

Modelling the Impact of Oil Prices and Exchange Rate on Economic Growth Rate in Nigeria

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Abstract

This study empirically examined the impact of real oil prices and real exchange rate on economic growth rate in Nigeria. The study used time series data covering the period of 1986 to 2016 and the data were sourced from Central Bank of Nigeria's statistical bulletins and annual report of National Bureau of Statistics of Nigeria. The autoregressive distributed lagged (ARDL) and error correction model (ECM) were used to establish the short-run and long run impacts and relationship between variables under consideration. The results showed that there is significant relationship between oil prices, real exchange rate and economic growth rate in Nigeria. The ARDL-bounds test results showed that there is co-integration among the variables under review. The ECM results revealed that real oil prices has negative impact on economic growth rate in Nigeria while real exchange rate has positive impact on economic growth rate in Nigeria. The implication of the results is that since the Nigerian economy is oil and import dependent, the activities of these economic variables if not managed will lead to poor economic performance in Nigeria. Therefore, the study recommended that government should adopt a mechanism to reduce the dependence oil and importation for the effective management of real oil prices and real exchange rate for sustainable economic growth rate in Nigeria.

Keywords: *Real exchange rate, Real oil prices, Nigerian economy, Economic growth rate*

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Background to the Study

Oil prices and exchange rate are two vital economic determinants in recent time in developing economies. According to Oriavwote and Eriemo (2012), the Real Exchange Rate (RER) is a significant factor in the development process of any economy as both its level and stability are important in increasing exports and investment, so also is oil price, as globally it has been a significant economic determinant of the level of economic performance in many oil depending economies. According to Krugman (2003), exchange rate appreciates in response to rising oil prices and depreciates with response to falling oil prices in oil exporting countries, while the opposite is expected to be the case in oil importing countries. The work of Marzieh (2006) opined that, 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.

According to Olanipekun, (2016) Nigeria's economy has heavily depended on crude oil export since the 1970s. Over the periods, several episodes of fluctuation in crude oil prices occurred in the international market. These frequent swings in oil prices have important implications on the exchange rate and external reserve accumulation in the country. Crude oil price fell from US\$34.00 to US\$17.01 per barrel between 1981 and 1985 and external reserve declined from US\$4682.90 million to US\$981.81 million. In the reference period, exchange rate depreciated from N0.64 to N0.99 per dollar (Central Bank of Nigeria, 2016). Recently, crude oil price declined from \$111.46 per barrel in 2011 to \$63.28 per barrel at the end of 2014 and further declined to \$40.68 in 2016 (CBN, 2016). This development has led to substantial reduction in external reserve and a further depreciation of the exchange rate in the country.

The fall in crude oil price in the past few years has largely affected the Nigerian economy by substantially reducing government revenue. Accordingly, most of the obligations of the government to its citizenry have not been adequately met. The statutory federal allocations to the state have largely reduced. Nigerian government could not adequately finance capital project and salaries of workers especially at the state and local government levels were also not paid for several months. In light of this, Nigeria's government has to adopt measures to reduce spending. Consequently, the monetary authority devalued the naira since there was an increasingly depletion of the external reserve. Naira was devalued from N155/USD to N198.6/USD between November 2014 and March 2015 to reduce the demand of foreign exchange by the end users (Olanipekun, 2016). The level of exchange rate experienced sharp increase from N198.6/USD in 2015 to N253.4/USD in 2016 (CBN, 2016).

Despite the decrease in oil price the contribution of oil to the federal government revenue still remain the highest in Nigeria since the discovering of oil in 1970s. From 1970 to 2016 the oil contribution to the federal government revenue the constituted 50% to 83% of the federal government revenue, largely on account of increase in oil prices in the international market Englama, Duke, Ogunleye & Isma (2010). Since oil is the main stay of

the Nigerian economy, the price of oil plays a vital role in shaping the economic wellbeing of the country. According to Ogundipe (2013), since the discovery of Oil in commercial quantity, Nigeria has been a mono-product economy. The value of Nigeria's total export revenue in 2016 stood at US\$8835.6 billion, while income from petroleum exports of the total export revenue was US\$8178.8 billion representing about 93 percent (CBN, 2016). The absolute dependence of oil export revenue has placed emphasis on the level of the Nigerian economy's vulnerability to sudden oil price movements.

The transmission mechanism through which oil prices influence the real exchange rate for economic growth includes both supply and demand channels. The supply side effects are related to the fact that crude oil is a basic input in production and consequently, an increase in oil price leads to a rise in the cost of production of domestic goods. The price of domestic goods will thus increase leading to an appreciation of the real exchange rate. The real exchange rate is also indirectly affected through its relation with disposable income. A rise in oil price reduces the consumers spending power (Englama, et al. 2010). Also, Nigeria's economy is highly import depended Nation thereby increasing the volume of foreign exchange in Nigeria. The higher the volume of import over the export the higher the demand for foreign exchange for instance in 2016 the total import value stood at US\$9480.4 billion of which the non-oil import accounted for 75% of the total import (CBN, 2016). On the other hand the total export value was US\$ 8835.6 billion lower than our total export and this shows the level of import dependence of the Nigerian economy (CBN, 2016). Based on the background both oil price and exchange rate remain vital economic indicators in Nigeria's economy.

Objective of the Study

The objective of the study is to empirically examine the impact of oil prices and exchange rate on economic growth rate in Nigeria.

Literature Review

Conceptual Review

Exchange rate is the rate at which one country's currency is exchanged for the currency of another country (Dornbusch, 2004). In other words, exchange rate is the price of one currency vis-à-vis another and is the number of units of a currency required to buy another currency (Mordi, 2006). Exchange rate is the ratio between a unit of one currency and the amount of another currency for which that unit can be exchanged at a particular time (Ngerebo & Ibe, 2013). According to CBN (2016) exchange rate is the price of one currency in terms of another currency, that is, the current market price for which one national currency can be exchanged for another. It is normally expressed as the number of units of a domestic currency that will purchase one unit of a foreign currency or the number of units of a foreign currency that will purchase one unit of a domestic currency. For example the naira per United States (US) dollar (N/US\$) or US dollars per naira (US\$/N). If 1 US Dollar can be exchanged for N240, then one naira can be exchanged for US\$0.0042.

While exchange rate premium measures the spread between the recognized official market exchange rate and the Bureaux de Change (BDC) rate. The exchange rate premium can also be measured by the differential between the official and inter-bank market exchange rates. The exchange rate premium helps to evaluate the stability in the foreign exchange market. The exchange rate premium is not expected to go beyond 5 per cent for the foreign exchange market to be considered stable (CBN, 2016).

While the price of oil, or the oil price, (generally) refers to the spot price of a barrel of benchmark crude oil a reference price for buyers and sellers of crude oil such as West Texas Intermediate (WTI), Brent ICE, Dubai Crude, OPEC Reference Basket, Tapis Crude, Bonny Light, Urals oil, Isthmus and Western Canadian Select (WCS) (Basedau & Lay, 2009).

According to Gordon (2007), Economic growth is the most powerful instrument for reducing poverty and improving the quality of life in developing countries. Economic growth can generate virtuous circles of prosperity and opportunity. Strong economic growth and employment opportunities improve incentives for parents to invest in their children's education by sending them to school (Aigbedion, Iyakwari & Gyang, 2017). This may lead to the emergence of a strong and growing group of entrepreneurs, which should generate pressure for improved governance. Strong economic growth therefore advances human development, which, in turn, promotes economic growth. Economic growth is the continuous improvement in the capacity to satisfy the demand for goods and services, resulting from increased production scale, and improved productivity that is innovations in products and processes (Department for International Development (DFID), 2011).

Empirical Review

There are many empirical studies on the relationship between oil prices, real exchange rate and economic growth rate among them are the works of Yousefi and Wirjanto (2004) who empirically investigated the role of the exchange rate on crude oil price formation among OPEC member countries and the US dollar against other major countries and prices of other members. The results highlighted a cross-regional dimension of the crude oil market. Also, Chen and Chen (2007) investigated the long run relationship between real oil prices and Real Exchange Rate by using a monthly panel for G7 countries and then found that real oil prices may have been the dominant source of Real Exchange Rate movements and that there is a link between real oil prices and Real Exchange Rate.

Aziz (2009) in a comparative study between net oil exporters and oil importers found evidence of a statistically significant relationship between oil prices and Real Exchange Rate and found no evidence of a long run relationship between Real Exchange Rate and oil prices. Leili (2010) investigated the long run relationship between real oil prices and Real Exchange Rate using monthly panel data of seven countries of OPEC members from 2000 to 2007. The result showed that real oil prices may have been the dominant source of Real Exchange Rate movements. The result also showed a long run linkage between real

oil prices and the Real Exchange Rate. In a study of the long run relationship between real oil prices, Real Effective Exchange Rate (REER) and productivity differentials.

Hassan and Zahid (2011) using annual data for Nigeria covering 1980 to 2010, found that whereas real oil prices exercise a significant positive effect on the Real Exchange Rate in the long run Productivity differentials exercise a significant negative influence on the Real Exchange Rate. Similarly, Ozsoz and Akinkunmi (2011) investigated the price based determinants of the Nigerian Real Exchange Rate. Also, Muritala, Taiwo, & Olowookere, (2012) studied how oil and stock prices affect economic growth using Johansen method of co-integration and found that the variables have long-run relationship. They showed the positive effects of world oil prices on the exchange rate. In addition, Igberaese, (2013) did a study on the impact of oil prices on Nigeria's economic growth and found out that oil prices significantly impacted growth. Specifically, in the short run, high oil prices spurred growth but not in the long run. Eze and Okpala (2014) carried out a quantitative analysis of the impact of exchange rate policies on Nigeria's economic growth. Their study revealed that, apart from government expenditure, both exchange rate and money supply are highly significant in the determination of Nigeria's economic growth performance. Adelowokan, Adesoye and Balogun (2015) in their of the effect of exchange rate volatility on investment and growth in Nigeria using the vector error correction method found out that exchange rate volatility has a negative effect with investment and growth while exchange rate volatility has a positive relationship with inflation and interest rate in Nigeria. In summary, most studies reviewed used real gross domestic product (RGDP) as a proxy for economic growth but in the studies the value of economic growth rate in Nigeria was use which represent the true measure for economic growth in Nigeria.

Theoretical Framework

The theoretical framework for this study rests on Optimal Currency Area (OCA) Theory, developed by Mundell (1961) and McKinnon (1963). The theory of optimum currency areas (OCA) explores the criteria as well as the costs and benefits of entering/forming a common currency area. In addition, the OCA theory can be viewed as a tool for finding an answer to the question on how to choose the optimum exchange rate regime. It should be mentioned, however, that there is no widely accepted algorithm or index to indicate unambiguously should a country join a currency area or not. In fact, there is no standard theory of optimum currency areas, but rather several approaches that have been inspired by Mundell's (1961) seminal paper.

This theory is concerned with stabilization of the business cycle and trade. It is based on concepts of the symmetry of shocks, the degree of openness, oil price, and labor market mobility. According to the theory, a fixed exchange rate regime can increase trade and output growth by reducing exchange rate uncertainty and thus the cost of hedging, and also encourage investment by lowering currency premium from interest rates. However, it can also reduce trade and output growth by stopping, delaying or slowing the necessary relative price adjustment process. This implies that exchange rate and other external factors like oil prices and degree of openness can influence the level of trade or output

within the economy. According to Mundell's (1961) economic output is a function of exchange rate and oil prices that are determined by stabilization of the business cycle and trade internally and externally.

Methodology

Sources of Data and Method of Analysis

The data used in this work are secondary data. Data source which the real oil price (ROIP) was gotten from Thomson Reuters annual spot price for crude oil and petroleum product workbook content of 2017 as crude oil price, Figures for exchange rate and external reversed were gotten from Central Bank of Nigeria statistical bulletin 2016. While the economic growth rate was gotten from the Annual Report of National Bureau of Statistics of 2017. The study adopted time series data covering the period of 1986 to 2015. The used descriptive statistics, graph and Correlation analyses were used to determine the strength of the linear association between oil prices, real exchange rate and economic growth rate in Nigeria.

In addition, Granger Causality test will be carried out to determine the direction of causation between oil prices, real exchange rate and economic growth rate in Nigeria. Then, the static long-run model will be derived, applying Autoregressive Distributed Lagged (ARDL) - Bounds test procedure to examine the co-integration relationship between oil prices, real exchange rate and economic growth rate in Nigeria. This procedure was developed by Pesaran and Shin (1999) which was later expanded by Pesaran, Shin and Smith (2001) and the procedure allow researcher to use variables which are not integrated in the same order. Also, the error correction model (ECM) will be used to establish the short-run and long run causal relations between oil prices, real exchange rate and economic growth rate in Nigeria.

Model Specification and a Priori Expectation

The model to be used for this study is based on exponential general autoregressive conditional heteroskedastic modeled by Daniel Nelson (1991). The model was used to estimate the relationship between oil price changes and exchange rate. For the purpose of this study the model was modified to incorporate real oil price, real exchange rate and external reserve as the independent variables while economic growth rate as the dependent variable. Assuming a linear relationship between the real oil prices, real exchange rate and economic growth rate in Nigeria and also adding a control variable; External Reverse the functional form of the model is specified as:

$$EGR_t = f(ROILP_t, REXCR_t, EXTR_t) \quad 1$$

Therefore explicitly the model becomes

$$EGR_t = \beta_0 + \beta_1 ROILP_t + \beta_2 REXCR_t + \beta_3 EXTR_t + \mu_t \quad 2$$

Where;

EGR_t is Economic Growth Rate at time t

$ROILP_t$ is Real Oil Prices at time t
 $REXCR_t$ is the Real Exchange Rate at time t in Nigeria
 $EXTR_t$ is the External Reverse at time t in Nigeria
 $\beta_0, \beta_1, \beta_2$, and β_3 are Parameters to be estimated
 μ_t is white noise error term

The Autoregressive Distributed Lagged (ARDL) model that will be used in this study is specified as follows:

$$\Delta EGR_t = \alpha_0 + \sum_{g=1}^k \alpha_{1i} \Delta EGR_{t-i} + \sum_{h=1}^l \alpha_{2i} \Delta ROILP_{t-i} + \sum_{i=1}^m \alpha_{3i} REXCR_{t-i} + \sum_{j=0}^n \alpha_{4i} \Delta EXTR_{t-j} + \alpha_5 EGR_{t-i} + \alpha_6 ROILP_{t-i} + \alpha_7 REXCR_{t-i} + \alpha_8 EXTR_{t-i} + \varepsilon_t(3)$$

Equation (3) was used to examine the short-run and long-run relationship between Real Oil Prices, Real Exchange Rate and Economic Growth Rate in Nigeria. While the Error Correction Model (ECM) that will be used in this study is specified as follows:

$$\Delta EGR_t = \beta_0 + \sum_{g=1}^k \beta_{1i} EGR_{t-i} + \sum_{h=1}^l \beta_{2i} \Delta ROILP_{t-i} + \sum_{i=1}^m \beta_{3i} \Delta REXCR_{t-i} + \sum_{j=0}^n \alpha_{4i} \Delta EXTR_{t-j} + \beta ECM_{t-1} + \varepsilon_t(4)$$

The model above is used to adjust the estimation until the ECM turned negative. The negative sign of coefficient of the error correction term ECM (-1) shows the statistical significance of the equation in terms of its associated t-value and probability value. The a priori expectation is that $\beta_1, \beta_2, \beta_3$ and $\beta_4 > < 0$ indicating a positive or negative relationship between Oil Prices, Real Exchange Rate, External Reserves and Economic Growth Rate in Nigeria.

Presentation and Discussion of Results

Descriptive Analysis of Variables

Table 1: Descriptive Analysis of Variables

	EGR	ROILP	REXCR	EXTR
Mean	4.592258	41.98710	92.21935	18284.73
Median	4.900000	24.36000	111.2000	7944.085
Maximum	33.70000	109.8700	362.3000	58472.88
Minimum	-10.80000	12.28000	1.800000	1576.838
Std. Dev.	7.261386	32.31406	80.68126	17155.91
Skewness	1.654752	0.998930	1.039933	0.770668
Kurtosis	10.11832	2.550164	4.907865	2.148828
Jarque-Bera	79.59684	5.416989	10.28914	4.004440
Probability	0.000000	0.066637	0.005831	0.135035
Sum	142.3600	1301.600	2858.800	566826.7
Sum Sq. Dev.	1581.832	31325.96	195283.9	8.83E+09
Observations	31	31	31	31

Source: Authors computation from E-views 9.0, (2018)

Table 1 shows the descriptive analysis of the variables used in the study. From the table the highest value for Economic Growth Rate (EGR) during the period of study is 33.7 percent. Also, highest value for real oil price (ROILP), real exchange rate (REXCR) and external reserve (EXTR) are 109.87 dollars, 362 dollars and 58472 dollars respectively. However, the lowest value for Economic Growth Rate (EGR) during the period of study is -10.8 percent. While, the lowest value for Real Oil Price (ROILP), Real Exchange Rate (REXCR) and External Reserve (EXTR) are 12.28 dollars, 1.8 dollars and 1576.83 dollars respectively. On the average the values of Economic Growth Rate (EGR) is 4.59 percent. Real Oil Price (ROILP), Real Exchange Rate (REXCR) and External Reserve (EXTR) are 41.98 dollars, 92.2 dollars and 18284.73 dollars respectively as indicated by their mean values.

Stationarity Test of Variables

Table 2: Summary of Unit Root Test

Variables	5% level	Critical ADF	Order of Integration
EGR	-2.963972	-4.420508	I (1)
ROILP	-2.967767	-4.671382	I (0)
REXCR	-2.963972	0.98444	I (1)
EXTR	-2.967767	-5.956088	I (0)

Source: Authors computation from E-views 9.0, (2018)

Table 2 shows stationarity test of the variables used in the study and from the table Augmented Dickey-Fuller Test results revealed that Economic Growth Rate (EGR) and Real Exchange Rate (REXCR) in Nigeria were stationary at first difference of 5 percent level of significance. While the Real Oil Price (ROILP) and External Reserve (EXTR) were stationary at level of 5 percent level of significance.

Correlation of Economic Variables

Table 3: The Causality Test Result

	EGR	ROILP	REXCR	EXTR
EGR	1			
ROILP	0.204819397	1		
REXCR	0.202313092	0.5960513100	1	
EXTR	0.187759700	0.8997933330	0.6467356054	1

Source: Authors computation from E-views 9.0, (2018)

Correlation coefficient shows the degree of linear association between two variables. The value can vary from -1 (perfect negative correlation) through 0 (no correlation) to +1 (perfect positive correlation). The analysis continues in this section in determining the degree of linear association between economic growth rate and the independent variables. From table 3 there is strong and significant positive relationship between economic growth rate and other variables (real oil price, real exchange rate and external reserve).

Pairwise Granger Causality Tests

Table 4: The Causality Test Result

Null Hypothesis:	Obs	F-Statistic	Prob.
ROILP does not Granger Cause EGR	29	0.39595	0.6774
EGR does not Granger Cause ROILP		1.00786	0.3799
REXCR does not Granger Cause EGR	29	0.57013	0.5729
EGR does not Granger Cause REXCR		0.15145	0.8603
EXTR does not Granger Cause EGR	29	0.00590	0.9941
EGR does not Granger Cause EXTR		2.86136	0.0768
REXCR does not Granger Cause ROILP	29	1.81389	0.1847
ROILP does not Granger Cause REXCR		5.96364	0.0079
EXTR does not Granger Cause ROILP	29	1.62138	0.2185
ROILP does not Granger Cause EXTR		0.81333	0.4552
EXTR does not Granger Cause REXCR	29	0.33394	0.7194
REXCR does not Granger Cause EXTR		2.97109	0.0703

Source: Authors computation from E-views 9.0, (2018)

Table 4 above shows Pairwise Granger Causality tests. From the results, all the listed pair of variables have no causal relationships among them. That is, there is no causal relationship among the variables given the probability values of the variables at 5 percent level of significance. Except real oil price (ROILP) that has causal relationship with real exchange rate (REXCR) in Nigeria. Therefore, the null hypotheses which state that, there are no causal relationship between real oil price (ROILP) and real exchange rate (REXCR) in Nigeria was rejected.

ARDL Bounds Test of Co-integration

Table 5: ARDL Bounds Test of Co-integration

Test Statistic	Value	K
F-statistic	4.912473	3
Critical Value Bounds		
Significance	I0 BoSund	I1 Bound
10%	2.72	3.77
5%	3.23	4.35
2.5%	3.69	4.89
1%	4.29	5.61

Source: Authors computation from E-views 9.0, (2018)

The Co-integration test was done using the ARDL Bound test equation in table 5. This became necessary to avoid a spurious regression result. Using the ARDL Bound test with critical value from Narayan (2005), the variables were co-integrated at 1per cent level of significance since the Wald F- statistics is greater than the critical lower and upper bound.

Discussion of Regression Results

Table 6: Long run regression results

Variable	Coefficient	Std. Error	t-Statistics	Prob.
C	3.493422	2.300922	1.518270	0.1420
ROILP	-0.080602	0.100860	-0.799153	0.4320
REXCR	0.091866	0.038188	2.405620	0.0242
EXTR	-0.000074	0.000179	-0.412611	0.6836

Source: Authors computation from E-views 9.0, (2018)

Table 6 shows the long run regression results and from the Table a unit increase in real oil price (ROILP) and external reserve (EXTR) on the average, holding other independent variables constant will lead to 0.0806 and 0.000074 unit decrease in economic growth rate (EGR) in Nigeria respectively. A unit increase real exchange rate (REXCR) on the average holding other independent variables constant will lead to 0.0919 unit increase in economic growth rate (EGR) in Nigeria. Finally, based on the probability value, the real oil price (ROILP) and external reserve (EXTR) were statistically insignificant in explaining the variation in economic growth rate (EGR) in Nigeria. While real exchange rate (REXCR) was statistically insignificant in explaining the variation in economic growth rate (EGR) in Nigeria.

Table 7: The Error Correction Model Results

Selected Model: ARDL(1, 2, 2, 1, 2)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ROILP)	-0.076159	0.095801	-0.794974	0.4344
D(REXCR)	-0.097012	0.044217	-2.193988	0.0382
D(EXTR)	-0.000070	0.000168	-0.414484	0.6822
ECN(-1)	-0.944871	0.186042	-5.078809	0.0000

Source: Authors computation from E-views 9.0, (2018)

Table 7 shows the error correction model results. Since the variables were found to be cointegrated implying that they have longrun equilibrium relationship, it is necessary to test for shortrun relationship. From table 7, the ECM parameter is negative (-) and significant which is -0.944, this shows that 0.94 percent disequilibrium in the previous period is being corrected to restore equilibrium in the current period. It has been established that the variables are cointegrated and also have short run relationship established from the ECM. All the independent variables were negatively related to economic growth rate in Nigeria. Finally, all the independent variables were statistically insignificant in explaining the variation in economic growth rate in Nigeria except the real exchange rate (REXCR) that was statistically significant in explaining the variation in economic growth rate in Nigeria.

Conclusion and Recommendations

In conclusion, the study revealed that at the long run real exchange rate (REXCR) was positively related to economic growth rate (EGR) in Nigeria this agreed with the work of Adesoye & Balogun (2015) that believed that real exchange rate has positive impact on economic growth while real oil price (ROILP) and external reserve (EXTR) were negatively related to economic growth rate (EGR) in Nigeria this finding was similar to the work of Igberaese, (2013) that found that oil price has a negative impact on economic growth at the long run. While the short run result shows that all the independent variables were negatively related to economic growth rate (EGR) in Nigeria. Finally, real exchange rate (REXCR) was statistically significant in explaining the variation in economic growth rate (EGR) while the real oil price (ROILP) and external reserve (EXTR) were statistically insignificant in explaining the variation in economic growth rate (EGR) in Nigeria. Based on the findings the study recommends the following policies.

- i. Government should adopt a mechanism to reduce the dependence oil and importation for the effective management of real oil prices and real exchange rate for sustainable economic growth rate in Nigeria.
- ii. Since exchange rate in Nigeria was positively related to economic growth rate and statistically significant in explaining variation in economic growth rate Nigeria, government through the monetary authority should use the exchange rate a monetary tool in Nigeria to stimulate other macroeconomic indicators for sustainable economic growth in Nigeria.
- iii. Government should adopt ways to improve the external reserve in Nigeria because external reserve is a strong control for exchange rate. Therefore, government should improve the performance of external reserve for sustainable impact of exchange rate for economic growth in Nigeria.

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