Interactive Effects of Crude Oil Price and Exchange Rate on Economic Growth in Nigeria

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Abstract.

This study examined the interactive effects of crude oil price and official exchange rate on economic growth in Nigeria. The estimation was carried out on annual time series data spanning from 1986 to 2021 with the aid of ARDL model. The data for the study were sourced from World Bank Database and Statistical Bulletin of the Organisation of Petroleum Exporting Countries (OPEC). Two distinct but interwoven models were estimated. Findings from model 1 and model 2 show evidence of co-integration. The results from model 1 further revealed that crude oil price and official exchange rate have significant and positive relationship with economic growth in the long-run period. In the short-run, only crude oil price has significant and positive relationship with economic growth. However, model 2 result shows that the interaction between crude oil price and official exchange rate have significant and positive influence on economic growth both in the short-run and long-run periods. The long-run results were corroborated by the robustness check conducted using Robustness Least Square (RLS). However, ARDL model 1 result shows only a significant evidence of short-run negative relationship between rate of inflation and economic growth in Nigeria during the study periods. Though, findings from RLS did show a significant and negative long-run relationship between inflation rate and economic growth in Nigeria.

The study recommends that policy makers in Nigeria should enact policies, programs and exercise the needed commitment to change the narrative from mono-cultural economy that hugely depend on oil export to a diversified export-oriented economy. These can be achieved through increased investment in mechanised agriculture and industrialisation. Government should encourage private investment in local refineries as an antidote for subsidy removal and a remedy for draining huge forex from the importation of refined oil. It is hope that this will increase Nigeria's foreign exchange earnings thereby appreciating foreign exchange rate of the Naira, attaining a unified foreign exchange rate and subsequently achieving a sustained economic growth.

Keywords: Economic Growth, Crude Oil Price, Official Exchange Rate, Inflation Rate, ARDL Model.

Introduction

Crude oil has been recognised as one of the most important natural resources endowment on earth. Crude oil drives the global economy such that any changes in its prices have direct or indirect bearing on the economic growth and standard of living of people around the globe. The ongoing conflict between Russia and Ukraine further vindicated the important of crude oil in the global economic stage where the conflict led to a dramatic increase in crude oil prices with attendant consequences on the global economy. The conflict further buttressed that crude oil prices are usually volatile and this poses a great advantage on one side and high risk on the other side to countries dependent on oil in running their fiscal finances. During oil boom, resources endowed countries may rely upon the revenue from oil to propel the growth and development of their economies. The proponent of staple theory assert that poor but resource abundant economies have the potential to utilise oil income to overcome the challenges of lower capital base and to provide public goods in order to uplift the general wellbeing of their citizenries (Oyefusi, 2007). Eregha and Mesagan (2016) reported that crude oil is one of the keys to country's growth and development. Fascinatingly, some oil resources countries especially in the developed countries have used oil income in the provision of infrastructures, and social security that improves the general wellbeing of their people. Despite the role played by oil resources in facilitating economic growth and development, theories and empirics from 1980's to the recent time provided a contrary evidence especially in developing countries. For instance, in Sub-Saharan Africa, the huge resources endowment could potentially have been used to providing infrastructures and social security but exchange rate volatility, corruption and inability to save oil money during rainy days to cushion the effect of capital flight have continued to kneel down the African economy for years.

This study will particularly focus on Nigeria where crude oil remained the major source of foreign exchange earnings to the government. Recently, Nigeria's crude oil production had suffered a huge setback ranging from the effect of covid-19 pandemic, the ongoing conflict in Ukraine to the activities of oil theft in the Niger Delta. Covid-19 pandemic plunged the global economy into recession where Brent crude oil price fell down from $63.65 per barrel in January, 2020 to its lowest ebb of $18.38 per barrel in April, 2020. The ongoing conflict in Ukraine rose the prices of crude oil from $97.13 per barrel in February, 2022 to $117.25 per barrel in March, 2022 which Nigeria have the potential to raise its foreign exchange earnings from its OPEC production quota of 1.8M barrel per day. Unfortunately, the activities of oil theft in the Niger Delta brought a significant reduction in crude oil production. Recently, crude oil production fell from 1.183M barrel per day in July, 2022 to an unprecedented low ebb of 937,766 barrel per day in September, 2022 indicating a decline of 245,234 barrel per day just in the span of two months. During same period, Nigeria battle with higher refined oil subsidy payment resulting from upsurge in the prices of refined oil in the global market amidst dwindling crude oil revenue occasioned by low production in the Niger Delta. For example, oil subsidy dramatically rose from $3.8Billion in 2021 to $6.2Billion in the first quarter of 2022.

In Nigeria, the dwindling foreign exchange earnings have been exacerbating the exchange rate crises making it difficult for the monetary authority to maintain her official exchange rates let alone to narrow the margin between the official exchange rate and parallel market rates. For example, the official exchange rate fell from 419.973 per USD in August, 2022 to 428.750 in September, 2022. Therefore, the objective of this study was to examine the effect of crude oil price and exchange rate on economic growth in Nigeria. this study is particularly significance in terms of unravelling the challenges posed by crude oil price shocks

and its interaction with exchange rate volatility on economic growth in Nigeria which was not explicitly examined in the literature. The interactive role of crude oil price and exchange rate cannot be underscored in the open macroeconomic environment like Nigeria. The outcome of this study will also help in providing enabling environment for investment flows in the oil sectors. Also, the research output will be relevant to researchers that are interested in expanding the research frontiers in the area under study and it equally equip policy makers in the local and international economic space with adequate policy tools in dealing with such issues in the oil and gas sector. Rest of the paper anchored on review of related literature, methodology, results and discussion while the last section focused on conclusion and policy recommendations.

Review of Related Literature

In the literature, the relationship between crude oil price and economic growth as well as exchange rate and economic growth were extensively examined in Nigeria. However, the interactive roles of crude oil price and exchange rate have not been studied and is the major gap which this study seeks to bridged. In the perspective of oil price, exchange rate and economic growth nexus, Isola, et al. (2016) applied ARDL model on data spanned from 1980 to 2013 to examine the exchange rate fluctuation and Nigeria economic growth. The study found that exchange rate fluctuation has effect on economic growth only in the short-run but not in the long-run. Similarly, Magaji and Singla (2020) used ARDL model and investigated the impact of oil price shocks on exchange rate and economic growth in Nigeria on annual time series data from 1981 to 2019. The study reported that oil price had significant positive relationship on economic growth both in the short run and long-run. However, the study does not establish long-run relationship between oil price and exchange rate. Daniel (2021) examined the asymmetric relationship of exchange rate and inflation on economic growth in Nigeria using annual data from 1981 to 2020. After applying a NARDL, the study found that in the long-run, exchange rate positively affects economic growth. To examine the asymmetric effect of oil price on exchange rate and stock price in Nigeria, Ajala, Sakanko and Adeniji (2021) employed Nonlinear Autoregressive Distributed Lag (NARDL) model on a monthly time series data from 1996:01 to 2020:09 and the study revealed that changes in oil price impacted asymmetrically on the exchange rate and stock price both in the short-run and long-run.

Musa, et al. (2019) investigated the impact of crude oil price and exchange rate on economic growth in Nigeria using an ARDL model from 1982 to 2018. The result found that crude oil price and exchange rate have significant positive impact on economic growth in both the long-run and short-run periods. Nitami and Hayati (2021) investigated the effects of crude oil price fluctuations on economic growth, inflation and exchange rate in Indonesia using annual time series data from 1967 to 2019. The study employed VAR/VEC method and the results reveled that oil price fluctuations had significant positive effect on economic growth in the long-run but exert a significant negative impact on inflation and exchange rate in the long-run. Manyo and Ugochukwu (2017) investigated the impact of exchange rate volatility on economic growth in Nigeria using time series data covering from 1981 to 2015. GARCH (1, 1) result found a persistent volatility of the Nigerian Naira against the US Dollar. In contrary, the results from the GMM revealed a significant negative impact of exchange rate and FDI on economic growth in Nigeria. However, government expenditure and external reserve had significant positive impact on economic growth in Nigeria. To explore the impact of crude oil volatility on exchange rate in Nigeria, Henry (2019) used ARDL model on data spanning from 1986 to 2015 and found that oil price had significant negative effect on exchange rate in the long-run. Bidemi, (2019) investigated exchange rate variation and

economic growth in Nigeria using annual time series data from 1981 to 2018. The result from the ARDL model revealed that exchange rate variation had significant positive effect on economic growth in the long-run but negative in the short-run. Also, exchange rate had significant negative effect on economic growth both in the short-run and long-run. Nweze and Edame (2016) empirically studied oil revenue and economic growth in Nigeria using annual time series data from 1981 to 2014. The study applied Johansen Cointegration test and Vector Error Correction Mechanism. The study found the existence of cointegration between economic growth and the explanatory variables except government expenditure. The result further showed that oil revenue is significant and positively related with economic growth in the long-run but negative in the short-run. In examining the dynamic nexus between oil revenues and economic growth in Nigeria, Aminu and Raifu, (2019) applied Non-Linear Autoregressive Distributed Lag (NARDL) model, Autoregressive Distributed Lag (ARDL) model, and Threshold Autoregressive Error Correction Model (TAR-ECM) on a data spanning from 1981 to 2016. The results found a long-run relationship between oil revenues and economic growth. Also, the results from ARDL, NARDL and TAR-ECM showed significant positive relationship between oil revenue and economic growth both in the short-run and long-run. Aragbeyen and Kolawole, (2015) examined the relationships among oil revenue, government spending and economic growth in Nigeria using annual data from 1980 to 2012. The study employed OLS, VECM and Granger Causality test. The results revealed that oil revenue granger caused economic growth in the period under study. Also, the relationship between oil revenue and economic growth is significant and positive both in the short-run and long-run. Ikue, et al. (2021) investigated the impact of oil revenue and the activities in the oil industry on per capita income of Nigerian from 1980 to 2019. The study used ARDL model and the result found a positive and significant impact of oil revenue on economic growth both in the short-run and long-run.

It can be deduced from the empirical literature that there was a mixed result on the relationship between oil price and exchange rate on economic growth in Nigeria. However, the theoretical postulation of the relationship between oil price and economic growth on one hand and exchange rate and economic growth on the other hand is positive and direct.

Methodology

This study employed annual time series data from 1986 to 2021. The data were sourced from World Bank Database and Organization of Petroleum Exporting Countries (OPEC). The study used Autoregressive Distributed Lag (ARDL) Model to determine both the long-run and short-run relationship among the variables in the models. Economic growth is the dependent variable and was proxy by Gross Domestic Product (GDP) at constant US$ 2010. The explanatory variables were Crude Oil Price, COP (USD per barrel), Official Exchange Rate, EXR (USD per LCU), Interaction between Crude Oil Price and Official Exchange Rate (COP*EXR), and Inflation rate (INF).

Two distinct but interwoven models were estimated. Model 1 separately estimated the effects of crude oil price and official exchange rate on economic growth in Nigeria while model 2 estimated the interactive effects of crude oil price and official exchange rate on economic growth in Nigeria. The econometric form of the model is in the spirit of Musa, et al. (2019) but differs in its explicit consideration of the interactive effects of crude oil price and exchange rate on economic growth which has not been previously examined in the literature. The models were expressed in a simple log-linear form as shown below:

$$lnGDP_t = \alpha_1 D(lnCOP)_{t-p} + \alpha_2 D(lnEXR)_{t-p} + \alpha_3 D(lnINF)_{t-p} + c_1 + \varepsilon_{1t} \quad \ldots\ldots 3.1$$

$$lnGDP_t = \beta_1 D(lnCOP * EXR)_{t-p} + \beta_2 D(lnINF)_{t-p} + c_2 + \varepsilon_{2t} \quad \ldots\ldots 3.2$$

Where; $lnGDP_t$ stand for natural log of Gross Domestic Product, $lnCOP_t$ is the natural log of Crude Oil Price, $lnEXR_t$ is the natural log of Official Exchange Rate, $lnCOP_t*EXR_t$ stand for the natural log of the interaction between Crude Oil Price and Official Exchange Rate, and $lnINF_t$ stand for natural log of Inflation rate and $\alpha_{j's}$, and $\beta_{j's}$, are coefficients, $\varepsilon_{j's}$ are error terms, $c_{i's}$ are constants.

Therefore, the general form of VAR is given as follows

$$\Delta y_t = \beta Z_{t-1} + \sum \delta_i \Delta Z_{t-i} + Bx_t + c_0 + \varepsilon_t \quad \ldots\ldots 3.3$$

Where, Δ is first difference operator, Z_t is a vector of both x_t and y_t, y_t is k x 1 vector of dependent variables, x_t is k x k matrix representing a set of explanatory variables, t is time trend, β is long run multiplier matrix, δ_i is short run coefficient matrix, c_0 is constant and ε_t is k x 1 vector of innovation. Also, the long run multiplier matrix can be re-written as follows

$$\beta = \begin{pmatrix} \beta_{yy} & \beta_{yx} \\ \beta_{xy} & \beta_{xx} \end{pmatrix} \quad \ldots\ldots 3.4$$

Therefore, the selected series can be either I(0) or I(1) such that if $\beta_{yy} = 0$, then y_t is I(1). However, if $\beta_{yy} < 0$, then y_t is I(0). This is because the diagonal elements of the matrix are unrestricted (Pesaran, Shin and Smith, 2001). Note that the ARDL bound test for cointegration was used because of its advantages over other test of cointegration. Notably, the ARDL approach can be used irrespective of the order of integration of the variables. Thus, it can be applied whether the variables are integrated of I(0), I(1) or fractionally integrated. Secondly, it gives unbiased estimates of the long run model. Thirdly, it can be used efficiently and conveniently under a small and finite sample data size. Lastly, ARDL bound approach yield a consistent estimates of the long run coefficients that are asymptotically normal whether or not the regressors are I(0) or I(1) (Pesaran and Shin 1997).

After ascertaining the existence of cointegration between the variables included in the models, the ARDL approach was used to estimate the coefficient of short run Unrestricted (conditional) error correction model otherwise known as Over parameterized model and the corresponding Error Correction Term (ECT) specified as follows.

$$lnGDP_t = \alpha_1 D(lnCOP)_{t-p} + \alpha_2 D(lnEXR)_{t-p} + \alpha_3 D(lnINF)_{t-p} + c_1 + \Theta_1(ECT_{t-1}) + \varepsilon_{1t} \quad \ldots\ldots 3.5$$

$$lnGDP_t = \beta_1 D(lnCOP * lnEXR)_{t-p} + \beta_2 D(lnINF)_{t-p} + \Theta_2(ECT_{t-1}) + \varepsilon_{2t} \quad \ldots\ldots 3.6$$

Θ_1 *and* Θ_2 are magnitude of error corrected each period. To achieve long run equilibrium, these values must be negative and statistically significant. ECT_{t-1} is Error Correction Term and defined as the speed of adjustment which will converge the disequilibrium in the short-run into equilibrium in the long run. The diagnostic checks conducted include serial

correlation, heteroscedasticity, normality test, specification test and stability test.

Results and Discussion

This study began the estimation by testing the time series properties of the variables (lnGDP, lnCOP, lnEXR, lnCOP*EXR, lnINF) included in the models. Specifically, the Augmented Dickey Fuller (ADF) and Phillip Peron (PP) tests were applied to find out whether the basis for using ARDL had been established. That is, whether the variables are of order 1(1), 1(0) or mixed. Table 1 depicts the results of the unit root test and all the variables are integrated at first difference 1(1) except log of inflation rate (lnINF) which was integrated at level 1(0). The unit root test results for ADF and PP are similar which further corroborate the efficacy and reliability for the application of ARDL model.

Table 1. Unit root test using Augmented Dickey Fuller (ADF) and Phillip Peron (PP) test

	Level		First Difference		
Variables	ADF	PP	ADF	PP	
	const. & trend	const. & trend	const. & trend	const. & trend	1(d)
$lnGDP_t$	-1.735	-1.824	-4.620	-4.618	1(1)
	(0.7143)	(0.6713)	(0.0040)	(0.0040)	
$lnCOP_t$	-1.978	-1.978	-5.366	-5.363	1(1)
	(0.5928)	(0.5928)	(0.0006)	(0.0006)	
$lnEXR_t$	-2.865	-2.865	-6.269	-6.605	1(1)
	(0.1854)	(0.1854)	(0.0001)	(0.0000)	
$lnCOPt*lnEXR_t$	-2.449	-2.449	-5.273	-8.083	1(1)
	(0.3499)	(0.3499)	(0.0008)	(0.0000)	
$lnINF_t$	-3.715	-3.720	-	-	1(0)
	(0.0344)	(0.0340)			

Source: Eviews 12. Note, ***,**, & * stand for 1%, 5% & 10% levels of significance and values in the parenthesis are the P-values.

Having established the reliability for using ARDL model, the long-run relationship of the models were tested to ensure whether or not the variables co-move in the long-run. The result from table 2 shows the bound test of cointegration. The null hypothesis of no co-integration (H_0: $\alpha1 = \alpha2 = \alpha3 = 0$) was tested against the alternative hypothesis of existence of co-integration (H_1: $\alpha1 \neq \alpha2 \neq \alpha3 \neq 0$). Table 2 results indicated that both model 1 and model 2 co-move in the long-run. In each case, the null hypothesis of no co-integration can be rejected within the study periods at 1% significance level. Specifically, in model 1, the F-statistics of 10.635 exceeded the critical upper bound value of 4.66 at 1% significance level. This model implies that ln GDP co-moves with its regressors (lnCOP, lnEXR, lnINF) in the long-run. Similarly, the F-statistics value of 7.114 exceeded the critical upper bound value of 5 in model 2 at 1% significance level. This result vindicated the existence of long-run relationship between ln GDP and its regressors (lnCOP*EXR, lnINF).

Table 2. Bound test results

		Critical values	
Models	F-statistics	1(0)	1(1)
F(lnGDP/lnCOP,lnEXR,lnINF) K=3, n=32	10.635***	3.65	4.66
F(lnGDP/lnCOP*lnEXR,lnINF) K=2, n=32	7.114***	4.13	5

Source: Authors' computation using Eviews 12. Note that, **** implies 1% significance level.

Having established that both model 1 and model 2 have long-run relationship, the study estimated the long-run coefficients of the models. In table 3, the long-run estimates for model 1 shows the existence of significant positive relationship between economic growth and crude oil price, such that, a percentage increase in crude oil price leads to 0.976 or 98% increase in economic growth. This result shows that Nigerian economic growth relies heavily on crude oil price and it further shows that the economy is much depended on oil price. This result is consistent with previous studies by Musa et al. 2019; Magaji and Singla, 2020; Nitami and Hayati, 2021 whose studies equally found that increase in oil price accelerates economic growth in the long-run. Similarly, model one reported that official exchange rate was found to have a significant positive relationship with economic growth in the long-run. This is because a percentage increase in official exchange rate will caused economic growth to increase by 0.413 or 41%. This result vindicated the importance of appreciation of naira exchange rate against its foreign currencies in accelerating economic growth. This result coincides with findings by Henry, 2019; Musa et al. 2019 and Daniel, 2021. Nevertheless, this finding is not in line with the findings by Nitami and Hayati, 2021 whose study found that exchange rate brings about a decline in economic growth in the long-run. Model 1 result did not find any evidence on the significance of inflation rate in influencing economic growth in the long-run.

Model 2 results was also presented in table 3 where the long-run relationship between the interaction of crude oil price and official exchange rate with economic growth was estimated as positive and significant. This is because, a percentage increase in the interaction between crude oil price and official exchange rate will leads to 0.723 or 72% increase in economic growth in Nigeria at 1% significant level. This result clearly shows the significance of the interaction and this estimation has not been considered previously by other studies in Nigeria. Just like in model 1, model 2 result did not find the significance of inflation rate in influencing economic growth in Nigeria within the study periods.

Table 3. Estimated long-run results

Dependent variable, lnGDPt		
Regressors	Model 1	Model 2
Constant		
lnCOPt	0.976***	-
	(13.038)	
lnEXRt	0.413***	-
	(12.859)	
LnCOPt*lnEXRt	-	0.723***
		(7.158)
lnINFt	-0.022	0.264
	(-0.478)	(0.874)

Source: Author's computation using Eviews 12. Note that, the t-statistics are reported in parenthesis while ***, ** & * stand for 1%, 5% & 10% levels of significance respectively.

This study estimated the short-run relationship of the models in table 4. In table 4, model 1 result shows that crude oil price is significant and positively related to economic growth. The result shows that a percentage increase in crude oil price leads to 0.297 or 30% increase in economic growth. This result is similar to the long-run relation between crude oil price and economic growth in Nigeria during the study periods. This result is indifferent to the one reported by Musa et al. 2019 and Magaji and Singla, 2020. Unlike in the long-run, the short-run relationship between official exchange rate and economic growth is insignificant. However, the relationship between inflation rate and economic growth is negative and significant in the short-run. The short-run model 2 result is indifferent to its long-run. This is because the interaction between crude oil price and official exchange rate leads to a significant positive increase in economic growth. Therefore, a percentage increase in the interaction between crude oil price and official exchange rate will exerts a significant positive increase in economic growth by 0.20 or 20%. Similarly, like its long-run, the short-run effect of inflation rate on economic growth is insignificant as reported in model 2. The Error Correction Model (ECM) reported in table 4 for both model 1 and model 2 are significantly negative and are in line with their apriori expectations. The ECM results imply that the disequilibrium in the short-run will converge into equilibrium in the long-run at the speed of 48% and 29% for model 1 and model 2 respectively.

Table 4. Estimated short-run results

Dependent variable, ΔlnGDPt		
Regressors	Model 1	Model 2
ΔlnCOPt	0.297***	-
	(6.064)	
ΔlnEXRt	0.090	-
	(1.3112)	
ΔlnCOPt*lnEXRt	-	0.201***
		(4.748)
ΔlnINFt	-0.117***	-0.058
	(-3.575)	(-1.563)
ECM (-1)	-0.478***	-0.292***
	(-8.105)	(-5.762)

Source: Author's computation using Eviews 12. Note that, the t-statistics are reported in parenthesis while ***, ** & * stand for 1%, 5% & 10% levels of significance respectively.

The models were subjected to diagnostic checks in order to examine their healthiness and reliability for usage. This is because any unhealthy results are unfit for usage. The result of the diagnostic checks reported in table 5 shows that model 1 is free from autocorrelation. This is because the null hypothesis of no serial correlation cannot be rejected as the F-statistic is insignificant and thus we conclude that there is no serial correlation. Similarly, model 1 is free from heteroscedasticity problem as the null hypothesis of no heteroscedasticity in the BPG test cannot be rejected since the F-statistic is insignificant and therefore, we conclude that the model is homoscedastic in nature. Likewise, model 1 is normally distributed as the null hypothesis of not normally distributed can be rejected as the Jacque-Bera is insignificant. However, the Ramsey Reset result in table 5 shows that model 1 result is not correctly specified as the null hypothesis of not correctly specified cannot be rejected at 10% significance level. The failure of model 1 to pass the specification test does not invalid the results since it has passed the rest of the diagnostic checks. Model 2 was also subjected to diagnostic checks and available evidences show that the model passed all the diagnostic checks. Obviously, as reported in table 5, model 2 is free from autocorrelation, since the null hypothesis of no serial correlation cannot be rejected. Also, model 2 is free from heteroscedasticity as the null hypothesis of no heteroscedasticity cannot be rejected as shown in the BPG test. Likewise, the model is normally distributed since the null hypothesis of not normally distributed can be rejected. In contrary to model 1, model 2 is found to be correctly specified since the null hypothesis of not correctly specified can be rejected. In all,

both model 1 and model 2 are healthy and could be relied upon in making policy analysis and prescriptions.

Table 5. Diagnostic test results

Variables	Model 1	Model 2
Serial Correlation LM test	1.807 (0.198)	0.023 (0.9776)
Heteroscedasticity (BPG test)	0.854 (0.6127)	1.004 (0.4858)
Normality test (Jarque-Bera)	0.336 (0.845)	0.761 (0.683)
Ramsey Reset test	3.469 (0.0810)*	0.919 (0.3511)

Source: Author's computation using Eviews 12. Note that, the p-values are reported in parenthesis while * stand for 10% level of significance.

To ensure the stability of the long-run relationship of the models, both model 1 and model 2 were subjected to stability test using CUSUM. The CUSUM test is based on the cumulative sum of recursive residuals on the number of a given observation. In figure 4.1, the plot of the residual lies within a 5% critical band implying the long-run stability of model 1. Similarly, figure 4.2 shows the plot of the residual lying within a 5% critical band indicating the long-run stability of model 2.

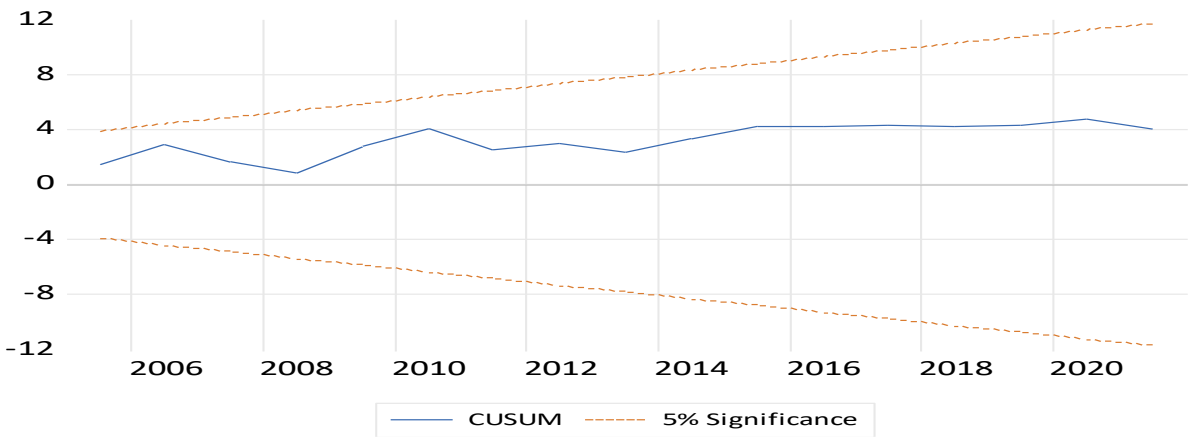

Fig. 4.1. CUSUM test for model 1

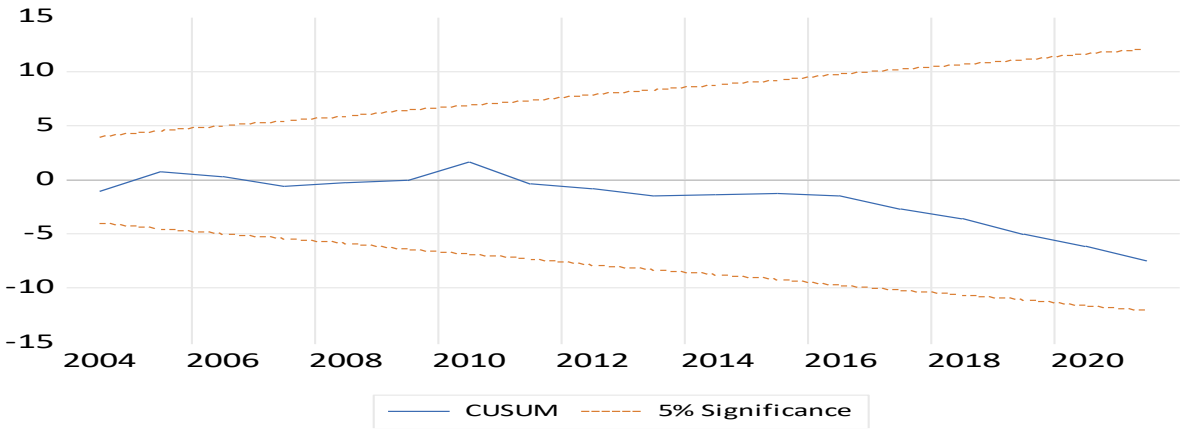

Fig. 4. 2. CUSUM test for model 2.

Robustness checks

To determine the robustness of the models used in the study, apart from the ARDL model, the long-run relationship of the models were estimated using Robustness Least Square (RLS). The results of the RLS was reported in table 6 and it shows that the long-run estimate is indifferent with what was obtained using ARDL model. This is because, in model 1, the long-run relationship between crude oil price and economic growth is significantly positive just similar to what was reported using ARDL. In the same vein, RLS result in model 1 shows that official exchange rate has a significant positive long-run relationship with economic growth. This is also in tandem with what was obtained using ARDL. In model 1, RLS result shows that inflation rate is insignificant and it was reported the same way using ARDL.

In model 2 as reported in table 6, the RLS long-run result shows that the interaction between crude oil price and official exchange rate is significantly positive. The same long-run relationship was reported for model 2 using ARDL. However, the only difference is with regard to the relationship between inflation rate and economic growth. The RLS result as reported in table 6 shows that inflation rate is significant and positive in influencing economic growth in the long-run. Therefore, a percentage increase in inflation rate leads to 0.149 or 15% increase in economic growth in the long-run in Nigeria during the study periods. In all, the ARDL model used in the study is reliably sufficient as attested by the results of the Robustness Least Square (RLS).

Table 6. Estimated long-run results using Robustness Least Square (RLS)

Dependent variable, lnGDPt		
Regressors	Model 1	Model 2
LnCOPt	1.144*** (12.189)	-
LnEXRt	0.170*** (2.714)	-
LnCOPEXRt	-	0.574*** (23.408)
LnINFt	0.011 (0.186)	0.149** (2.109)

Source: Author's computation using Eviews 12. Note that, the standard errors are reported in parenthesis while ***, ** & * stand for 1%, 5% & 10% levels of significance respectively.

Conclusion and Policy Recommendations

In conclusion, this study investigated the interactive effects of crude oil price and official exchange rate in Nigeria covering periods from 1986 to 2021. The study employed ARDL model to estimate two distinct but interwoven models using data sourced from World Bank and OPEC. The stationary properties of the variables were tested and found to be of mixed integration of order 1(0) and 1(1) justifying the use of ARDL model. Evidence from the bound test results show that both model 1 and model 2 are co-integrated, implying the co-movement of the variables in the long-run. Other findings from model 1 show both long-run and short-run relationship between crude oil price and economic growth in Nigeria. However, official exchange rate had a significant and positive relationship with economic growth in Nigeria only in the long-run period. Findings from model 2 results revealed a significant and positive relationship between the interaction of crude oil price and official exchange rate in Nigeria in the long-run and short-run periods. However, neither model 1 nor model 2 results show any evidence of significant relationship between inflation rate and economic growth in the long-run. However, in the short-run, model 1 shows a significant negative relationship between inflation rate and economic growth in Nigeria. The ARDL results was corroborated by the results of the robustness check using Robustness Least Square (RLS). RLS results show evidence of a significant long-run negative relationship between inflation rate and economic growth in Nigeria within the study periods.

The results clearly revealed the huge dependent of Nigerian economy on crude oil price, hence, policy makers should increase the diversification drive of the economy from crude oil export to non-crude oil export such as mechanized agriculture and industrialization. The non-oil export drive should be supported by encouraging investment in domestic refineries to reduce the reliance on oil import that has been draining the large chunk of Nigeria's foreign exchange earnings. More so, investment in local refineries will serve as an antidote for petroleum subsidy removal which has been the political nightmare of successive governments in Nigeria. If these recommendations are carefully undertaken, it will strengthen not only Nigeria's foreign reserve but also appreciate the Naira against foreign currencies. The recommendations will serve as an incentive to the monetary policy makers in enacting policies that will ensure the unification of the Naira foreign exchange rate and consequently leading to a sustained economic growth.

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Reference

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