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ON THE CRUDE OIL PRICE, STOCK MARKET MOVEMENT AND ECONOMIC GROWTH NEXUS IN NIGERIA EVIDENCE FROM COINTEGRATION AND VAR ANALYSIS

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ABSTRACT

This work focuses majorly on modelling the dynamic relationship that exists between crude oil prices, stock market indicators and the economic growth in Nigeria using vector autoregressive (VAR) model and cointegration analysis. Market Capitalization and Exchange Rate were used as proxies for stock market indicators and economic growth. The series consist of monthly data points from 1995:1 to 2014:11 totalling up to 239 observations obtained from the Nigerian stock market and Central Bank of Nigeria bulletin. From the study, there exists a viable, long run and sustainable relationship among the series from the cointegration analysis. Two cointegrating equations were found to exist among the variables. The dynamic relationship that exists among these variables can be captured with a vector autoregressive model of order three (VAR(3)). Structural inference was carried with the VAR model and from the result it was noticed that the Nigerian stock market behaviour and the economic growth can better be predicted when taking the past values crude oil prices into consideration. These results mean that the crude oil prices, stock market movement and the economic growth have a long term and sustainable equilibrium relationship and that stock market movement and the economic growth are affected by the distortions in the prices of the crude oil.

Contribution/ Originality: The paper's primary contribution is finding that there exists a causal relationship between oil price, stock market indicators and economic growth in a core oil dependent economy like Nigeria. It also shows that oil price dictates the movement of market indicators and economic growth rate in an oil dependent economy.

1. INTRODUCTION

The impacts of crude oil price shocks on economic variables have been a controversial but interesting topic globally over the past years. Controversial in the sense that, different and divergent results have been obtained amidst the dire need to curb the negative results of these oil price shocks on the economy. Many questions are being raised concerning the direct and indirect relationship between these variables. In an effort to unravel this, many researchers have used several measures in different dimensions to study this trend. All of which boil down to the fact that the impact of the oil price shocks varies from economy to economy depending on whether the economy is an importer of oil or an exporter of oil. As asserted by Marzieh (2006) the magnitude of the direct effect of a given oil price increase depends on the share of the cost of oil in national income, the degree of dependence on imported oil and the ability of end-users to reduce their consumption and switch away from oil. For Nigerian economy, having oil as its main stay, the price of oil significantly shapes the economic status of the country.

It is estimated that over 90 percent of the total revenue in Nigeria accrue from petroleum and allied products and this makes the economy to be exposed to major crude oil price distortions. The economy having a very special feature of being both an exporter and importer of crude oil due to malfunctioning of refineries is even more vulnerable to oil price volatility. This oil price volatility is so severe that the Nigerian budget is even at some point in time tied up to a particular benchmark price of crude oil. The budget has been adjusted in so many occasions when there is a sudden change in crude oil prices such as the reduction of budget due to a fall in oil prices during the global financial crisis (Oriavwote and Eriemo, 2012).

The sudden negative distortions in the price of crude oil in the last and the first quarters of 2014 and 2015 respectively have raised panic in both oil exporting and oil dependent economies. In Nigeria particularly, economic activities and budgeting will be streamlined within the confines of this new oil price. Questions are raised on how to diversify the economy in a way of shifting our focus from oil as our main stay to other sectors like agriculture and manufacturing. Distortions in the international crude oil price affect both exchange rate and inflation rates of an oil-dependent economy, this in-turn affect prospects of the economy for investors to invest and its direct consequence is reflected on the investability and returns of the stock market and the economy at large. Owing to all these, it is of empirical importance to investigate the relationships that exist between the crude oil prices, the Nigerian stock market indices and the economic growth with the help of cointegration and vector autoregressive (VAR) analysis.

The rest of this paper is structured as follows: section 2 provides literature review while section 3 presents data and methods. The empirical analysis results are presented in section 4 while discussion of policy implications of the results is presented in section 5. Finally, section 6 presents summary and conclusion.

2. EMPIRICAL REVIEW OF RELATED LITERATURES

Several researches have been done on this subject area with different approaches and different results obtained. Most of them which point to the fact that oil price exert effect on stock market and economic growth either directly or indirectly.

In a study conducted by Hammoudeh and Aleisa (2004) Johansen co-integration technique was employed to investigate the relationship between oil prices and stock markets in Gulf Cooperation Council (GCC) countries. Conclusion reached was that Saudi market is the only market in the group that could be predicted by oil future prices. In a similar study. Similar study carried out by Arouri *et al.* (2010) on GCC countries showed that stock market returns significantly react to oil price changes in Oman, Qatar, Saudi Arabia, and United Arab Emirate (UAE). Results from the same study also showed that the oil price shocks do not affect stock market returns in Bahrain and Kuwait. These authors also established that the relationship between oil prices and stock markets in these countries are non-linear and switching according to oil prices. This implies that a particular direction of relationship between oil shocks and stock returns could not be identified since they are changing per regime.

The finding of Driespronga *et al.* (2003) suggests that oil price changes significantly predict negative excess returns and the author also maintain that financial investors seem to under-react to information in the oil price. They observed a strong linkage between monthly stock returns and lagged monthly changes in oil price.

Cheung and Ng (1998) employed the Johansen co-integration technique and established the existence of long-run co-movement between five national stock market indices and real oil price, real consumption, real money and real output. They found that oil prices were negatively correlated with stock prices. Miller and Ratti (2009) examined long-run relationship between the world crude oil price and international stock markets for the samples period 1971: 1-2008:3 using a co-integrated VECM. They concluded that international stock market indices respond negatively to increases in the oil price in the long run. They also established the existence of a long run co-movement between crude oil price and stock market during 1971:1 – 1980: 5 and 1988: 2- 1999:9 with evidence of break down in the relationship after the period. They submitted that it was suggestive of the possibility that the relationship between real oil price and stock prices have changed in recent period compared to the earlier period.

Other researches in this subject area include Narayan and Narayan (2010); Eryigit (2009); Cong *et al.* (2008); Henriques and Sadorsky (2008); Lippi and Nobili (2008); Fang *et al.* (2009); Aspergis and Miller (2009); Korhonen and Juurikkala (2009); Basher *et al.* (2012); Tweneboah and Adam (2008) and Chang and Wong (2003)

In Nigeria many works have been done and literatures scripted around oil price shocks and macroeconomic variables but few of them are directed towards investigating connections between oil price shocks and stock market indicators. These are: Ekong *et al.* (2016); Olomola and Adejumo (2006); Akpan (2009); Mordi and Adebiyi (2010); Umar and Abdulahkeem (2010); Adebiyi *et al.* (2010); Adaramola (2012); Asaolu and Ilo (2012); Oriakhi and Osaze (2013) and Effiong (2014).

3. DATA AND METHODS

3.1. Data Collection

Monthly data for the crude oil prices, market capitalization and exchange rate were obtained for a period spanning from 1995:1 to 2014: 11. Each of these series consists of 239 observations. Data for the crude oil prices is obtained via www.eia.gov/dnas/pet-pet_pri_spt_sl_d.htm. Monthly data for Market Capitalization was purchased from the Nigeria Stock Exchange (NSE), Stock Exchange House, 2-4 Customs Street, Lagos, Nigeria via contactcentre@nigerianstockexchange.com & www.nse.com.org. Data on Exchange Rate was obtained from the Central Bank of Nigeria statistical database, www.cenbank.org. Though the Gross Domestic Product (GDP) is the commonest used indicator of economic growth, we have other indicators of the economic growth and one of such is the Exchange Rate. Exchange rate is used as a proxy for economic growth here instead of the GDP because, unlike the GDP, its monthly data is always readily available. The data sets are all obtained as numerical data sets. The data sets are then entered into the computer as Excel file with two columns; the date and the corresponding information for the particular date. From the Excel, the data sets are exported to other software like the Eviews, JMulti and Gretl for various analyses.

3.2. Johansen Cointegration Test

Cointegration is defined as a long run or equilibrium relationship between two series. This definition of co-integration makes the term a very vital and ideal technique for analyzing and ascertaining the existence of a long-run relationship between the Crude Oil Prices and Market Capitalization and between the Crude Oil Prices and Exchange Rate.In testing for cointegration in $\boldsymbol{Y_t}$withknown cointegratingvector $\boldsymbol{\beta'}$, we formulate the null hypothesis to test whether the process $\boldsymbol{X_t = \beta' Y_t}$ contains a unit root so that we can again use the test discussed in preceding section above. We will conclude that $\boldsymbol{Y_t}$is cointegrated if the null hypothesis is rejected. When the cointegrating vector is unknown, we can use the following method to test and estimate the cointegration.

3.2.1. The Likelihood Ratio Test

Now we consider a vector autoregressive process of finite order p

$$Y_t = A_1 Y_{t-1} + \cdots + A_p Y_{t-p} + \varepsilon_t \qquad (1.0)$$

Which can be written as

$$Y_t = \sum_{j=1}^{p} A_j Y_{t-j} + \varepsilon_t \qquad (2.0)$$

Whereε_t denotes a normally distributed k-dimensional white noise process, A_j, $j = 1,2, \dots, p$ are the $k \times k$-dimensional parameter matrices. The reparameterization as a vector error-correction model leads to

$$\Delta Y_t = -\Pi Y_{t-1} + \sum_{j=1}^{p-1} A_j^* \Delta Y_{t-j} + \varepsilon_t \quad (3.0)$$

with

$\Pi = A(1) = I - \sum_{j=1}^{p} A_j$ and $A_j^* = -\sum_{i=j+1}^{p} A_i$, $j = 1,2,\cdots,p-1$

For the sake of this study, we will not treat the vector error-correction model deeply.

The matrix Π represents the long-run relations between the variables. Since all components of Y_t are $I(1)$ variables, each component of $\Delta Y_t, \cdots, \Delta Y_{t-p+1}$ is stationary and each component of Y_{t-1} is also integrated of order one. This makes (3.0) unbalanced as long as Π has a full rank of *k*. In this case the inverse matrix Π^{-1} exists and we could solve (3.0) for Y_{t-1} as a linear combination of stationary variables. However, this would be a contradiction. Therefore, Π must have a reduced rank of $r < k$. Then the following decomposition exists:

$$\underset{(k\times k)}{\Pi} = \underset{(k\times r)}{\Gamma}\ \underset{(r\times k)}{B'} \quad (4.0)$$

Where all matrices have rank r. $B'Y_{t-1}$ are r stationary linear combinations which ensures that the system of equations in (3.0) are balanced. The columns of B contain the r linearly independent cointegration vectors and the matrix Γ contains the so-called loading coefficients which measure the contributions of the r long-run relations in the different equations of the system. The adjustment processes to the equilibria can be derived from these coefficients.

If there is no cointegration, i.e. if $r = 0$, Π is the zero matrix and (3.0) is a VAR of $p-1$ in ΔY. This system possesses k unit roots, i.e. k stochastic trends. If $r = k-1$, the system contains exactly one common stochastic trend and all the variables of the system are pair-wise cointegrated. As a general rule, the system (3.0) contains $k-r$ common stochastic trend and r linearly independent cointegration vectors for a contegration rank r with $0 < r < k$.

The approach proposed Johanson (1988) is a maximum likelihood estimation of (3.0) that considers the restriction (4.0). We can write

$$\Delta Y_t + \Gamma B' Y_{t-1} = A_1^* \Delta Y_{t-1} + \cdots + A_p^* \Delta Y_{t-p+1} + \varepsilon_t \quad (5.0)$$

We get the maximum likelihood estimation of $A_j^*, j = 1, \dots, p-1$, by applying ordinary least squares on (3.0) if Γ and B are given. Eliminating the influence of the short-run dynamics on ΔY_t and Y_{t-1} by regressing $\Delta \mathrm{Y_t}$ on the lagged differences and Y_{t-1} on the lagged differences, we get the residuals R_{0t} and R_{1t} respectively for which

$$R_{0t} = -\Gamma B' R_{1t} + \hat{\varepsilon}_t \quad (6.0)$$

holds.

Here, R_0 is a vector of stationary and R_1 a vector of nonstationary processes. The idea of the Johansen approach is to find those linear combinations $B'R_1$ which show the highest correlations with $\mathrm{R_0}$. The optimal values of Γ and the variance-covariance matrix $\sum$ of ε can be derived for known B by ordinary least squares estimation of (5.0). We get

$$\hat{\Gamma}(B) = -S_{01} B (B' S_{11} B)^{-1} \quad (7.0)$$

and

$$\hat{\sum}(B) = S_{00} - S_{01} B (B' S_{11} B)^{-1} B' S_{10} \quad (8.0)$$

with

$$S_{ij} = T^{-1} \sum_{t=1}^{T} R_{i,t} R_{j,t}' \text{ for } i,j = 0, 1. \quad (9.0)$$

It can be shown that the likelihood function concentrated with (6.0) and (7.0) is proportional to $\left|\hat{\sum}(B)\right|^{-T/2}$. Therefore, the optional values of B result from minimizing the determinant

$$|S_{00} - S_{01} B (B' S_{11} B)^{-1} B' S_{10}|$$

Showed that this is equivalent to the solution of the following eigenvalue problem

$$|\lambda S_{11} - S_{10} S_{00}^{-1} S_{01}| = 0 \quad (10.0)$$

with the eigenvalues λ_i and the corresponding k-dimensional eigenvectors υ_i, $i = 1,2,\dots,k$, for which

$\lambda_i S_{11} v_i = S_{10} S_{00}^{-1} S_{01} v_i$s

Using the arbitrary normalization

$$\begin{bmatrix} v_1' \\ \vdots \\ v_k' \end{bmatrix} S_{11} [v_1 \quad \cdots \quad v_k] = I_k \ ,$$

WithI_k being the k-dimensional identity matrix, leads to a unique solution. $1 \geq \hat{\lambda}_1 \geq \cdots \hat{\lambda}_k \geq 0$holds for the ordered estimated eigenvalues. It can be shown that for $k\,I(1)$ variables with cointegration rank r exactly r eigenvalues are positive and the remaining $k - r$ eigenvalues are asymptotically zero. The cointegrating vectors are estimated by the corresponding eigenvectors and combined in the $k \times r$ matrix

$$\hat{B} = [\hat{v}_1 \quad \cdots \quad \hat{v}_r] \ ,$$

The number of significantly positive eigenvalues determines the rank r of the cointegration space. This leads to two different likelihood ratio test procedures:

i. The so called trace test has the null hypothesis

$$H_0\text{: There are at most r positive eigenvalues}$$

against the alternative hypothesis that there are more than r positive eigenvalues. The test statistic is given by

$$Tr(r) = -T \sum_{i=r+1}^{k} ln\left(1 - \hat{\lambda}_i\right) \qquad (11.0)$$

ii. The so-called λ_{max} test analyses whether there are r or $r + 1$ cointegrating vectors. The null hypothesis is

$$H_0\text{: There are exactly } r \text{ positive eigenvalues}$$

against the alternative hypothesis that there are exactly $r + 1$ positive eigenvalues. The corresponding test statistic is given by

$$\lambda_{max}(r, r+1) = -Tln\left(1 - \hat{\lambda}_{r+1}\right) \qquad (12.0)$$

The series of tests starts with $r = 0$ and is performed until the first time the null hypothesis cannot be rejected. The cointegration rank is given by the corresponding value of r. The null hypothesis is rejected for too large values of the test statistic. Since the test statistics do not follow standard asymptotic distributions, the critical values are generated by simulations (Kirchgassner and Wolters, 2007).

3.3. Vector Autoregressive Model

A vector autoregressive is a system in which each variable is regressed on a constant and p of its own lags as well as on p lags of each of the other variables in the vector autoregressive model (VAR) model (Hamilton, 1994).

3.3.1. Stationary Vector Autoregressive Model

Let $\boldsymbol{X} = (X_{1t}, X_{2t}, \ldots, X_{nt})'$ denote $(n \times 1)$ vector of times series variables. The pth-order vector autoregressive model denoted by $VAR(p)$ has the form

$$\begin{bmatrix} X_{1t} \\ X_{2t} \\ \vdots \\ X_{nt} \end{bmatrix} = \begin{bmatrix} c_1 \\ c_2 \\ \vdots \\ c_n \end{bmatrix} + \begin{bmatrix} \phi_{11}^1 & \phi_{12}^1 & \cdots & \phi_{1n}^1 \\ \phi_{21}^1 & \phi_{22}^1 & \cdots & \phi_{2n}^1 \\ \vdots & \vdots & \ddots & \vdots \\ \phi_{n1}^1 & \phi_{n2}^1 & \cdots & \phi_{nn}^1 \end{bmatrix} \begin{bmatrix} X_{1t-1} \\ X_{2t-1} \\ \vdots \\ X_{nt-1} \end{bmatrix} + \begin{bmatrix} \phi_{11}^2 & \phi_{12}^2 & \cdots & \phi_{1n}^2 \\ \phi_{21}^2 & \phi_{22}^2 & \cdots & \phi_{2n}^2 \\ \vdots & \vdots & \ddots & \vdots \\ \phi_{n1}^2 & \phi_{n2}^2 & \cdots & \phi_{nn}^2 \end{bmatrix} \begin{bmatrix} X_{1t-2} \\ X_{2t-2} \\ \vdots \\ X_{nt-2} \end{bmatrix} + \cdots +$$

$$\begin{bmatrix} \phi_{11}^p & \phi_{12}^p & \cdots & \phi_{1n}^p \\ \phi_{21}^p & \phi_{22}^p & \cdots & \phi_{2n}^p \\ \vdots & \vdots & \ddots & \vdots \\ \phi_{n1}^p & \phi_{n2}^p & \cdots & \phi_{nn}^p \end{bmatrix} \begin{bmatrix} X_{1t-p} \\ X_{2t-p} \\ \vdots \\ X_{nt-p} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \vdots \\ \varepsilon_{nt} \end{bmatrix} \qquad (13.0)$$

In matrix notation

$$\boldsymbol{X_t} = \boldsymbol{C} + \boldsymbol{\phi_1}\boldsymbol{X_{t-1}} + \boldsymbol{\phi_2}\boldsymbol{X_{t-2}} + \cdots + \boldsymbol{\phi_p}\boldsymbol{X_{t-p}} + \boldsymbol{\varepsilon_t} \quad (14.0)$$

Here **C** denotes an $(n \times 1)$ vector of constants and $\boldsymbol{\phi_j}$an $(n \times n)$ matrix of coefficients for $j = 1,2,\dots,p$. The $(n \times 1)$ vector $\boldsymbol{\varepsilon_t}$is a vector of vector generalization of white noise (Hamilton, 1994).

3.3.2. Diagnostic Checking of VAR Models

To avoid misspecification, the VAR models should be checked and crosschecked before they are used for any specific purpose in order to ensure that they fit the data adequately. Some of the areas to look into are the inverse root of the AR polynomial; the roots must lie within the unit circle before stability condition is met. Other analyses to guard against model misspecification include plots of standardized residuals against time and the analysis of residual correlation matrices. Various tests are prescribed for testing the autocorrelation of the residuals; we will make use of Portmanteau test.

3.3.3. Portmanteau Test

Portmanteau test can be implemented only when the order of autocorrelation is higher than the lag length in the VAR model. It tests the overall significance of the residual autocorrelations of a $VAR(P)$ model up to lag s. The null hypothesis of no multivariate residual autocorrelation of degree s is

$H_0: \boldsymbol{B_1} = \boldsymbol{B_2} = \cdots = \boldsymbol{B_s} = \boldsymbol{0}$and the alternative hypothesis is

H_0:The $\boldsymbol{B_i}$'s not all 0

where$\boldsymbol{B_i} (i = 1,2,\dots,s)$ are the autocorrelation matrices.

The test statistic for large T is

$$\boldsymbol{Q_s} = T\sum_{i=1}^{s} tr\left(\widehat{\boldsymbol{C}}_i'\widehat{\boldsymbol{C}}_0^{-1}\widehat{\boldsymbol{C}}_i\widehat{\boldsymbol{C}}_0^{-1}\right) \quad (15.0)$$

Therefore, the modified test statistic (especially in small samples) is

$$\overline{\boldsymbol{Q}}_s = T^2\sum_{i=1}^{s}(T-i)^{-1} tr\left(\widehat{\boldsymbol{C}}_i'\widehat{\boldsymbol{C}}_0^{-1}\widehat{\boldsymbol{C}}_i\widehat{\boldsymbol{C}}_0^{-1}\right) \quad (16.0)$$

$\overline{\boldsymbol{Q}}_s$has the same asymptotic distribution as $\boldsymbol{Q_s}$, that is, approximately in large samples and for large s,

$\overline{\boldsymbol{Q}}_s \approx \chi^2_{\alpha,[K^2(s-p)]}$

where$K$ is the dimension of the time series and $\widehat{\boldsymbol{C}}_i$are the estimated autocovariance matrices of the residuals and $\widehat{\boldsymbol{C}}_0$the estimated variance of the residuals.

4. RESULTS

The variables used are represented in a vector form as $\boldsymbol{X'} = [lnCOP, lnER, lnMC]$where lnCOP, lnER and lnMC are the natural logs of Crude Oil Prices, Exchange Rates and the Market Capitalization respectively. The plots of the original series and their natural logs are presented in Figures 1 and 2 respectively.

We chose to use the natural logarithm of the variables since it is seen that the variable are highly non-linear and as such needs a variance stabilizing transformation like the natural logarithm.

4.1. Johansen Cointegration Analysis

The existence of cointegration among the variables in Table 1 intimates us that we can go ahead and analyze the variables as vector autoregressive (VAR) since VAR analysis is appropriate with stationary series or with cointegrating series.

4.2. VAR Modeling

4.2.1. Model Identification

The optimal length selection criteria provide a basis for VAR model identification. The following information criteria prescribe optimal lag length for the VAR model of the log of International Crude Oil Price, Nigerian Stock Market Capitalization and Exchange Rate as follows:

$AIC = 3, BIC = 2,$ and $HQ = 2.$

4.2.2. Estimation of Parameters

Since it is better to error on the side of including many lags, i.e. it is safer to over fit the model instead of under fitting (Ng and Perron, 2001) we prescribe a VAR with a lag $p = 3$. The estimates are presented in Table 3.

4.2.3. Diagnostic Checking of the VAR Model

The $VAR(3)$ is shown to be well-specified from Portmanteau test result presented in Table 4 since the Q-statistic $= 385.8216$ at lag $48 < \chi^2_{0.05,405} = 452.923$ with a p-value of 0.7458 and the adjusted Q-statistic = 431.0981 at lag $48 < \chi^2_{0.05,405} = 452.923$ with a probability value of $p = 0.1784$, we conclude that VAR(3) is adequate for the analysis of the relationship that exist between the variables.

4.2.4.Granger-causality and Instantaneous Causality

The $VAR(3)$ is used to make structural inference on the variables in terms of Granger-causality and instantaneous causality as presented in Table 5. The result showed that crude oil price Granger-causes market capitalization and exchange rate, Market capitalization does not Granger-cause crude oil price and exchange rate; and exchange rate does not Granger-cause crude oil and market capitalization. There is no instantaneous causality amongst the variables.

5. DISCUSSION

Having established the need for the variables to be analyzed as multivariate time series model using cointegration analysis, a $VAR(3)$ model was prescribed for the VAR analysis. The model was seen to be adequate as the inverse root of the characteristic polynomial confirms that the VAR has met the stability condition. The multivariate Portmanteau test and the VAR Residual Serial Correlation also confirm the adequacy of the model since the Q-statistic $= 385.8216$ at lag $48 < \chi^2_{0.05,405} = 452.923$ with a p-value of 0.7458 and the adjusted Q-statistic = 431.0981 at lag $48 < \chi^2_{0.05,405} = 452.923$ with a probability value of $p = 0.1784$ (Table 4). The various information criteria also speak well of the model.

The $VAR(3)$ model was used to make structural inferences in terms of Granger-Causality and instantaneous causality on the relationships between the time series variables. From the Granger-causality test conducted, we rejected the null hypothesis of no Granger-causality from lnCOP to lnER, lnMC, accepted the null hypothesis of no Granger-causality from lnER to lnCOP, and also accepted the null hypothesis of no Granger-causality from lnMC to lnCOP, lnER. For instantaneous causality test, we accepted the null hypothesis of no instantaneous causality from lnCOP to lnER, lnMC, accepted the null hypothesis of no instantaneous causality from lnER to lnCOP, lnMC, and also accepted the null hypothesis of no instantaneous causality from lnMC to lnCOP, lnER. These results imply that the distortions in the Crude Oil Prices will cause effect(s) in the Exchange Rates and Market Capitalization though these effects may not be instantaneous; that is, the effects may be obvious after some time lags. Distortions in Exchange Rates does not cause any effect in Crude Oil Prices and Market Capitalization both instantaneously and in the long run. Movement in the Market Capitalization does not cause any effect in Crude Oil Prices and Exchange Rates both instantaneously and in the long run. The result is a hint to the authority and policy makers to keep a watch on the distortions on the prices of crude oil in order to be guided on improving the indicators of economic growth and the stock market.

6. SUMMARY AND CONCLUSION

This study investigates the dynamic relationships that exist between crude oil prices, stock market movement and economic growth using cointegration analysis and also develop a structural VAR model in which these variables are analyzed. Market capitalization and exchange rate respectively proxy stock market indicators and economic growth. The data set is a monthly data set that span between 1995:1 and 2014:11. From the analysis, the following results are obtained:

Firstly, there exists a long run, viable cum sustainable equilibrium among these variables, a result obtained from cointegration analysis. Secondly, a vector autoregressive model of order 3 has been able to capture the dynamic relationship that exists among the variables.

In conclusion, the structural model was used to make structural inference on the variables. From the inferences made, it is evident that the crude oil prices Granger-causes market capitalization and exchange rates, market capitalization does not Granger-cause crude oil prices and exchange rates and exchange rates does not Granger-cause crude oil prices and market capitalization. It is also evident that there is no instantaneous causality between the variables. These results mean that oil price is a very salient variable and its changes affect the stock market movement significantly after one month. Oil price decrease leads to depreciation in exchange rates of naira significantly after a period of two months. This implies that policy makers in oil-dependent economies should keep an eye on the effects of changes in oil prices on their economies and stock markets. Policy makers may also play a role in influencing exchange rates and volumes of market capitalization through the use of oil prices.

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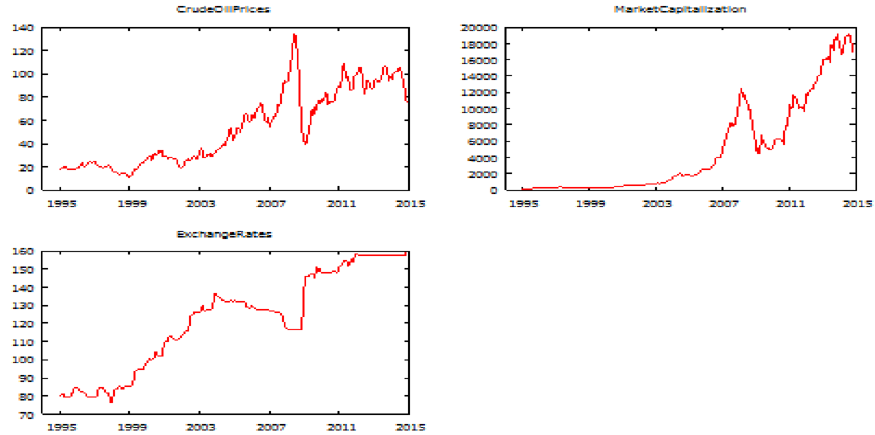

Figure-1. Time series plots of COP, MC &ER

Source: Output from Gretl Statistical Software

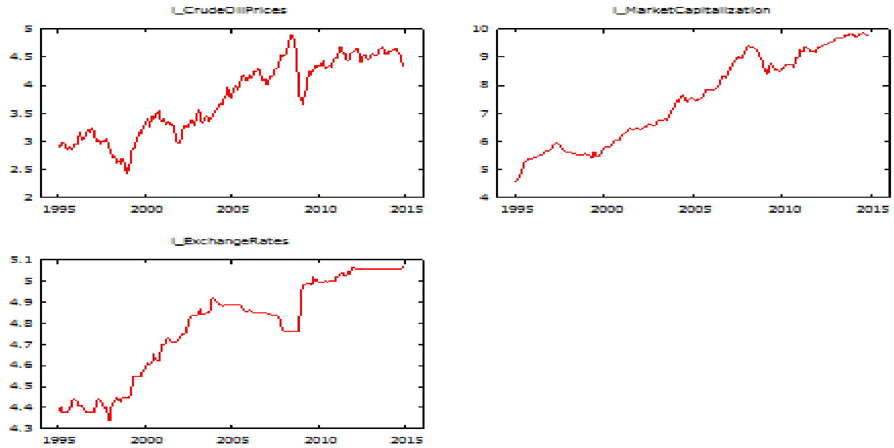

Figure-2. Time series plots of logs of COP, MC & ER

Source: Output from Gretl Statistical Software

Table-1. Johansen Cointegration Trace Test Showing 2 CointegrationRelationship among the Variables

None *	0.085945	37.71440	24.27596	0.0006
At most 1 *	0.067685	16.59631	12.32090	0.0091
At most 2	0.000538	0.126505	4.129906	0.7694
Trace test indicates 2 cointegratingeqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon *et al.* (1991) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.085945	21.11810	17.79730	0.0152
At most 1 *	0.067685	16.46980	11.22480	0.0055
At most 2	0.000538	0.126505	4.129906	0.7694
Max-eigenvalue test indicates 2 cointegratingeqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon *et al.* (1991) p-values				

Max-eigenvalue test indicates 2 cointegratingeqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon *et al.* (1991) p-values

Table-2. Optimal Lag Length Selection for the Log of the Variables

VAR Lag Order Selection Criteria						
Endogenous variables: LG_CRUDEOILPRICES LG_EXCHANGERATES LG_MARKETCAPITILATION						
Exogenous variables: C						
Sample: 1995M01 2014M11						
Included observations: 231						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-185.9123	NA	0.001030	1.635604	1.680311	1.653636
1	1175.944	2676.548	8.43e-09	-10.07743	-9.898608	-10.00531
2	1201.086	48.76155	7.33e-09	-10.21720	-9.904251*	-10.09098*
3	1211.439	19.80896*	7.25e-09*	-10.22891*	-9.781842	-10.04859
4	1217.518	11.47412	7.44e-09	-10.20362	-9.622434	-9.969208
5	1224.110	12.27107	7.60e-09	-10.18277	-9.467466	-9.894265
6	1230.783	12.24770	7.75e-09	-10.16262	-9.313196	-9.820020
7	1238.625	14.19098	7.84e-09	-10.15260	-9.169053	-9.755902
8	1239.888	2.251288	8.39e-09	-10.08561	-8.967939	-9.634813
* 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: Output from Gretl Statistical Software

Table-3. VAR (3) Estimation Results

Vector Autoregression Estimates			
Sample (adjusted): 1995M04 2014M11			
Included observations: 236 after adjustments			
Standard errors in ( ) & t-statistics in [ ]			
	LG_CRUDEOIL PRICES	LG_EXCHANGE RATES	LG_MARKETCAPIT ILATION
LG_CRUDEOILPRICES(-1)	1.148976	-0.020962	0.133346
	(0.06685)	(0.01250)	(0.06356)
	[17.1869]	[-1.67709]	[2.09801]
LG_CRUDEOILPRICES(-2)	-0.138397	-0.027537	0.019748
	(0.10079)	(0.01884)	(0.09582)
	[-1.37314]	[-1.46129]	[0.20608]
LG_CRUDEOILPRICES(-3)	-0.113317	0.042332	-0.093907
	(0.06780)	(0.01268)	(0.06446)
	[-1.67128]	[3.33934]	[-1.45677]
LG_EXCHANGERATES(-1)	0.001627	1.302340	-0.189526
	(0.34686)	(0.06485)	(0.32977)
	[0.00469]	[20.0823]	[-0.57473]
LG_EXCHANGERATES(-2)	0.335634	-0.439330	0.230597
	(0.55559)	(0.10388)	(0.52821)
	[0.60411]	[-4.22940]	[0.43656]
LG_EXCHANGERATES(-3)	-0.252635	0.137771	0.062775
	(0.35075)	(0.06558)	(0.33347)
	[-0.72028]	[2.10089]	[0.18825]
LG_MARKETCAPITILATION(-1)	0.165534	-0.000283	1.007298
	(0.06973)	(0.01304)	(0.06629)
	[2.37404]	[-0.02174]	[15.1950]
LG_MARKETCAPITILATION(-2)	-0.162613	-0.006804	0.011129
	(0.09926)	(0.01856)	(0.09437)
	[-1.63819]	[-0.36664]	[0.11793]
LG_MARKETCAPITILATION(-3)	0.026290	0.008876	-0.059776
	(0.06759)	(0.01264)	(0.06426)
	[0.38899]	[0.70241]	[-0.93028]

C	-0.235598	0.009127	-0.390092
	(0.18779)	(0.03511)	(0.17854)
	[-1.25460]	[0.25995]	[-2.18495]
R-squared	0.987210	0.996302	0.997928
Adj. R-squared	0.986700	0.996155	0.997845
Sum sq. resids	1.332606	0.046583	1.204534
S.E. equation	0.076789	0.014357	0.073005
F-statistic	1938.193	6765.073	12091.99
Log likelihood	275.9806	671.7131	287.9037
Akaike AIC	-2.254073	-5.607738	-2.355116
Schwarz SC	-2.107300	-5.460965	-2.208343
Mean dependent	3.778574	4.781586	7.534151
S.D. dependent	0.665852	0.231518	1.572686
Determinant resid covariance (dof adj.)		6.39E-09	
Determinant resid covariance		5.61E-09	
Log likelihood		1237.282	

Source: Output from Gretl Statistical Software

Table-4. VAR(3) Residual Serial Autocorrelation Test

PORTMANTEAU TEST (H0:Rh=(r1,...,rh)=0) Reference: Lutkepohl (1993) Introduction to Multiple Time Series Analysis, 2ed, p. 150.	
tested order:	48
test statistic:	390.2033
p-value:	0.6925
adjusted test statistic:	437.2242
p-value:	0.1299
degrees of freedom:	405.0000

Source: Output from Gretl Statistical Software

Table-5. Causality Test Results

LCrudeOilPrices on LExchangeRates, LMarketCapt
TEST FOR GRANGER-CAUSALITY:
H0: "LCrudeOilPrices_log" do not Granger-cause "LExchangeRates_log, LMarketCapt_log" Test statistic l = 5.0065 pval-F(l; 6, 663) = 0.0000
TEST FOR INSTANTANEOUS CAUSALITY:
H0: No instantaneous causality between "LCrudeOilPrices_log" and "LExchangeRates_log, LMarketCapt_log" Test statistic: c = 2.4993 pval-Chi(c; 2) = 0.2866
LExchangeRates on LCrudeOilPrices, LMarketCapt
TEST FOR GRANGER-CAUSALITY:
H0: "LExchangeRates_log" do not Granger-cause "LCrudeOilPrices_log, LMarketCapt_log" Test statistic l = 1.4856 pval-F(l; 6, 663) = 0.1804
TEST FOR INSTANTANEOUS CAUSALITY:
H0: No instantaneous causality between "LExchangeRates_log" and "LCrudeOilPrices_log, LMarketCapt_log" Test statistic: c = 1.8153 pval-Chi(c; 2) = 0.4035
LMarketCapt on LExchangeRates, LCrudeOilPrices
TEST FOR GRANGER-CAUSALITY:
H0: "LMarketCapt_log" do not Granger-cause "LCrudeOilPrices_log, LExchangeRates_log" Test statistic l = 1.7455 pval-F(l; 6, 663) = 0.1080
TEST FOR INSTANTANEOUS CAUSALITY:
H0: No instantaneous causality between "LMarketCapt_log" and "LCrudeOilPrices_log, LExchangeRates_log" Test statistic: c = 0.8263 pval-Chi(c; 2) = 0.6616

Source: Output from Jmulti Statistical Software