables. The decades-old debate, between those who argue that market developments can be directly attributed to changes in fundamentals and those who believe that speculators are creating price volatility, is showing no signs of abating. The speculative theory was propounded by Dvir and Rogo (2009), they argue that the real price of oil has gone through three distinct periods. First, from 1970 to about 1985, the price of oil was generally high (in real terms), and was moreover highly persistent and volatile. Then came a much less volatile period, between 1990 and 1999, in which prices were also generally lower and not at all persistent. This long period can be further divided into two sub-periods: before and after 1993, where price volatility is significantly lower after 1993 compared with the years 1970-1985. Finally, from 1999 onwards, there is a recurrence of high persistence and volatility accompanied again by higher prices. Dvir and Rogo (2009) argued that in these periods two forces coincided: first, demand (governed by income) was high and very persistent, i.e it was governed by growth shocks. Second, access to supply was restricted by agents who had the capability and incentive to do so.

The theory is an extension of the classic commodity storage framework. Chambers and Bailey (1996) and Deaton and Laroque (1996) extend the model to allow for autoregressive shocks. We extend it further to explicitly incorporate demand, and to allow for growth shocks.

Time is discrete, indexed by *t*. The market for oil consists of consumers, producers, and risk neutral arbitrageurs. The latter have at their disposal a costly storage technology which may be used to transfer any positive amount of oil from period t_1 to period *t*. Storage technology is limited by a non-negativity constraint, i.e. the amount stored at any period cannot drop below zero. This implies that intertemporal arbitrage, although potentially portable, cannot always be achieved. In these cases the market is "stocked out". Let A_t denote *oil availability*, the amount of oil that can potentially be consumed at time *t*. This amount has already been extracted from the ground, either in period *t* or at some point in the past, and has not been consumed before period *t*. It is given by

$$A_t = X_{t-1} + Z_t; \qquad (2.1)$$

where X_{t-1} denotes the stock of oil transferred from period *t* 1 to *t*, and Z_t denotes the amount of oil that is produced at time *t*. For simplicity, we assume that no oil is lost due to storage. Decisions concerning both variables - how much to store, how much to produce - are assumed to have been made before period *t* began. In period *t* agents decide how to divide A_t between current consumption Q_t and future consumption, so that demand - the sum of current consumption and the amount stored for the future - must always equal current availability:

3. Methodology

Methods of Data Analysis

The research will be empirical. The VAR statistical technique will be adopted using the linear model to explore the relationship between oil price and exchange rate in Nigeria. The technique was so adopted because it will also test for the pattern of causality between the variables.

The stationarity test (unit root test) will be carried out first using the Augmented Dickey-Fuller test on each variable to test for stationarity and avoid for spurious regression. If variables are found to be non-stationary, the cointegration test, which is a pre-test for spurious regression will first be carried out. The Johansen's cointegration test will be used to test for long run relationship between variables. Furthermore, the Augmented Engle-Granger cointegration test will be carried out thus ensuring that the model is fit for use in analyzing the relationship that exist between oil price and exchange rate in Nigeria.

Specification of the Model

A model based on the oil speculation theory of oil price determination using Vector Auto Regressive (VAR) model is adopted from the work of Agboluaje and Olaleye, (2013). Conventionally the VAR model is given as;

$$Y_t = a\sum_{j=1}^{m} Y_{t-i}\, \emptyset_j + \mu_t, \quad \mu_t \sim IID(0,\sigma^2) \qquad 3.1$$

Where,

Y_t = Vector of endogenous variables in the system at time t, the current period

α = vector of constant term

Y_{t-i} = Lagged endogenous variables. This captures the effect of the variables in the system as suggested by Sims.

$\emptyset_i$ = the matrix of the coefficients of the variables in the system

m = lag length

U_t = the vector of random disturbance error term,

IID = independently and identically distributed error term with zero mean and finite variance.

Instructively, this study employs a three variables VAR model comprising of oil price, exchange rate and oil export. Thus, the VAR models can be specified below.

$$EXR_t = \alpha_0 + \sum_{j=1}^{m}\alpha_{1j}\, EXR_{t-j} + \sum_{j=1}^{m}\alpha_{2j}\, OP_{t-j} + \sum_{j=1}^{m}\alpha_{3j}\, OE_{t-j} + U_{1t} \qquad 3.2$$

$$OP_t = \beta_0 + \sum_{j=1}^{m}\beta_{1j}\, OP_{t-j} + \sum_{j=1}^{m}\beta_{2j}\, EXR_{t-j} + \sum_{j=1}^{m}\beta_{3j}\, OE_{t-j} + U_{2t} \qquad 3.3$$

$$OE_t = \lambda_0 + \sum_{j=1}^{m} \lambda_{1j}\, OE_{t-j} + \sum_{j=1}^{m} \lambda_{2j}\, EXR_{t-j} + \sum_{j=1}^{m} \lambda_{3j}\, OP_{t-j} + U_{3t}$$

3.4

Where,
OP is Oil Price
OE is Oil Export
EXR is Exchange Rate
α_0, β_0, λ_0 and δ_0 are constant parameters,
$\alpha_1 - \alpha_3$, $\beta_1 - \beta_3$, $\lambda_1 - \lambda_3$ are Coefficients to be estimated,
$U_{1t} - U_{3t}$ are the Gaussian white noise that are independently and identically distributed random variable.

Error Variance Decomposition

Forecast error variance decomposition (FEVD) is an econometric tool used by many economists in the vector autoregression (VAR). FEVD is used to aid in the interpretation of a vector autoregression (VAR) model once it has been fitted. The variance decomposition indicates the amount of information each variable contributes to the other variables in the autoregression. It determines how much of the forecast error variance of each of the variables can be explained by exogenous shocks to the other variables.

A prori Expectation

Basically the VAR model is used for forecasting as pointed out by Greene (2003) stated that VAR can be used for testing empirical relationship between macroeconomic variables especially in financial time series analysis. VAR model is atheoretic and is not usually based on theory (see Greene 2003). Hence we shall allow the data to speak for themselves although it is expected that Oil price and oil export should be positively related this have been established from previous literature and theories e.g Bruno and Sachs (2015).

Stationarity Test

To test for stationarity, the unit root method will be used and will take the form of an Autoregressive model (AR (1) process), with each variable regressed on its own lagged value without an intercept and a deterministic trend. To correct for autocorrelation in the error term, the ADF unit root test will be applied. The model used is:

$$\Delta Y_t = \delta Y_{t-1} + \mu_t$$

3.5

$\delta = \rho - 1$

Where;
Y represents all the variables under consideration.
δ represents the coefficient of the lagged value of Y.
Δ is the first difference operator.
Y_{t-i} represents the lagged terms included
μ_t represents pure white noise error term.

The null hypothesis to be tested is such that the variable possess unit root, and as such is non-stationary.

$H_0 : \delta = 0$ ($\rho = 1$) presence of unit root
$H_0 : \delta \neq 0$ ($\rho < 1$) no unit root

The decision rule will be such that if the absolute ADF statistic is greater than the absolute critical values, the null hypothesis will be rejected.

Cointegration Equation

Johansen and Juselius (1990) is employed to determine the number of co-integrating vectors using the methodology with two different test statistics namely the trace test statistic and the maximum Eigen-value test statistic. The trace statistic tests the null hypothesis that the number of divergent co-integrating relationships is less than or equal to '*r*' against the alternative hypothesis of more than '*r*' co-integrating relationships, and is defined as:

$$\theta_{trace}(r) = -T \sum_{j=r+1}^{P} 1n\left(1 - \hat{\theta}_j\right)$$

3.6

The maximum likelihood ratio or the maximum Eigen-value statistic, for testing the null hypothesis of at most 'r' co-integrating vectors against the alternative hypothesis of 'r+l 'co-integrating vectors, is given by:

$$\theta_{\max}\ (r,r,+1) = -T\ 1n\ (1-\hat{\theta}_{r+1})$$

$$\theta_{trace}\ (r) = -T \sum_{j=r+1}^{P} 1n\left(1-\hat{\theta}_j\right) \qquad 3.7$$

Where $\hat{\theta}_j$ = the Eigen values, T = total number of observations. Johansen argues that, trace and statistics have nonstandard distributions under the null hypothesis, and provides approximate critical values for the statistic, generated by Monte Carlo methods. In a situation where Trace and Maximum Eigen-value statistics yield different results, the results of trace test should be preferred.

Granger Causality Equation

The causative test will make use of the technique of Vector Auto-regression (VAR). The equations will be of the form of equation (3.2), (3.3) and (3.4) above

The equations will be used to test for the causal relationship that exists between oil price and exchange rate.

4. Data Presentation, Analysis and Interpretation

Data Presentation

In economic research and analysis, attempt is usually made to discover and establish existing relationship between the various economic variables involved in a study.

This chapter serves as an attempt to establish the relationship between oil price and exchange rate movement in Nigeria as evident in the economy. This would be done by checking the type of relationships that exist between the oil price, exchange rate and oil export. Vector Auto-regressive analysis was used and the computational device includes E-views.

Summary Statistics

The Summary statistics as derived through E-Views 9.0 shows the Mean, Median, Maximum, Minimum, Standard Deviation, Skewness, Kurtoise, Jacque-Bera and Probability of each of the variables as presented below:

Table 4.1: Summary Statistics

	EXR	OE	OP
Mean	19.64667	18.89354	2723.733
Median	12.45000	18.13625	351.5962
Maximum	272.80000	29.80000	14112.17
Minimum	5.400000	10.50000	11.35150
Std. Dev.	17.84840	3.881111	4549.497
Skewness	1.629195	0.857905	1.561169
Kurtosis	4.537545	4.322560	3.755973
Jarque-Bera	16.22643	5.866462	12.90061
Probability	0.000300	0.053225	0.001580
Sum	589.4000	566.8063	81711.98
Sum Sq. Dev.	9238.395	436.8276	6.00E+08
Observations	34	34	34

Sources: Author's own computation using E-Views Software, Version 9.0

It was observed from the above summary statistics with reference to the Jarque Bera estimates and probability value that exchange rate and oil price (OP) are not normally distributed due to their low probability values of 0.000300 and 0.001580 respectively which is lower than the probability value of 0.05.

On the other hand it was observed that the probability values for oil export (OE) was normally distributed due to their high probability value of 0.053225 which are higher than the probability of 0.05.

4.1.3 Trend Analysis

Graphically, the trend analyses showed that the variables fluctuates at one point or the other during the period under review. This was attributed to the effects of Government policies and forces of demand and supply in the world oil market that would have had attendant effects on some of the variables. These are presented graphically.

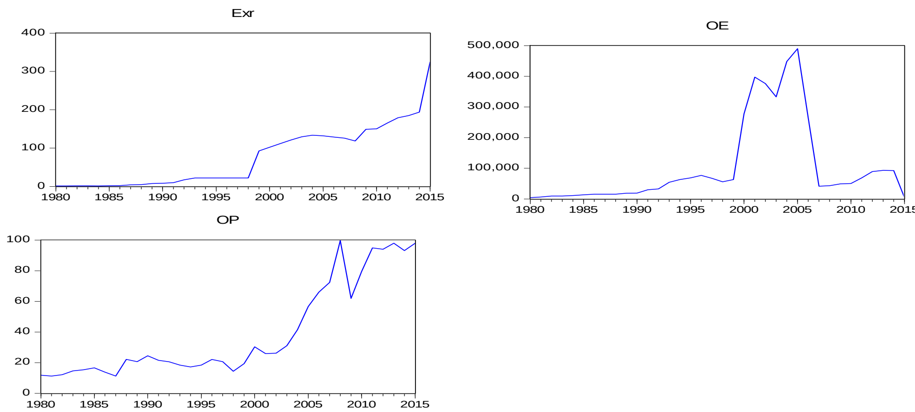

Figure 1.0 Trend Analysis

Looking at the graphical analysis in Fig. 1, it was observed that the variables fluctuated over the period 1980-2015 which is clearly depicted by the graph flow lines.

Data Analysis

Stationarity Result

The augmented dickey fuller test was used to test for unit root. All the variables were regressed on trend and intercept to determine if they have trend, it was discovered that exchange rate has only intercept without trend, oil price has no intercept and trend and oil export has intercept and trend, hence the unit root test was conducted based on the component of each time series. The result is presented below:

Table 4.2: Unit Root Stationarity Result

Time Series	ADF Statistics	Critical Value	Stationary Status
EXR	-11.03404	-3.64634 (1%) -2.95402 (5%) -2.61582 (10%)	I(1)
OP	-4.783871	-2.63690 (1%) -1.95133 (5%) -1.61075 (10%)	I(1)
OE	-9.394201	-4.262735 1%) -3.55297 (5%) -3.20964(10%)	I(1)

Source: Author's Computation

Table 4.2 shows unit root test carried out on the time series variables used in this study. The Three variables (EXR, OP and OE) underwent unit root test using the Augmented Dickey-Fuller (ADF) test. All three variables were found to be non-stationary at levels but were stationary at first difference I(1).

Cointegration Result

Table 4.3 shows cointegration test conducted using Johansen cointegration approach indicating the Eigen Value, Trace Statistics, critical value and probability value. Due to the non-stationarity of time series, the cointegration test was carried out using the Johansen approach.

Table 4.3: Johansen's Cointegration Result

Eigen Value	Trace Statistics	5% Critical Value	P- Value
0.613596	45.86032	29.79707	0.0003
0.305129	17.33419	15.49471	0.0261
0.192472	6.413319	3.841466	0.0113

Source: Author's Computation

This became necessary to avoid a spurious regression result. Using the Johansen's test, there were found three cointegrating equations at the 5 per cent level of significance. From table 4. 2 above, the first three equations show the cointegrated equations with their trace statistics of (45.86032, 17.33419 and 6.413319) greater than the 5 per cent critical values (29.79707, 15.49471 and 3.841466). The cointegration result shows that the three variables have long-run equilibrium relationship.

VAR Results and Error Variance Decomposition

The Vector Autoregressivie Model estimated is presented in the appendix of this study. From the VAR model, the Variance Error Decomposition is extracted using the cholesky decomposition. The variance decomposition indicates the amount of information each variable contributes to the other variables in the autoregression. It determines how much of the forecast error variance of each of the variables can be explained by exogenous shocks to the other variables.

Table 4. 4 VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-253.3626	NA	3714.417	16.73307	17.01062	16.82354
1	-224.1831	48.94625	1018.474	15.43117	16.12503	15.65735
2	-207.6877	24.47710	645.3381	14.94759	16.05777*	15.30948
3	-201.6403	7.802981	829.8418	15.13809	16.66459	15.63569
4	-182.4543	21.04277*	482.0080*	14.48092*	16.42374	15.11423*

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Source: Author's Computation

Table 4.4 indicate the lag selection criteria, the table shows the various lag selection criteria used to determine the lag length for the VAR model. To carryout VAR analyses on the variables, the fourth lag will be selected since all the lag selection criteria chose the fourth lag except Schwarz information criterion that which chose the second lag.

Error Variance Decomposition

Table 4.4 shows variance decomposition of the VAR model, the table indicate how the variance of exchange rate, oil price and oil export were decomposed using cholesky decomposition technique for four period.

Table 4.4 Forecast Error Variance Decomposition

Variance Decomposition of Exchange rate: Period	S.E.	EXR	OP	OE
1	3.086407	100.0000	0.000000	0.000000
2	3.176038	97.56888	0.164560	2.266557
3	4.512796	91.19246	1.987198	6.820337
4	4.900877	89.82066	1.792864	8.386472

Cholesky Ordering: POV

Cholesky Ordering: INF
Variance Decomposition of UMP:

Period	S.E.	EXR	OP	OE
1	0.683284	2.860890	33.69438	63.44473
2	0.728476	12.99846	29.64740	57.35415
3	0.845621	30.64609	24.24095	45.11295
4	0.900727	34.06199	22.40086	43.53715

Cholesky Ordering: UMP

Source: Author's Computation

From table 4.4, Variation in exchange rate for the first period is explained only by exchange rate. Variation in exchange rate for the second period is attributed 97.6%, 0.1% and 2.2% variation in exchange rate, oil price and oil export. Variation in exchange rate for the third period is attributed 91.2%, 1.99% and 6.82% variation in exchange rate, oil price and oil export. Variation in exchange rate for the fourth period is attributed 89.8%, 1.79% and 8.39% variation in exchange rate, oil price and oil export.

Variation in oil price for the first period is explained by 16.4% and 83.6% variation in exchange rate and oil price. Variation in oil price for the second period is attributed 25.8%, 72.99% and 1.19% variation in exchange rate, oil price and oil export. Variation in oil price for the third period is attributed 51.8%, 35.8% and 12.4% variation in exchange rate, oil price and oil export. Variation in oil price for the fourth period is attributed 64.9%, 23.9% and 11.3% variation in exchange rate, oil price and oil export.

Variation in oil export for the first period is explained by 2.86%, 33.69% and 63.44% variation in exchange rate, oil price and oil export. Variation in oil export for the second period is attributed 12.998%, 29.65% and 57.35% variation in exchange rate, oil price and oil export. Variation in oil price for the third period is attributed 30.6%, 24.2% and 45.1% variation in exchange rate, oil price and oil export. Variation in oil price for the fourth period is attributed 34.1%, 22.4% and 43.5% variation in exchange rate, oil price and oil export.

Granger Causality Test

Table 4.5 is granger causality test it illustrate the direction of causality among the variables under study (exchange rate, oil price and oil export).

Table 4.5 Causality Test

Null Hypothesis (H0)	Chi-Square	Probability	Decision
OP does not cause EXR	10.51789	0.0917	Reject Ho
EXR does not cause OP	13.74877	0.0081	Reject Ho
OE does not cause EXR	14.90053	0.0877	Reject Ho
EXR does not cause OE	10.60593	0.0314	Reject Ho
OP does not cause OE	4.986681	0.2887	Accept Ho
OE does not cause OP	10.96944	0.0269	Reject Ho

Source: Author's Computation

From the table 4.5, there is bi causality between exchange rate and oil price. This means that oil price Granger cause exchange rate and exchange rate Granger cause oil price.

There is two way causality between oil export and exchange rate. This means that oil export Granger-cause exchange rate and exchange rate Granger-cause oil export.

There is one way causality between oil export and oil price. The causality flows from oil price to oil export. This means that oil price granger cause oil export.

Discussion of Result

From the result interpreted and the findings, oil price influences exchange rate in Nigeria. This result is in line with the work of Apere and Ijomah (2013) who carried out the same research on Nigeria, using VAR model and he concluded that oil price affects exchange rate in Nigeria. Anshasy et al, (2013), and Balke, (2016) all arrived at the same conclusion from their findings. Also oil export causes exchange rate in Nigeria, this result is in line with Blanchard and Gali (2007). Other research such as Darby (2013) found out that oil export have a significant impact on exchange rate in oi exporting countries such as Nigeria.

Furthermore from the exchange rate causes both oil export and oil price. This result is in line with some study such as Chen and Hsu (2012), Bruno and Sachs, (2015) who all concluded that exchange rate causes oil price and oil export.

Finally, oil price causes oil export in Nigeria. The causal relationship that flows from oil price to oil export indicate that oil price pass through to oil export in Nigeria. This result supports that of Englama (2010).

5. Conclusion

Concluding Comments

From the findings, it is evident that oil price volatility affects exchange rate significantly. Oil is the major source of energy and is essential to the growth of any nation as it affect key macroeconomic variables in Nigeria. This study reveals that there is a linkage between oil price and exchange rate movement vis-à-vis market oil price (OP), oil export (OE) and exchange rate (EXR). The study has provided answers to the research questions raised such as the relationship between oil prices and exchange rate and the causal flow. It is therefore concluded that oil price is a major determinant of changes in key macroeconomic variables in Nigeria.

Recommendations

Based on the conclusion drawn and findings in the course of this project particularly the results of the VAR model, it is clear that the development of the Nigerian economy is highly dependent on oil which is no doubt the major source of revenue. The following recommendations could be made. The government should:

i. Diversify the economy to reduce over-reliance on oil revenue. Diversification of the economy will reduce the vulnerability of the domestic economy towards adverse oil price shocks.

ii. Promote oil export since it has a significant impact on exchange rate. Oil export can be promoted in Nigeria by changing the ownership structure of the Nigerian oil industry by allowing the private sector to participate in the downstream sector especially in the construction of refineries

iii. Control monetary instruments such as money supply to control exchange rate movement in the economy. Central Bank should make more stringent punishment for non compliance to the monetary policies by financial institutions. This will help to curtail the nefarious activities of some unscrupulous financial institution operations who trade the welfare of the whole Nigerian populace for a penny.

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