Lafia Journal of Economics and Management Sciences: Vol. 6, No. 1; Issue 1, 2021
ISSN: 2550-732X
Published by Department of Economics, Federal University of Lafia, Nigeria

Nexus between Crude Oil Prices and Exchange Rate in Nigeria

Adewale E. Adegoriola[1] & Musari Onimisi Aliyu[2]
[1]Department of Economics, Fedeeal University Lafia, Nigeria
[2]Department of Arts and Social Sciences, Waziri Umaru Federal Polytechnic Brinin-Kebbi
Corresponding Email: musty.oneil16@gmail.com

Abstract
This study investigates the nexus between real crude oil price and exchange rate in Nigeria from January 1999 to December 2019. The study employed Monthly data which includes the bilateral exchange rate between Nigeria (Naira) and the United State (Dollar), and the spot price of crude oil measured in West Intermediate Price (WTI). The Johansen cointegration was explored to test the cointegrating relationship between Exchange rate, crude oil price, interest rate and external reserve. The findings show there is a long-run relationship between the variables. Meaning a 1 percent increase in crude oil price will lead to a 2.66 percent increase in naira per US dollar exchange rate. As for external reserve, a 1 percent increase will result in a 1.15 percent decrease in the exchange rate. While a 1 percent increase in interest rate will lead to a 3.75 percent increase in the exchange rate. However, it takes a 0.9 percent speed of adjustment for the equilibrium to be restored from the short-run disequilibrium. The study, therefore, recommends that adequate measures should be taken to de-link long-run movements of the naira exchange rate from crude oil price changes due to its high volatility rate.

Keywords: Exchange Rate, Crude Oil Prices, Nigeria

1. Introduction

Nigeria is blessed with abundant natural and human resources and many believe there is potential for the economy to be among the high-income economies in the world. Nigeria is the largest producer of oil in Africa and 6th in the world with about 2.7% of the world's oil supply. Since the discovery of Crude oil in 1955 in Olobiri, crude oil has contributed largely to the development of the country. The fluctuations in world crude oil prices have significant effects on the macroeconomic variables of oil-exporting countries. Oil price volatility has become an important topic because of its recognized role in macroeconomic variables. Mckillop (2004) explained that falling oil price will lead to high interest rates and even a plunge into recession.

The over-dependence on oil has made the economy vulnerable to oil price shock at the international market. A decline in crude oil prices for an oil exporter like Nigeria drives down the price of non-traded goods in the internal economy and thereby the real exchange rate. The adjustment of the real exchange rate could require nominal exchange rate depreciation if the price of non-traded goods is found to be sticky. Also, a negative oil price shock transfers wealth from oil exporters to oil importers, leading to large shifts in current account balances and portfolio reallocation (Sascha et al. 2015). To restore the external net financial sustainability of oil importers (exporters), the real exchange rate has to depreciate (appreciate) following a negative shock to the oil price to improve the non-oil trade balance.

According to Sascha et al. (2015), while theory suggests that oil exporters' currencies should depreciate in the wake of negative oil price shocks (and vice versa for positive shocks), in practice there may be counter-balancing forces. It has been recognized in some literature that depreciation of exchange rate tends to expand exports and reduce imports, while the appreciation of exchange rate would enhance exports and encourage imports. Thus, exchange rate depreciation leads to income transfer from importing countries to exporting countries through a shift in the terms of trade. It is on this note that this study seeks to examine the nexus between crude oil price and exchange rate in Nigeria from 2009 to 2019. This study will provide information about crude oil price and exchange rate movement which will guide investors in investment decisions and reveal the level of correlation between crude oil price and naira/ U.S. dollar exchange rate.

2. Empirical Literature

Salisu et al. (2020) used historical datasets over a country ranging from September 1859 to April 2020 to predict the exchange rate returns of BRICS countries (Brazil, Russia, India, China and South Africa) based on crude oil prices. The study employed modified OLS techniques with a formulated predictive model that accounts for predictor and predicted series. The results establish an asymmetry, meaning that crude oil price is a good predictor of exchange rate returns for all net oil-importers (South Africa, India and China) and one out of the two net oil-exporters (Russia). The findings further showed that with convincing in-sample and out-of-sample forecast results that accounting for the role of asymmetry are vital for the oil-based model to beat the benchmark or historical average model.

Saidi et al. (2019) investigate the asymmetric effect of crude oil price and volatility on the exchange rate in Indonesia for the period of January 2006 to December 2017. The study adopts West Texas Intermediate (WTI) crude oil as the proxy for crude oil price on Indonesian rupiah (IDR) per U.S. dollar exchange rate. The results of the nonlinear autoregressive distributive lag model (NARDL) employed to test the asymmetric effect shows that in the short-run there is an asymmetric effect of crude oil price and volatility on the Indonesian rupiah per U.S. dollar exchange, while in the long-run such effect was not found. Sibanda and Courage (2014) investigate the impact of oil prices on the exchange rate in South Africa using the GARCH (1,1) model to estimate monthly data for the period of 1994 - 2012. The study employed the nominal exchange rate of Rand against the Dollar and oil price (Brent crude oil price). The finding shows that interest rate and oil price both have a significant impact on the value of the Rand. That is, a one percent increase in interest rates led to a 0.25 percent increase in Rand exchange rate, while a one percent increase in oil price led to a 0.12 percent depreciation or decrease of Rand exchange rate.

Oluwatonmisin, Paul and Adeyemi (2014), using the Johansen cointegration and error correction model to ascertain whether oil price has a significant impact on the exchange rate in Nigeria for the period of 1970-2010. The results indicate oil price exerts an elastic significant fluctuation on the exchange rate in Nigeria. That is, a change in oil price will cause a more than proportional change in exchange.

In furtherance, Englama, Duke, Ogunleye and Ismail (2010) examined oil prices and exchange rate volatility in Nigeria using monthly data for the period 1999:1 to 2009:12. The study employed Vector Autoregressive (VAR) model, Johansen co-integration and Vector error correction model (VECM) and the results indicate that a 1.0% permanent increase in oil price at the international market increases exchange rate volatility by 0.54% in the long run. In conclusion, there is a direct link between the demand for foreign exchange and oil price volatility.

Obi, Oluseyi and Evans (2018), investigates the impact of oil price shocks on stock market prices volatility in Nigeria: New evidence from a non-linear ARDL cointegration. The study used quarterly time series data ranging from 1986 to 2016 to analyze both the short run and the long-run relationship among the variables. The findings from the study affirmed the presence of the nonlinear relationship between oil price shocks and stock price volatility in Nigeria.

Nwoba, Nwonu and Agbaeze (2017) used Simple regression, Pearson Product Moment Correlation and chi-square to investigate the impact of fallen oil prices on the Nigerian economy. The result indicates that falling oil price has a significant effect on the Nigerian economy and has impacted negatively on it. They recommended that the Nigerian economy should be diversified.

Abraham (2016) examines exchange rate policy and falling crude oil prices: effect on the Nigeria stock market from January 2008 to July 2009 (during the global financial crisis) and June 2012 to June 2015 (before and after 2014 crude oil shock). The findings show crude oil prices are positively related to the performance of the stock market in Nigeria.

Aliyu (2009) examines the impact of oil price shock and exchange rate volatility on economic growth in Nigeria. He used Johansen VAR-based cointegration & pairwise granger causality test to analyzed quarterly data from 1986Q1 to 2007Q4. The results show that there is unidirectional causality from oil prices to real GDP and bidirectional causality from real exchange rate to real GDP and vice versa. Both oil price and real exchange rate have a positive impact on real GDP. He concluded that it is important to diversify the economy through investment in key productive sectors.

3. Methodology and Theoretical Framework

The study examines data on the exchange rate which is the dependent variable, while crude oil price, interest rate, foreign reserve are independent variables from January 1999 to December.2019. We utilized monthly data, Nguyen (2015) in a related study said that weekly or monthly data helps to reduce time aggregation bias and capture both short and long-run behaviour. The bilateral exchange rate was sourced from the Central Bank of Nigeria (2020). The West Intermediate Texas price for real crude oil was collected from the U.S. Energy International Agency [EIA], (2020). While the prime lending rate as a proxy for interest rate and the external reserve were collected from the Central Bank of Nigeria. All the variables were transformed into their natural logarithm to reduce or diminish the exponential patterns with consistent upward fluctuation that are visible in raw data.

The theoretical framework for this study is based on purchasing power parity theory by Cassel (1924). The theory states that the equilibrium rate of exchange is determined by the domestic or internal price levels in two countries. The two angles to this theory are the absolute and relative version. The absolute version of purchasing power parity has to do with the units of currencies required to buy a given quantity of goods in two different countries. While the relative version of purchasing power parity theory relates the changes in the price levels in two countries between some base period and current period which is key in the determination of exchange rates of currencies in the two periods.

3.1 Model Specification

The study adapts the theoretical model built by Sibanda and Courage (2014)

$$EXR = F(OIP, REV, INT) \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (1)$$

$$LEXR_t = \beta_0 + \beta_1 LOIP_t + \beta_2 LREV_t + \beta_3 LINT_t + \mu_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (2)$$

Where EXR is the exchange rate, OIP is the real crude oil price, REV is an external reserve and INT is the interest rate. Crude oil price is the spot price per barrel denominated in the US dollar. The exchange rate is bilateral exchange rates between Nigeria (Naira) and the United State of America (Dollar). External reserves are assets held on reserve by a monetary authority in foreign currencies. While prime lending rate is the interest rate used by banks approved by the monetary authority.

A priori Expectations: It is expected that an increase in oil price would lead to an appreciation of currencies of oil-exporting countries, while currencies of countries with large oil dependence in the tradable sector would depreciate due to high inflation. It is also expected that an increase in a domestic interest rate should depreciate the domestic currency according to revealed interest rate parity, but several studies show that an appreciation is frequently observed (Beckmann, Czudaj, & Arora, 2017). An increase in oil price raises the level of external reserve which further lead to an appreciation of currencies of oil-exporting countries.

3.2 Estimation Techniques

This study adopted Johansen Maximum likelihood estimation procedure to determine the cointegration rank of equation (1). Then, the vector error correction model (VECM) to ascertain the speed of adjustment from disequilibrium to long-run equilibrium. The first step is to ascertain the order of integration of all the variables using Augmented Dickey-Fuller (ADF) and Phillips-Perron unit test in equation (3).

$$\Delta Y_t = \beta_1 Y_{t-1} + \alpha_i \sum \Delta Y_{t-i} + \varepsilon_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (3)$$

ΔY_t is the differenced value of a given time series, Y_{t-1} is the first lag value of a series, ΔY_{t-i} represent lag values of the differenced series, β represent the coefficient, while ε standing for white noise. We test the null hypothesis $H_0 : \beta = 0$, meaning there is a presence of unit root, and the alternative hypothesis $H_1 \prec 0$. If a variable is stationary at level, it is said to be integrated at order 0 (I(0)). But if that variable is differentiated once before it becomes stationary, it is said to be integrated at order 1 (I(1)).

. If a variable is stationary at level, it is said to be integrated at order 0 (I(0)). But if that variable is differentiated once before it becomes stationary, it is said to be integrated at order 1 (I(1)).

The next step is to test for the existence of cointegration or long-run relationship when all the variables are found to be stationary after the first difference, I(1). Johansen cointegration test developed by Johansen and Juselius (1990) which procedure is based on the maximum likelihood estimation of Vector Autoregressive (VAR) model and this involves the identification of the rank *n* by *n* vector of the matrix$\prod$. The model is constructed as follows:

$$\Delta Y_t = \beta + \sum_{i=1}^{n-1} \Gamma_i \Delta Y_{t-i} + \prod Y_{t-1} + \upsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (4)$$

Where

Where Y_t is the vector of LEXR, LOIP, LREV and LINT. β represent the intercept vector, υ_t is the error term. The matrix $\prod$contains the long-run information, while Γ_i conveys the short-run information among the variables. The Johansen cointegration is based on the maximum likelihood ratio and the two statistics are: Trace statistics and the Maximum Eigenvalues statistics:

$$J_{trace} = -T \sum_{i=r+1}^{n} \log(1 - \lambda_i^{\Lambda}) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (5)$$

$$J_{\max} = -T \log(1 - \lambda_{r+1}^{\Lambda}) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (6)$$

$\lambda$is the estimated Eigen values, *T*represent number of sample observations, while *r*is the number of individual variable. We test the trace hypothesis of *r*against the alternative hypothesis*n*. On the other hand the maximum Eige null hypothesis *r*against the alternative hypothesis .1+*r*If the estimates are found to cointegrated or long-run relationship, we move to the vector error correction model (VAR) to analyze the short-run relationship.

The Vector Error Correction Model of this study are as follows:

$$\Delta LEXR_t = \alpha_1 + \sum_{i=1}^{n} \varphi_{1i} \Delta LEXR_{t-i} + \sum_{i=1}^{n} \varphi_{2i} \Delta LOIP_{t-i} + \sum_{i=1}^{n} \varphi_{3i} \Delta LREV_{t-i} + \sum_{t=1}^{n} \varphi_{4i} LINT_{t-i} + \beta_1 ECM_{t-i} + \mu_{t1} \dots\dots\dots (7)$$

$$\Delta LOIP_t = \alpha_2 + \sum_{i=1}^{n} \lambda_{1i} \Delta LEXR_{t-i} + \sum_{t=1}^{n} \lambda_{2i} \Delta LOIP_{t-i} + \sum_{t=1}^{n} \lambda_{3i} \Delta LREV_{t-i} + \sum_{i=1}^{n} \lambda_{4i} LINT_{t-i} + \beta_2 ECM_{t-i} + \mu_{t2} \dots\dots\dots (8)$$

$$\Delta LREV_t = \alpha_3 + \sum_{i=1}^{n} \sigma_{1i} \Delta LEXR_{t-i} + \sum_{i=1}^{n} \sigma_{2i} \Delta LOIP_{t-i} + \sum_{i=1}^{n} \sigma_{3i} \Delta LREV_{t-i} + \sum_{i=1}^{n} \sigma_{4i} \Delta LINT_{t-i} + \beta_3 ECM_{t-i} + \mu_{t3} \dots\dots\dots (9)$$

$$\Delta LINT_t = \alpha_4 + \sum_{i=1}^{n} \omega_{1i} \Delta LEXR_{t-i} + \sum_{i=1}^{n} \omega_{2i} \Delta OIP_{t-i} + \sum_{i=1}^{n} \omega_{3i} \Delta LREV_{t-i} + \sum_{i=1}^{n} \omega_{4i} \Delta LINT_{t-i} + \beta_4 ECM_{t-i} + \mu_{t4} \dots\dots\dots (10)$$

Equation (7, 8. 9 and 10) represent the error correction model which enables us to capture the short-run dynamics of the interrelationships among the variables and the speed of adjustment to restore long-run equilibrium.

4. Results and Discussion

Table 1: Descriptive Statistics

	LEXR	LOIP	LREV	LINT
Mean	5.048053	3.973860	10.09655	2.896199
Median	5.000617	4.046026	10.40047	2.845780
Std. Dev.	0.350459	0.505185	0.728963	0.133892
Skewness	0.892510	-0.474524	-0.848366	0.951529
Kurtosis	2.798760	2.507169	2.232259	3.256894
Jarque-Bera	33.88132	12.00753	36.41743	38.72005
Probability	0.000000	0.002469	0.000000	0.000000
Observations	252	252	252	252

Source: Authors' computation, Using Ev iews 9, 2021.

The descriptive statistics in table 1 comprises the mean, standard deviation, skewness, kurtosis, jarque-bera, and probability with a total observation of 252. The external reserve shows the highest depreciation and average of 10.09 followed by the exchange rate and the interest rate with the least mean value of 2.90. Table 1 reveal external reserve is more volatile with a standard deviation of 0.73 followed by crude oil price and interest rate having the minimum. The crude oil price and external reserve are negatively skewed to the left, while the exchange rate and interest rate are positively skewed to the right. Also, crude oil price, exchange rate and external reserve are normally distributed, wide, flat and it indicates platykurtic as their kurtosis values are 2.51, 2.80 and 2.23 respectively. The interest rate is leptokurtic in nature as the kurtosis value is greater than 3. The Jarque-bera statistics and their probability value is an indication that the null hypothesis of normality is rejected at a 5% significant level.

Table 2: Unit Root Test

	ADF		PP	
Variables	P-Values, I(0)	P-Values, I(1)	P-Values, I(0)	P-Values, I(1)
LEXR	0.6993	0.0000*	0.7731	0.0000*
LOIP	0.1728	0.0000*	0.3011	0.0000*
LREV	0.8447	0.0000*	0.9031	0.0000*
LINT	0.3339	0.0000*	0.3651	0.0000*

Note: ***, ** and * depicts Stationarity at 10%, 5% and 1% respectively. All variables are tested on intercept and trend.
Source: Authors' Computation, using Eviews 9, 2021.

Table 2 represents the Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) test. The two tests mechanism shows that all variables were not stationary at level. These were tested at 10%, 5% and 1% level of significance respectively. So, due to the non-stationary of the data at level, the variables were differenced once, I(1) order of integration and all the variables became stationary at 1% significance level. Since all the variables are stationary after the first difference, we then move ahead to conduct the lag length selection criterion and Johansen Cointegration test.

Table 3: Lag Length Selection Criterion

Lag	LR	FPE	AIC	SC	HQ
0	NA	1.12e-05	-0.045091	0.012239	-0.022002
1	3360.243	1.00e-11	-13.97354	-13.68689*	-13.85809
2	66.05021	8.64e-12	-14.12346	-13.60748	-13.91565*
3	32.93560*	8.54e-12*	-14.13489*	-13.38959	-13.83472
4	22.19384	8.84e-12	-14.10151	-13.12689	-13.70899
5	8.244907	9.72e-12	-14.00734	-12.80339	-13.52245
6	14.76407	1.04e-11	-13.94360	-12.51034	-13.36636
7	16.98577	1.09e-11	-13.89146	-12.22887	-13.22186
8	10.63814	1.19e-11	-13.81073	-11.91882	-13.04877

*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, HQ: Hannan-Quinn information criterion.
Source: Authors' Computation, Using Eviews 9, 2021.

Table 3 presents the lag order selection criteria which indicate that Schwarz information criterion and Hannan-Quinn information criterion selects one lag at 0.05 level of significance. Final prediction error selects two lag, while sequential modified LR test statistics select 6 lag. However, this study employs the Schwarz information criterion by selecting the optimum lag of one (1) as the lag length.

Table 4: Johansen Cointegration Test

	Trace Statistics			Maximum Eigen Value		
No. of cointegrating equation	Statistics	0.05 Critical values	P-values	Statistics	0.05 Critical values	P-values
None	55.528*	47.856	0.008	35.824*	27.584	0.004
At most 1	19.704	29.797	0.443	13.948	21.132	0.369
At most 2	5.756	15.495	0.724	5.755	14.265	0.645
At most 3	0.000	3.8415	0.985	0.000	3.841	0.985

*denotes rejection of the null hypothesis at the 0.05 level.

Source: Authors' Computation, Using Eviews 9, 2021.

Decision Rules

H_0: There is no co-integrating relationship among the integrated variables

H_1: There is a cointegrating relationship between the integrated variables

In table 4, the null hypothesis of no cointegration was rejected at none as the probability values of trace statistics (0.008) and maximum eigen value (0.004) were less than 0.05 significance level. Meaning, there is a presence of cointegration or long-run. When it is At Most 1, we accept the null hypothesis because the probability values of trace statistics (0.443) and maximum eigenvalue (0.369) are greater than the 0.05 significance level. Therefore, the results in table 4 indicate one (1) cointegrating equation at a 0.05 significance level. Having established the existence of cointegration in equation 3.2, we move ahead to analyze the long-run and short-run impact.

Table 5. Long-Run: Normalized Co-integrating Coefficients

Table 5. Long-Run: Normalized Co-integrating Coefficients

Variables	LEXR	LOIP	LREV	LINT
Coefficients	1.000000	2.664	-1.151	3.750
Standard Error		(0.409)	(0.305)	(1.354)

Source: Authors' Computation, Using Eviews 9, 2021

We derive the co-integrating equation using the normalized co-integrating coefficients in table 5 from equation (3) with the natural log of the exchange rate (LEXR) as the dependent variable, while the independent variables are a natural log of crude oil price (LOIP), external reserves (LREV) and interest rate (LINT). The coefficients of the long-run equation show that a

1% increase in crude oil price will lead to a 2.66% increase in naira per US dollar exchange rate. As for external reserve, a 1% increase will result in a 1.15% decrease in the exchange rate. Also, a 1% increase in interest rate will lead to a 3.75% increase in the exchange rate.

Table 6: Short-Run: Vector Error Correction Estimates

Error Correction:	D(LEXR)	D(LINT)	D(LOIP)	D(LREV)
CointEq1	-0.009040	-0.009895	-0.032947	0.010360
	(0.00315)	(0.00300)	(0.00889)	(0.00465)
	[-2.87139]	[-3.29541]	[-3.70735]	[2.22986]
D(LEXR(-1))	0.139553	0.158273	-0.327874	-0.029611
	(0.06329)	(0.06036)	(0.17864)	(0.09339)
	[2.20510]	[2.62234]	[-1.83538]	[-0.31706]
D(LINT(-1))	-0.022923	-0.197652	0.012333	0.074586
	(0.06470)	(0.06171)	(0.18264)	(0.09548)
	[-0.35427]	[-3.20305]	[0.06752]	[0.78114]
D(LOIP(-1))	-0.019108	0.004005	0.320200	0.088708
	(0.02173)	(0.02072)	(0.06134)	(0.03207)
	[-0.87928]	[0.19326]	[5.21998]	[2.76620]
D(LREV(-1))	-0.027518	0.005207	-0.042469	0.297569
	(0.04074)	(0.03885)	(0.11499)	(0.06012)
	[-0.67550]	[0.13403]	[-0.36933]	[4.94997]
C	0.004685	-0.002457	0.006413	0.004806
	(0.00190)	(0.00181)	(0.00537)	(0.00281)
	[2.46241]	[-1.35438]	[1.19407]	[1.71177]
R-squared	0.073572	0.102143	0.131958	0.164630
Adj. R-squared	0.054588	0.083744	0.114170	0.147512
Sum sq. resids	0.206398	0.187724	1.644540	0.449464
S.E. equation	0.029084	0.027737	0.082097	0.042919
F-statistic	3.875442	5.551632	7.418461	9.617241

Note: Standard errors in ( ) & t-statistics in [ ]

Source: Authors' Computation, Using Eviews 9, 2021

Table 6 presents the short-run impact and reveal the speed of adjustment from short-run disequilibrium back to equilibrium. The estimate indicates that it takes 0.9% for equilibrium to be restored from disequilibrium. From the first column were EXR is dependent variable, the estimates shows that one lag period of OIP, REV and INT have no significant impact on EXR as their t-statistics, 0.879, 0.676 and 0.354 are less than 2 critical value, based on rule of thumb.

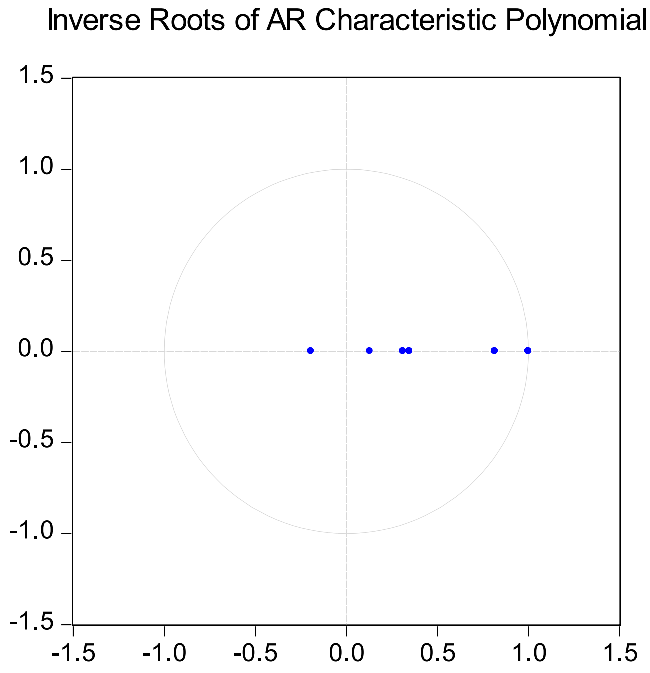

Figure 1: Polynomial Inverse Roots of AR Characteristic
Source: Authors' Computation, Using EViews 9, 2021

Figure 1 above shows the graph of the VEC stability check result. The figure indicates that the VEC results satisfy the stability condition check since the dots are located within the cycle. Thus, the result is stable.

5. Conclusion and Policy Recommendations

The study examines the nexus between real oil price and exchange rate in Nigeria from January 1999 to December 2019. The study employed augmented Dicky-Fuller (ADF) and Phillips-Perron unit root test and we found out that all the variables were stationary after first difference. The result of Johansen cointegration test indicates one (1) cointegrating equation at the 0.05 level of significance from the trace statistic test and maximum eigenvalue test. Therefore, we found out that in the long-run, 1% increase in crude oil price will lead to 2.66% increase in naira per US dollar exchange rate. As for external reserve, a 1% increase will result to 1.15% decrease in exchange rate. While, 1% increase in interest rate will lead to 3.75% increase in exchange rate. The estimates of error correction model shows that only the one lag period of exchange rate has significant impact on the current exchange rate as indicated by the t-statistics which is greater than 2, other variables, crude oil price, external reserves and interest rate which are in one lag period do not have significant impact on the current exchange rate as their t-statistics is below 2 based on rule of thumb. However, the study shows that it takes 0.9% to restore long-run equilibrium from the disequilibrium position. The Polynomial Inverse Roots test indicates the existence of stability in the error correction model as all the dots are located within the cycle.

This study has shown that crude oil price volatility accounts for a movement in the exchange rate, therefore the regulatory body must ensure permanent adjustment to ensure stability. Going forward, adequate measures should be put in place to de-link long-run movements of the exchange rate of naira per U.S. dollar from crude oil price changes due to its high volatility rate. The monetary authority should maintain a stable interest rate that is attractive sufficiently enough that will appreciate the naira per U.S. dollar exchange rate. There is a need for a robust external reserve because it helps to strengthen the naira exchange rate.

References

Abraham, T.W. (2016). Exchange rate policy and falling crude oil prices: effect on the Nigerian stock market. *CBN Journal of Applied Statistics,* 7(1), 76-86

Aliyu, S. U. (2009). Impact of oil price shock and exchange rate volatility on economic growth in Nigeria: An empirical investigation. *Research Journal of International Studies,* 1(1), 4-15.

Beckmann J., Czudaj, R., & Arora, V. (2017). The relationship between oil prices and exchange rates: Theory and evidence. *U.S. Department of Energy. Washington,* DC 20585. www.eia.gov.

Cassel, G. (1924). "The purchasing-power parity". *Skandinaviska Kreditaktiebolaget*. Quarterly Report.

Central Bank of Nigeria (2020). Statistical Bulletin, 1999-2020

Englama, A., Duke, O. O., Ogunleye, T. S., & Ismail, F. U. (2010). Oil Prices and Exchange Rate Volatility in Nigeria: An Empirical Investigation. Central Bank of Nigeria, *Economic and Financial Review, 48*(3), 66-76

McKillop, A. (2004). Oil Prices, Economic Growth and World Oil Demand. *Middle East Economic Survey,* XLVII (35), 206-216

Nguyen, M. (2015). *The relationship between oil prices and exchange rate:* Evidence from Norway, Canada and Mexico. Norwegian School of Economics. Bergen, autumn, 2015.

Nwoba O.E, Nwonu C.O & Agbaeze E.K (2017). Impact of fallen oil prices on the Nigerian Economy. *Journal of poverty, Investments and Development*, 33(12), 432-442

Obi, B., Oluseyi, A.S., & Evans O. (2018). Impact of oil price shocks on stock market prices volatility in Nigeria: New evidence from a Non-linear ARDL Cointegration. *Journal of Global Economy*, 14(3), 640-650

Oluwatomisin M.O., Paul O., & Adeyemi A.O. (2014). Oil price and exchange rate volatility in Nigeria. *IOSR Journal of Economics and Finance (IOSR-JEF), 5*(4), 01-09.

Saidi, L.O., Aedy, H., Saranani, F., Rosnawintang, Adam, P., & Sani, L.O. (2021). Crude oil price and exchange rate: An analysis of the asymmetric effect and volatility using the Non-Linear Autoregressive Distributed Lag and General Autoregressive Conditional Heteroscedasticity in Mean Models. *International Journal of Energy Economics and Policy*, 10(1), 104-108

Salisu, A.A., Cunado, J., Isah, K., & Gupta R. (2020). Oil price exchange rate behaviour of the BRICS for over a Country. University of Pretoria, South Africa, *Department of Economics Working Paper Series:* 2020-64.

Sascha, B., Maurizio, H. & Livio, S. (2015). How does a falling Oil price affect exchange rates? World Economic Forum. https://www.weforum.org/agenda/2015/03/how-does-a-falling-oil-price-affect-exchange-rates/

Sibanda, K., & Courage, M. (2014), the impact of oil prices on the exchange rate in South Africa. *Kamla-Raj J Economics,* 5(2); 193-199

U.S. Energy Information Administration (2021), West Texas Intermediate crude oil prices and Brent oil prices data. URL: http://www.eia.gov/dnav/pet/pet_pri_spt_s1_d.htm (retrieved 20 April, 2020).

Yusuf, M. (2015). An analysis of the impact of oil price shocks on the growth of the Nigerian economy, 1970-2011. *African Journal of Business Management,* 9(3), 103-115