Crude Oil Revenue, Institutional Quality and Economic Growth Nexus in Nigeria: An Augmented ARDL Cointegration Approach and Toda-Yamamoto Causality Test

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Abstract

Although there is a number of research that deals revenue- growth, institutional quality growth nexus, but little has been done to study the impact of crude oil revenue and institutional quality on economic growth in Nigeria. This study examines the impact of crude oil revenue and institutional quality on economic growth in Nigeria from 1996:Q1 to 2020:Q4. Using Augmented Autoregressive Distributive Lag bound testing approach and Toda- Yamamoto causality test. The result of the bounds test revealed that there is the long run relationship between crude oil revenue, institutional quality and economic growth in Nigeria. Furthermore, crude oil revenue has positive and significant impact on economic growth in the long run. The result also demonstrates that institutional quality (control of corruption) has a negative effect on economic growth in Nigeria in both short run and long run and is statistically significant. This result support 'Grease the wheels' hypothesis which shows that corruption has contributed to the growth of the Nigerian economy by reducing bureaucratic incompetence which create obstacles to investment and economic growth. Furthermore, the results of the Toda-Yamamoto causality test revealed that there is bi-directional causality between crude oil revenue, institutional quality and economic growth in Nigeria. This study recommends Government policies to improve the quality of its institutions so as to ensure efficient utilization of crude oil revenue such will boost economic growth in the country.

Keywords: *Crude oil Revenue, Institutional Quality, Economic Growth, Augmented ARDL*

Introduction

The ability of any economy to maintain its capital and recurrent expenditure indefinitely and the country desire to increase the wellbeing of the citizenry depend on its level of economic growth. Economic growth is the long term increase in the ability of an economy to produce increasingly various economic commodities to its citizen, this increasing capability based on advancing technology, institutional and the ideological change that it demands (Kuznets, 1955).

Economic growth play a essential role in the development of any nation, as it improve government spending on education, health care facilities, provision of social services, employment creation, saving and investment. On contrary, economic sluggish can bring

undermine consequences on the citizenry. Poor economic growth resulted to many economic problems such as Unemployment, poverty, low per capita income, low saving and investment subsequently economic recession and depression.

Despite the importance of high economic growth, available statistics from the world development indicators (WDI) indicates that economic growth proxied (GDP) is not stable in developing countries. Nigeria is not in exception; its growth rate is lower than some of the selected developing countries over the years. Nigeria's growth rates witness a significant increase from 2002 to 2010 which exceeded some selected developing countries. However, the growth rate of Nigeria have experienced a declining trend from 15.3% in 2002 to 6.6% in 2007 compared to India and Egypt that recorded substantial increase throughout that period. Also Nigeria's growth rate showed fluctuations from 2015 to 2019. Going up and coming down, for instance the (GDP) was 2.6 % in 2015, -1.6% in 2016, 0.8% in 2017, 1.9% in 2018 and 2.2% in 2019. However, the Benin (GDP) increased from 2.1% in 2015, 4.0% in 2016, 5.6% in 2017, 6.0% in 2018 and 6.3% in 2019. Similarly, Senegal growth rate increased from 6.5% in 2015. 6.7% in 2016, 6.8% in 2017, 6.2% in 2018 when comparing the growth rate between selected developing countries, it is clear that Nigerian growth rate is not impressive and might have accounted for numerous social and economic challenges.

Over the years Nigerian government has introduced several policies and programs aims to maintain and boost economic growth in the country, such policies include; National economic empowerment and development strategy (2004), Seven point Agenda (2007), small and medium enterprises scheme (SMEs) Credit Guarantee scheme N200bn to guarantee loans issued by commercial banks to (SMEs) and manufacturing sector, the youth entrepreneurship development programme launched in (2016) and the paddy aggregation scheme set up in (2017) to support rice millers, with a view to improve the competitiveness of local rice etc.

Despite these policies and programs by the Nigerian government to maintain and enhance economic growth, yet Nigerian economy is not growing as expected as its gross domestic product (GDP) is declining, unemployment and poverty are rising. The growth of Nigeria economy is sluggish weigh against the developing economy in the world (Yaqub, 2011). Nigeria's positive and significant impact on growth in Nigeria. Other studies suggest that crude oil revenue does not contribute to the country economic growth and development (see Ibeh, 2013; Ogunmakin, Adebayo & Dada, 2014; Musa, Sunusi & Sabiu 2016; Akinlolu & Nejo, 2020). In ability to maintain substantial growth has been blamed on numerous factors, Policy analysts, economists, and other professionals hinged the weakening of the country economy to corruption, bureaucracy, political instability, lack of accountability and transparency, poor control, and lack of vision that will direct the economy to the path of growth (Isaksson, 2001).

Nigeria has generated huge revenue from crude oil for a number of years, for instance in 1996 oil revenue raised from N408.8 billion to N1591.7 billion and N6530.4 billion in 2000 and 2008 respectively, oil revenue in 2013 was N6809.2 billion and in 2018 and 2019 oil revenue dropped to N3654.4bn and N3595.9bn respectively. The massive increase in crude oil revenue due to the middle- East war of 1973 created unplanned and unexpected funds for Nigeria as such lead to the remarkable change in policies to ensure a holistic approach to benchmark of the state of oil sector (Ogunmakin, et al. 2014; Akinleye, Olowookere & Fajuyagbe, 2021).

Even with the huge amount of revenue Nigeria has generated over decades from crude oil export, the country GDP has not been increasing to meet the need of increasing population. This might be the result of weak institutions. Halvor, Moene and Ragnar (2006) differences in the institutional quality between countries may lead to countries with rich resources (like crude oil)

having high or low growth rate; this may be witnessed if the Institutional measures are grabber friendly or producer friendly depending on the control adopts by the resources and economic managers of such institutions in a given country . Grabber-friendly institutions are regularly the outcome of the weak rule of law, imperfect bureaucracy, and corruption. Grabber-friendly institutions can be terrible for growth when resource abundance draw limited entrepreneurial resources away of production and into uncreative activities. On the contrary, by producer-friendly institutions rich resources focus on entrepreneurs into production resulting in higher growth (Aunty, 1990).

Though, various studies have been done on crude oil revenue, economic growth nexus in Nigeria (see Akinlo, 2012; Ibeh 2013; Ogunmakin et al. 2014; Abubakar 2016; Nwoba and Abah 2017; Asagunla and Agbede 2018; and Akinlolu and Nejo and Efanga et al. 2020). However, despite the function of institutional quality in the administration of crude oil revenue little has been done to empirically study the impact of crude oil revenue and institutional quality on economic growth in Nigeria. Although the recent study by Oluseun and kazeem (2017) on the impact of oil revenue and institutional quality on economic growth in Nigeria deserves some commendations. However, their study has certain weaknesses. In particular the study did not carry out important diagnostic test such as heteroscedasticity and normality test making one doubt the consistency of the reported results.

In addition, factors such as labour force, gross national expenditure that have been found to be significant determinants of economic growth in the literatures were left out by Oluseun and kazeem (2017). Thus, this study is significance and adds to the literature for a couple of reason. First, the study uses different methods of analysis specifically the bootstrapping ARDL bound test and Toda- Yamamoto causality test; this method is advanced compare to conventional (ARDL) co integration techniques. In addition, the study carry out diagnostic tests including heteroscedasticity and normality which Oluseun and kazeem (2017) failed to conduct to confirm the consistency of the results obtained. In investigates the impact of crude oil revenue and institutional quality on economic growth in Nigeria.

The objective of this study is to investigate the impact of crude oil revenue and institutional quality on economic growth in Nigeria. Following the introduction, section two is the review of theoretical and empirical literature. Section three represents the model formulation and the data. Section four is the methodology whereas results and discussion are taken up in section five. The last section is the conclusion.

2. Literature Review

Several empirical studies have been conducted to explore crude oil revenue, economic growth nexus, but little has been done to examine the relationship between crude oil revenue, institutional quality and economic growth in Nigeria.

Effect of Crude Oil Revenue on Economic Growth

This section reviews past related studies on the relationship between crude oil revenue and economic growth. Numerous studies have shown that crude oil revenue has significant impact on economic growth For instance, Khalid and Azrai (2014) examined the effect of oil revenue on economic growth in Sudan using johansen co integration approach from the period 2000-2002, their result shows that oil revenue has positive significant impact on economic growth in Sudan. In addition, Odularu (2008) examined the relationship between crude oil sector and the Nigerian economic performance from the period 1970 to 2005, employing ordinary least square (OLS) regression method. The results revealed that crude oil consumption and export contribute to the

development of the country economy performance. Similarly, Efanga, et al. (2020) examined the impact of oil revenue on Nigeria economic growth from 1981 to 2018 period, their study employed auto-regressive distributed lag (ARDL) techniques. Their results revealed that oil revenue has positive and significant impact on economic growth of Nigeria. Also, Akinleye et al. (2021) carried out a study on the effect of oil revenue on economic growth of Nigeria from the period covering 1981 to 2018 using the autoregressive distributive lag (ARDL) techniques. Empirical finding demonstrated that oil revenue has a significant direct relationship with economic growth of Nigeria in both short run and long run. Gideon, Johnson and Samson (2021) used autoregressive distributive lag (ARDL) co integration Approach to empirically determine the impact of oil revenue on economic growth in Nigeria from 1981 to 2018 period. Their finding indicates that oil revenue has significant and positive impact on economic growth in Nigeria.

A number of studies did not support the view that crude oil revenue promotes economic growth. Elijah, Denis, David and Augustine (2018) investigated oil and gas production and the growth of Ghana from the period 2010 to 2013.using ordinary least square method. Their result proves that crude oil has a negative significant impact to economic growth in Ghana. Ifeoluwa, Forget and Kin (2020) employed pooled mean group estimators on panel autoregressive distributed lag model to empirically investigate the relationship between sustainable development and crude oil revenue in some selected oil-producing African countries from the period of 1992 to 2017. Their results exposed that there was no long-run relationship between crude oil revenue and sustainable development. In other words, the results suggest that change to crude oil revenue have a negative statistical effect on sustainable development in the selected countries.

Similarly, Ibeh (2013) employed ordinary least square (OLS) regression technique to investigate the impact of oil industry on the Nigerian economic growth for the period 1980-2010. The findings indicate that the two explanatory variables did not have any significant impact on growth performance of the country economy within the same period. This finding contradicts the finding of Odularu (2008), who found a positive relationship between oil sector and Nigeria economic performance. However, Asagunla, Temitope and Moses (2018) employed fully modified ordinary least squared method to investigate the relationship between oil revenue and output growth in Nigeria from the Period 1981 to 2014. Their findings indicated that oil revenue has no short-run impact on the economic activities of Nigeria. Nevertheless, in the long run the result exposed that constant increase in oil revenue would lead to the country's future economic growth. Furthermore, Akinlolu and Nejo (2020) employed ordinary least square techniques and granger causality test to empirically assess the relationship between oil revenue and economic growth of Nigeria from 1981 to 2018 period. Their findings illustrated a negative significant relationship between oil revenue and gross domestic product. The study concluded that oil revenue is a resource curse for the country judging from the dependence of the country on oil revenue and that it a negative effect which hinders other sectors from growing and help curb the rising economic volatility in the country.

Effects of Institutional Quality on Economic Growth

Elisa and Sara (2011) examined the impact of institutional quality on economic growth considering 181 developed and developing countries using panel data containing observation from 1950 to 2009 period through pooled regression model and a fixed effects model. Their result showed that institutional quality has a positive and significant impact on economic growth

for both developed and developing countries. However, Nawaz, Iqbal and Khan (2014) empirically examined the impact of institutional quality on economic growth in a number of Asian economies from the period 1996- 2012 using static and dynamic panel system generalized method of moment's techniques with fixed effects. Their empirical results exposed that institutions are significant in assessing the long run economic growth in Asian countries. Though, the impact of institutions on economic growth varies across Asian countries and depends on the stage of economic development. The results submitted that institutions are more efficient in developed Asia than developing Asia; this result shows that different countries need different set of institutions to enhance long term growth.

Similarly, Nabila, Shazia and Muhammad (2015) evaluated the impact of institutional quality on economic growth in developing countries of Asia from 1990-2013 using panel ARDL techniques and causality test. Their result revealed that institutional quality has positive and significant impact on economic growth. The result also revealed that there is a one way causality running from institutional quality to economic growth. This result is supported by Chimere, Godfrey and Chigozie (2017) used a panel data of 12 West African nations from 1996 to 2015 using the fixed effect model, the random effect model and the panel two-stage least square technique to examine institutional quality and economic growth in West Africa. Their finding revealed that all the variables of institutional quality used in the model have direct and significant impact on economic growth in west Africa.

Empirical studies in Nigeria include that of Yusuf (2013) used Autoregressive distributive lag (ARDL) techniques to empirically investigate the institutions and growth performance in Nigeria from the period of 1980 to 2011. Empirical result demonstrated long run relationships between institutions and economic growth. In addition on the direction of causality the result indicated two way causal relationships, which indicate that institutions and economic growth causes each others. Contrary, Jonathan, Fidelia and Anthony (2020) examined institutional quality and economic performance in Nigeria from 1981Q1 to 2016Q4 using the ARDL approach. Their empirical results demonstrate that institutional quality has negative impact on growth but statistically insignificant in Nigeria,. In addition, Abubakar (2020) tested the effect of Institutional quality using contract intensive money and effective governance index to economic growth in Nigeria from the period 1979 to 2018 using johansen Co integration method and ordinary least square techniques. Their result of co integration test reveals joint relationship among the variables. OLS result indicated that economic growth has positively and significant impact on institutional quality while effective governance index shows positive and insignificant impact on the economic growth.

Effects of crude Oil revenue and Institutional Quality on Economic Growth

With regard to the importance of including institutional quality on the impact of crude oil revenue on economic growth. Adewale, Daniel and Sebastian (2019) investigated the effect of institutional quality and oil revenue on economic growth in oil-exporting developing countries from 1984 to 2016 period, using panel autoregressive distributed lag with a dynamic fixed effect estimator. Their result shows that Institutional reduce the negative effect of oil revenue on economic growth in the long- run, while in the short run institutional quality was found to boost the positive effect of oil revenue on economic growth. Furthermore, the results present the threshold levels of institutional quality, ahead of which oil wealth promotes economic growth, both in the long- run and in the short run, for the sampled countries.

In Nigeria, Oluseun and Kazeem (2017) empirically assessed the impact of oil revenue and

institutional quality on economic growth in Nigeria from the period of 1984 to 2014 using autoregressive distributive lag approach. Their Results illustrate long run relationship among oil revenue, institutional quality and economic growth. The short-run result submitted that institutional quality measured by the control of corruption promotes economic growth, while institutional quality reduce economic growth in the long –run, oil revenue enhanced economic growth in the short run and reduces it in the long -run, thus confirm the existence of the resource curse hypothesis in Nigeria.

This study is significant as previous studies have focused more on the impact of crude oil revenue on economic growth. While ignoring the roles of institutions in the management of crude oil revenue. Thus, this study contributes to the existing literature by examining the impact of crude oil revenue and institutional quality on economic growth in Nigeria. Using augmented ARDL bound testing technique and Toda-Yamamoto causality test. This technique is an advance compared to the conventional method used by the previous studies.

Theoretical Framework

Various models have been used in the literature to examine the relationship between oil revenue and economic growth in Nigeria, this study used endogenous growth model propounded by Lucas (1988) and Romer (1990) which is an expansion of the neoclassical growth model developed by Ramsey (1928). The neoclassical model was generalized by Solow (1956) the model assumes technological changes as exogenous and the production function as constant return to scale. In addition, the marginal product of additional units of capital is assumed to decline. The model highlighted that if productivity was to increase, the labour force most continuously be provided with more resources. Resources in this phase comprised physical capital, human capital, and knowledge capital (technology). Therefore growth was determined by accumulation of factors of production. The neoclassical production function can be written as:

$Y= F (K, L)$ …… (1)

However, Lucas (1988) and Romer (1990) expanded the neoclassical model by including investment in human capital (H), innovation (I) and knowledge as the significant input to economic growth. The model is specifies as follows:

$Y= F (K, L, H, I)$……..... (2)

Thus, equation 2 is the endogenous models that state economic growth as a function of human capital, innovation and knowledge.

3. Model Specification

This study adopts Solow (1957) growth model, the model state that output (Y) is determine by the amount of capital (K), labour (L) and Knowledge or the effectiveness of labour (A). The production function takes the form;

$Y=AK^{\alpha} L^{\beta}$…… (3)

Where Y= level of Output in a given period

A= total factor productivity

K= Capital stock

L= Labour

α and β = are the changes of capital and labour with respect to output, the model assume that each productive unit will use equal amount of capital and labour with the following aggregate production function:

$Y=AK^{\alpha} L^{\beta}$ …… (4)

According to Romer (1990), Aghion and Howitt (1992) the capital stock (K) is separated into physical capital ($K_{P(t)}$) and human capital ($K_{H(t)}$). Thus, when included into the model we have;

$Y= AK_{P(t)} K_{H(t)}{}^{\alpha} L^{\beta}_{t}$ ..... (5)

Thus, human capital development in the model can be represented by institutional quality that (INSQ) as follows:

$K_{H(t)} = INSQ_t$ ..... (6)

However, Physical capital in the model can also be represented by gross fixed capital formation (GFCF) and Gross national expenditure (GNE) as follows:

$K_{P(t)}= GFCF_t, GNE_t$ ..... (7)

However, crude oil revenue (COILR) is one of the most important drivers of economic growth in Nigeria and a key variable in the attainment of the objective of this study. Therefore, crude oil revenue (COILR) is incorporated in equation (3.8).

Substituting equation (6) and (7) and including crude oil revenue in to equation (8) the model will be

$Y_t= F (LABF_t, GFCF_t, INSQ_t, COILR_t, COILR*INSQ_t, LGNE_t)$ ..... (8)

Thus: the modified functional model for this study is presented in equation 9 as follows:

$GDP_t = F(LABF_t, GFCF_t, INSQ_t, COILR_t, COILR*INSQ_t, LGNE_t)$ ..... (9)

The mathematical model will be:

$GDP_t = \alpha_0 + \alpha_1 LABF_t + \alpha_2 GFCF_t + \alpha_3 INSQ + \alpha_4 COILR_t + \propto_5 COILR*INSQ_t + \propto_6 LGNE_t + \mu_t$ ..... (10)

Taking the natural logarithm of equation (3.8), the model will be

$GDP_t = \alpha_0 + \alpha_1 LABF_t + \alpha_2 GFCF_t + \alpha_3 INSQ_t + \alpha_4 COILR_t + \propto_5 COILR*INSQ_t + \propto_6 LGNE_t + \mu_t$ ..... (11)

Where; where L stand for logarithm. The logarithm is taken to lessen the skewness of the series.

GDP= Gross Domestic product

LABF = Labour Force

GFCF= Gross fixed capital formation

COILR= Crude oil revenue

INSQ= Institutional quality

LGNE= log of gross national expenditure

μ_t = Error term

α_0 = constant term and t stands for time.

3. Methodology

This study applied quarterly time series data consisting of observation from 1996:Q1 to 2020:Q4 data on gross domestic product (GDP), crude oil revenue (COILR), gross national expenditure (GNE), gross fixed capital formation (GFCF), labor force (LABF), institutional quality (INSQ) were collected from World Development Indicator (WDI) and world governance indicator (WDI).

Unit root Test

The purpose for stationarity of time series data led to the investigation of unit root tests. Unit root tests are statistical process designed to make conclusion as to whether a given sample of time series data implies a unit root or is found to be stationary (Wooldridge, 2009). Even though, there are many procedures in testing the unit root of time series data. However, there is no

consensus on which type of test to use without any drawbacks. For this purpose, the Augmented Dickey-Fuller and the Phillips Perron tests were used in this study. The tests are essential to ensure that the variables are stationary; otherwise, the regression result will be meaningless. The ADF and PP tests test the null hypothesis that a series has a unit root against the alternative hypothesis that a series does not have unit-roots.

Augmented Autoregressive Distributed Lag (AARDL) Model

The Augmented ARDL bounds testing procedure can mathematically specify, following Goh, Yong, Lau and Tang (2017), as follows:

$$\Delta GDP_t = \beta_0 + \beta_1 GDP_{t-1} + \beta_2 LABF_{t-1} + \beta_3 GFCF_{t-1} + \beta_4 COILR_{t-1} + \beta_5 INSQ_{t-1} + \beta_6 COILR * INSQ_{t-1} + \beta_7 LGNE_{t-1} + \sum_{i=1}^{n} \propto_{1i} GDP_{t-i} + \sum_{j=0}^{p} \propto_{2i} LABF_{t-j} + \sum_{k=0}^{s} \propto_{3i} GFCF_{t-k} + \sum_{l=0}^{u} \propto_{4i} COILR_{t-l} + \sum_{m=0}^{q} \propto_{5i} INSQ_{t-y} + \sum_{n=0}^{r} \propto_{6i} COILR * INSQ_{t-w} + \sum_{p=0}^{t} \propto_{7i} LGNE_t + \mu_t \ldots\ldots (12)$$

where i, j, k, l, m, n and p indicate the lags, t represents time, GDP is the dependent variable, LABF, GFCF, COILR, INSQ, COILR*INSQ and LGNE are the independent variables, α_1 is the coefficient of the lagged dependent variable, α_2 α_3……..α_7 represent the coefficient of the lagged independent variables. μ_t represent the error-term with zero mean and finite variance. An error correction form can be presented as follows:

$$\Delta GDP_t = \beta_0 \sum_{i=1}^{q} \alpha_1 \Delta GDP_{t-i} + \sum_{i=1}^{r} \alpha_{2i} \Delta LABF_{t-i} + \sum_{j=0}^{s} \alpha_{3i} \Delta GFCF_{t-i} + \sum_{i=1}^{w} \alpha_{4i} \Delta COILR_{t-i} + \sum_{j=1}^{q} \alpha_{5i} \Delta INSQ_{t-i} + \sum_{i=1}^{r} \alpha_{6i} \Delta COILR * INSQ_{t-i} + \sum_{j=1}^{s} \alpha_{7i} \Delta LGNE_{t-i} + ECT_{t-1} \mu_t \ldots\ldots\ldots\ldots (13)$$

To ascertain the co integration among the variables, it involves the rejection of the following three null hypotheses:

I) F_1 test which is based on all the relevant error-correction terms (H_0: $\beta_1=\beta_2=\beta_3=\beta_4=\beta_5=\beta_6=\beta_7=0$ against H_1: $\beta_1\neq\beta_2\neq\beta_3\neq\beta_4\neq\beta_5\neq\beta_6\neq\beta_7\neq 0$

II) The F_2 test which is based on all of the explanatory variables terms (H_0: $\beta_2=\beta_3=\beta_4=\beta_5=\beta_6=\beta_7=0$ against H_1: $\beta_2\neq\beta_3\neq\beta_4\neq\beta_5\neq\beta_6\neq\beta_7\neq 0$),

III) The t-test which is based on the lagged dependent variable (H_0: $\beta_1 = 0$ against H_1: $\beta_1 \neq 0$ meaning that β_1 is different from zero).

Based on the above three null hypotheses, McNown, Sam and Goh (2018) explain two

degenerates of Pesaran, Shin and Smith (2001) as follows:

Degenerate case #1. The F_1 test and the t test for the lag dependent variable are significant; however the F_2 test for the lag independent variable is not significant.

Degenerate case #2. The F1 and F2 tests for the lag dependent variable are significant, but the t test for the lag dependent variable is not significant. Pesaran et al. (2001) excluded degeneration case #1, and if they did not consider the integration order of the dependent variable, it must be I (1). To solve this problem, McNown et al. (2018) employed additional test of the lagging independent coefficient. Therefore, if Co integration exists among the dependent and independent variable, the above three fundamental hypotheses will all together be rejected.

Moreover, the critical values of bounds test for F1 and t-tests are generated in the traditional ARDL approach, yet it ignores the test statistic for F2 test on the lagged explanatory variables However, by employing the Augmented ARDL approach proposed by McNown et al. (2018), one can provide the critical values for all the three tests. At the same time, to provide empirically appropriate results, this study used the tabulated critical values by Sam et al. (2019).

Causality Test

If co-integration among variables is established, this suggests that causality exists between them at least in one direction (Granger, 1986). To check the way of causality between the crude oil revenue and economic growth, the Toda-Yamamoto (1995) techniques is used to carry out the causality test even though the standard Granger causality test is more appropriate to problems with residuals in small samples compared to the Toda-Yamamoto causality test. The Toda-Yamamoto technique involves estimating a two-equation system, adapts the Wald test and can be used irrespective of the order of integration of the series, I(0) and I(1). The models are specified as follows:

$$GDP_t = \beta_0 + \sum_{i=1}^{k+d} \pi_1 GDP_{t-i} + \sum_{t-i}^{k+d} \pi_2 COILR_{t-i} + \sum_{i=1}^{k+d} \pi_3 GFCF_{t-i} + \sum_{t-i}^{k+d} \pi_4 LABF_{t-i} + \sum_{i=1}^{k+d} \pi_5 INSQ_{t-i} + \sum_{t-i}^{k+d} \pi_6 COILR * INSQ_{t-i} + \sum_{i=1}^{k+d} \pi_7 LGNE_{t-i} + \mu_{1t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (14)$$

$$COILR_t = \beta_0 + \sum_{i=1}^{k+d} \varphi_1 COILR_{t-i} + \sum_{t-i}^{k+d} \varphi_2 GDP_{t-i} + \sum_{i=1}^{k+d} \varphi_3 LABF_{t-i} + \sum_{t-i}^{k+d} \varphi_4 GFCF_{t-i} + \sum_{i=1}^{k+d} \varphi_5 INSQ_{t-i} + \sum_{t-i}^{k+d} \varphi_6 COILR * INSQ_{t-i} + \sum_{t=1}^{k+d} \varphi_7 LGNE_{t-i} + \mu_{2t} \quad \ldots\ldots (15)$$

$$INSQ_t = \beta_0 + \sum_{i=1}^{k+d} \delta_1 INSQ_{t-i} + \sum_{t-i}^{k+d} \delta_2 GDP_{t-i} + \sum_{i=1}^{k+d} \delta_3 COILR_{t-i} + \sum_{t-i}^{k+d} \delta_4 GFCF_{t-i} + \sum_{i=1}^{k+d} \delta_5 LABF_{t-i} + \sum_{t-i}^{k+d} \delta_6 COILR * INSQ + \sum_{i=1}^{k+d} \delta_7 LGNE_{t-i} + \mu_{3t} \ldots\ldots (16)$$

a) $COILR_t$ Does not Granger causes GDP if $\pi_2 = 0$
b) GDP_t Does not Granger causes COILR if $\varphi_2 = 0$
c) $INSQ_t$ Does not Granger causes GDP if $\pi_5 = 0$
d) GDP_t Does not Granger causes INSQ if $\delta_2 = 0$

4 Results and Discussions

The analysis commenced with the unit root tests, the augmented Dickey- Fuller (ADF) and Phillips- perron (PP) unit root test were conducted. These tests examine the null hypothesis that the measured variable has a unit root against the alternative hypotheses that the variable has no unit root and also is stationary. Table 1. Shows that GDP, LABF, GFCF, COILR*INSQ and LGNE are stationary after taking their first difference, in other word the series are integrated of order one I (1). On the other hand COILR and INSQ were found to be stationary at level and also at first difference. Therefore the series are in combination of I (0) and I (1). The mixed order of integration of the variables provides a strong backing for the adaptation of the augmented ARDL in this study.

Table 1. Results of Unit Root Tests

	Level		First Difference	
VARIABLES	ADF	PP	ADF	PP
GDP	-1.472	-1.571	-3.260**	-5.812***
LABF	-1.687	-1.893	-2.928**	-4.418***
GFCF	-1.337	-1.229	-4.612***	-3.855***
COILR	-1.572	-2.585*	-4.028***	-5.146***
INSQ	-2.584	-1.904	-2.368	-5.527***

COILR*INSQ	-1.487	-2.533	-3.104**	-5.096***
LGNE	-1.653	-1.279	-3.356**	-5.742***

Source: author's computation Schwarz information criterion (SIC) is used to select the maximum lag length in the ADF test, Asteriks ***, **, and * indicate statistically significant at 1% 5% and 10% respectively.

Table 2. Augmented ARDL Co integration Test Results

Estimated model	F_{JOINT}	F_{IND}	t_{DV}	Remark
	31.975***	15.033***	-4.669***	Co integration

Note: Akaike Information Criterion (AIC) is used to select optimum lag length,***,**,* signify statistical significant at 1%, 5% and 10% level respectively. With reference from table 1 in appendix . F_{JOINT} is the F-statistics for testing $\beta_1=\beta_2=\beta_3=\beta_4=\beta_5=\beta_6=\beta_7=0$. F_{IND} is the F-statistics for testing $\beta_2=\beta_3=\beta_4=\beta_5=\beta_6=\beta_7=0$ and t is the tDV- statistics for testing $\beta_1=0$
Source: Author's computation (2021).

Table 4.4 represents the empirical results of the Augmented ARDL bound testing for co integration. Our finding from the F- test and T-test demonstrated a long -run relationship. We conclude that economic growth, crude oil revenue, institutional quality, labour force, gross fixed capital formation and gross national expenditure have a long run relationship during the period 1996Q1-2020Q4 in Nigeria. see table 1 in appendix 1.

ARDL Long run and run Result Short

The result of the estimated short run and long run ARDL model are presented in Panels A and B of Table 4.5 respectively. Panel A, shows the long run ARDL result that examines the effect of crude oil revenue and institutional quality on economic growth in Nigeria. In estimation the model the Schwarz information criteria (SIC) confirmed that the optimal lag-length for the variable is (3,1,3,2,0,0,4).

Table 3. ARDL Regression Result

Panel A: long run Coefficients – Dependent variable is GDP				
Regressors	Coefficient	Standard Error	T- Statistics	Prob.
LABF	-12.454	2.865	-4.346***	0.000
GFCF	-0.513	0.172	-2.975***	0.0039
COILR	2.626	0.833	3.153***	0.0023
INSQ	-32.559	9.418	-3.457***	0.0009
COILR*INSQ	2.259	0.729	3.097***	0.0027
LGNE	-8.509	3.148	-2.702***	0.0085
Panel B: Short- run Coefficients				
D(GDP(-1))	0.481	0.084	5.727***	0.000
D(GDP(-2))	0.182	0.071	2.587**	0.012
D(LABF)	-12.303	2.984	-4.122***	0.000
D(GFCF)	-0.404	0.087	-4655***	0.000
D(GFCF(-1))	0.368	0.108	3.397***	0.001
D(GFCF(-2))	0.192	0.102	1.879*	0.064
D(INSQ)	-28.030	2.302	-12.179***	0.000
D(INSQ(-1))	10.250	3.086	3.322***	0.001

D(LGNE)	-4.214	1.853	-2.274**	0.026
D(LGNE(-1))	5.174	2.022	2.559**	0.013
D(LGNE(-2))	3.547	2.062	1.720*	0.089
D(LGNE(-3))	2.830	1.807	1.567	0.121
C	195.712	30.304	6.458***	0.000
ECT_{t-1}	-0.210	0.033	-6.461***	0.000
R – Squared	0.776			
Adjusted R^2	0.741			
F- Stat	21.869			0.000

Source: Authors' calculation. ARDL optimal lags length is (2, 1, 4, 1, 2, 1, 1) lag selection based on Schwarz information criterion (SIC). Asterisks ***, **, and * indicate statistical significant at 1%, 5% and 10% respectively.

Panel A indicates that the coefficient (2.626) of crude oil revenue is positive and statistically significant in the long run. A 1% increase in crude oil revenue will generate a 2.6% increase in economic growth. This satisfies the prior expectation. This means a raise in crude oil revenue will enhance the economic growth of Nigeria in the long run. Thus, crude oil revenue is a contributing factor for the sustainability of economic growth and development in Nigeria. The finding of positive relationship between crude oil revenue and economic growth are consistent with the study of Asagunla and Moses (2018), Efanga et.al (2020) who reported that in the long-run crude oil revenue lead to future economic growth of the country. However the result is different to the work of Musa, et.al (2016) who reported a high insignificance of crude oil revenue into the Nigerian economy.

However, the coefficient (-32.559) of institutional quality (INSQ) has negative and statistical impact on Nigerian economy in the long run. In other word the empirical results demonstrate that increase in the institutional quality (i.e. decrease in corruption) by 1% will reduce economic growth by 32.556% this does not satisfy a priori expectation. This finding is in line with "grease the wheel" hypothesis of corruption promoted by Leff (1964) later supported by Leys (1965) and Huntington (1968). Who maintained that corruption contribute to economic growth by reducing bureaucratic inefficiency which create obstacle to investment and in the long run growth. In addition, this finding is consistent with the study of Ubi and Uda (2014), Abu (2017) who reported that corruption has statistical and significant impact on economic growth of Nigeria.

Labour force is found to have a negative relationship with economic growth and statistically significant in the long run. A 1% increase in labour force will reduce economic growth by 12.454%. However, Gross fixed capital formation shows negative relationship with economic growth and is statistically significant in the long run. A 1% increase in the gross fixed capital formation will reduce economic growth by (0.513%) in Nigeria.

Crude oil revenue interaction with institutional quality has positive and statistical significant relationship with economic growth in the long run. A 1% increase in crude oil revenue interaction with institutional quality will generate an increase of 2.259% in economic growth**.** Furthermore, gross national expenditure is found to have negative relationship with economic growth in the long run but statistically significant. Specifically, a 1% increase in gross national expenditure will lead to a decrease of 8.509% of economic growth in Nigeria.

Panel B represent the short run ARDL result. Institutional quality (INSQ) has negative and significant impact on economic growth in the short run. A 1% increase in institutional quality

will lead to 28.030% decrease in economic growth in the short run. However, labour force is reported to have a negative and significant effect to economic growth in the short run. A 1% increase in labour force will lead to a 12.303% decrease in economic growth.

Gross fixed capital formation has negative and statistically significant effect on economic growth in the short run. A 1% increase in gross fixed capital formation will result to decrease in economic growth by 0.513% in the short run. Moreover, gross national expenditure was found to have negative effect on economic growth in the short run and statistically significant. A 1% increase in gross national expenditure will lead to decrease in economic growth by 4.214%.

Furthermore, the coefficient of the error correction term lagged by one period is negative, less than one and statistically significant at 1%. Therefore, it meets priori expectation. In addition 21% of the variation in the short run is corrected in a single quarter. R^2 indicates that 78% of the total variation in economic growth is determined by changes in the explanatory variables. Thus the model is valid and good fit for interpretation.

Diagnostic Test Results

Table 4. ARDL Result of Diagnostic Tests

Tests	F statistics	Decision
Normality (Jarque-Bera Test statistics)	37.947[0.000]	Not Normally Distributed
Serial Correlation (Breusch–Godfrey LM Test)	1.232[0.298]	No Serial Correlation
Hetroscedasticity (Breusch-pagan-Godfrey)	1.168[0.307]	Homoscedastic
RamseyRESETTest (Specification Error)	0.499 [0.482]	No Specification Error

Source: Researcher's Computation. Values in the Square bracket are the Probability values of the test.

The diagnostic test result was reported in table 4. The results indicate that the AARDL model passes the Serial correlation, Heteroscedasticity and Ramsey reset tests. For the serial correlation test, breusch Godfrey LM test was adopted and the p- value is (0.298) indicating that the null hypothesis of no serial correlation is accepted. Also on the test for heteroscedasticity, the null hypothesis that says the model is homoscedastic could not be rejected going by the probability value (0.307). However, the probability (0.482) of Ramsey reset test for specification error indicates that the model is correctly specified no omitted variables and no functional form problem.

Stability Test Result

The stability of the model was established by the result of the Recursive estimates, indicating cumulative sum of recursive residuals (CUSUM) test in figure 1 and cumulative sum squares of recursive residuals (CUSUMSQ) in figure 2. The results point out that the models are stable. The plot of the CUMSUM and CUMSUMQ are within the boundaries none of them break the red upper and lower boundaries.

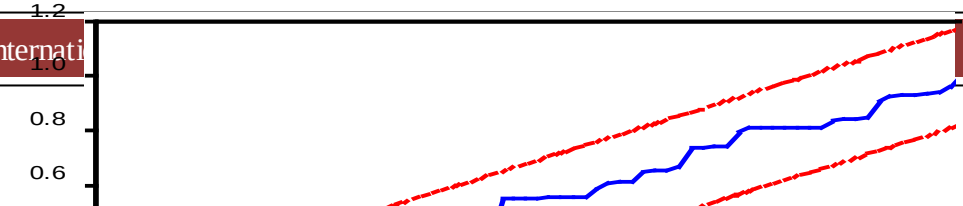

Figure 1. Cumulative sum squares of recursive residuals plot

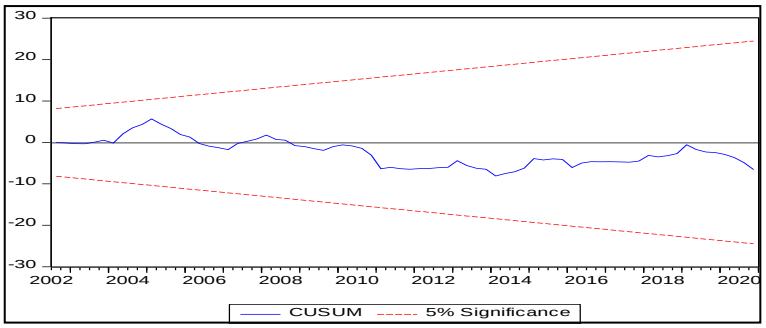

Figure 2. Cummulative sum of recursive residuals plot.

Results of ARDL Causality Tests

The purpose here is to determine the direction of causality between crude oil revenue, institutional quality and economic growth. The Toda -Yamamoto causality test result presented in Table 4.7 revealed that crude oil revenue, institutional quality Granger causes economic growth (GDP) and vice versa. This implies that there is two-way or bi-directional causality between crude oil revenue, institutional quality and economic growth in Nigeria.

Table 5. Results of ARDL Toda -Yamamoto Causality tests.

Null Hypothesis	Chi-Sq.	D.f	Prob	Decision
GDP does not Granger causes COILR	22.316	5	0.001	Null Hypothesis is Rejected
COILR does not Granger causes GDP	15.486	5	0.009	Null Hypothesis is Rejected
GDP does not granger cause INSQ	13.411	5	0.019	Null Hypothesis is Rejected

INSQ does not granger cause GDP	11.098	5	0.049	Null Hypothesis is Rejected

5 Conclusions / Recommendation

This study achieves its objective of examining the impact of crude oil revenue and institutional quality on economic growth in Nigeria during the 1996Q1 to 2020Q4 period, using Augmented ARDL techniques. The empirical results of the bounds testing to co integration have clearly revealed that there is a long run relationship between crude oil revenue, institutional quality and economic growth in Nigeria. The Toda-Yamamoto causality test results point out that crude oil revenue, institutional quality Granger causes economic growth and vice versa. Government should take up policies to improve the quality of its institutions so as to ensure efficient utilization of crude oil revenue such will boost economic growth in the country.

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