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The Relationship Between Natural Resource Rent and Economic Growth in Nigeria

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Abstract:

Purpose: *The current study explored the nature of the relationship between natural resources and economic growth in Nigeria, drawing on linear and nonlinear versions of the ARDL model over the period covering 1972–2019.*
Design/Methodology/Approach: *In this study, real GDP per capita was used as a proxy variable for economic growth, and it was sourced from the World Bank's database of world development indicators. As a measure of natural resources, the study used total natural resource rent expressed as a percent of GDP. Oil is represented by oil rent as a percent of GDP. The data on these variables was collected from world development indicators of the World Bank.*
Findings: *The models consistently show that natural resources, economic growth, trade openness, and financial development are co-integrated. Findings of the current study indicate that natural resource is growth neutral in the long run and that there is no evidence of resource curse hypothesis. The study results also reveal that the relationship between natural resources and economic growth is asymmetric, such that a negative shock to natural resources retards economic growth in the short run. In addition, the study result reveals that natural resource and economic growth reinforce each other as bidirectional causality between the variables was detected. On the other hand, minor and major shocks to natural resources fuel economic growth.*
Practical Implications: *The study recommends that the government of Nigeria design effective strategies to avoid a negative shock to natural resources and follow economic policies that enable the country to generate large revenues from natural resource exports.*
Originality/Value:

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1. Introduction

Despite centuries-old dependence on agriculture, developing countries are still unable to spur sustainable and faster economic growth. A similar story applies concerning natural resource endowment, as developing countries are more natural resource dependent than their developed counterparts.

According to the World Bank's 2022 data, the total natural resource rent as a percent of GDP in 2019 is 0.17 and 0.67 in European Union and North American countries, respectively, while in regions home to many developing countries like sub-Saharan Africa, the share is about 7.33%. The data from the indicated source also shows that in low, middle, and high-income countries, the share of total natural resource rent in GDP is 6.20%, 3.23%, and 1.29%, respectively.

There are several theoretical explanations with empirical support as to the reasons for the failure of natural resources to fuel economic growth, which is often dubbed the "resource curse" hypothesis. One such explanation is related to the mainstream economics of international trade. Natural resource windfalls have a negative spillover effect on other sectors.

This is done by the collapse of the manufacturing sector due to domestic currency appreciation and the diversion of productive resources from other sectors of the economy to the natural resource sector following natural resource windfalls. This phenomenon was first occurred in Netherlands in early 1960s (Roy et al., 2013), which rendered it the term “Dutch diseases” in natural resource literatures (see (Sachs and Warner, 1995; Drelichman, 2005; Gerelma and Kotani, 2016; Petkov, 2018; Vaz, 2017).

Another line of argument in favor of ‘resource curse’ hypothesis is related to institutional quality. According to this theory, the negative correlation between natural resource abundance and economic growth is attributed to bad institutional set up (Isham *et al.,* 2003; Leite and Weidmann, 1999; Sala-I-Martin and Subramanian, 2003).

Nonetheless, there are also cases in favor of positive relationship between natural resource and economic growth. Like human and physical capital, natural resource (natural capital) is an important productive input and, hence, contributes to economic growth (Allcott and Keniston, 2017).

Besides, revenues generated from natural resource exports can be made available for investment in development infrastructure, human capital accumulation, and foreign exchange reserves. Seen from this angle, therefore, the relationship between natural resources and economic growth can be better represented by the "resource blessing" hypothesis. Several studies across the world confirm this hypothesis (Gylfason, 2001; Peach and Starbuck, 2011; Petkov, 2018).

Even though the literature on the natural resource and economic growth nexus is extensive and dates as far back as the 1960s, little attention is given to examining the impact of positive and negative shocks to natural resources on economic growth in contemporary research. A shock to natural resource stems from demand for and supply of natural resource.

Overexploitation that is beyond the existing stock can bear causes supply shock while fluctuation in prices of natural resources and global pandemics like covid-19 can cause demand shock. Moreover, the first time that natural resources with high economic significance like oil are discovered, it can be considered a positive shock to the natural resource, which is also sometimes referred to as a "resource boom" or a "resource windfall." According to Cockburn *et al.* (2018), revenues generated from natural resource entail significant vulnerability in developing countries.

Nigeria is among the top resource-rich countries in the continent of Africa. According to Dennis Brown and Stephen (2017), the country is blessed with over 34 types of natural resource. Natural resource in general and oil in particular are significant economic indicators in Nigeria. In spite of dependence on natural resource, however, it seems that the ‘resource curse’ hypothesis holds for the Nigerian case (Fosu and Gafa, 2019; Sala-I-Martin and Subramanian, 2003).

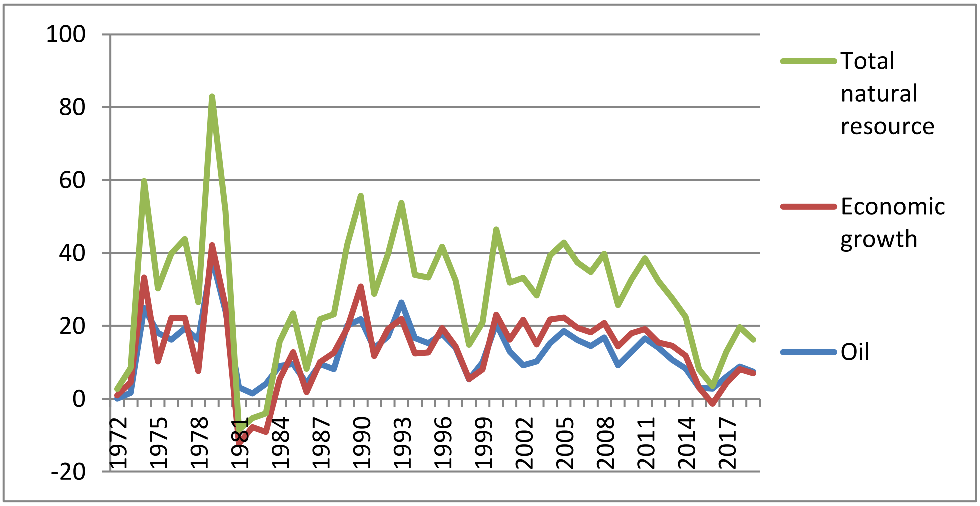
United Arab Emirates (UAE) was established as a country 15 years later after the 1956 oil discovery in Nigeria. Yet, UAE has benefited a lot from its natural resource (Hayat and Tahir, 2021) while Nigeria is still unable to embark on sustained growth trajectory.

An interesting issue of natural resource and economic growth nexus in Nigeria has attracted researchers’ attention from across the world (Alley *et al.,* 2014; Dennis Brown and Stephen, 2017; Fapohunda, 1976; Fosu and Gafa, 2019; Ogunleye, 2008; Sala-I-Martin and Subramanian, 2003; Uwakonye *et al.,* 2011; Yanıkkaya and Turan, 2018).

With the only exception of Alley et al. (2014), all sources indicated above focused either on examining the direct impact of natural resource on economic growth or the role of institutional quality in shaping the relationship between natural resource and economic growth.

In addition to examining the direct impact of oil price on economic growth, *Alley et al.* (2014) studied the impact of shock to oil price. Thus, sufficient literature does not exist for the Nigerian case regarding the possible asymmetric relationship between natural resource and economic growth.

Figure 1. *Economic growth, oil and total natural resourses 1972-2017*



Source: *Own study.*

As illustrated in Figure 1, it seems reasonable to suspect an asymmetric relationship between the variables. For example, the data from WDI shows that natural resource rent and oil rent as percents of GDP were 40.77 and 38.55, respectively, in 1979, while the corresponding figure for the economic growth rate was 3.63. Surprisingly, natural resource and oil rents collapsed to the levels of 3.85 and 3.14 in 1981.

Following this, the economic growth rate became -15.45, which indicates that economic growth is sensitive to a negative shock to natural resources. Figure 1 also shows that a positive shock to total natural resource rent and oil rent matters to economic growth.

The current study adds to the existing literature in four major ways:

(i) The study tests the "resource curse" hypothesis, drawing on a nonlinear ARDL approach. In this regard, the study explores whether natural resource rent in general and oil rent in particular exert positive effects on the economic growth of Nigeria. This issue has been ignored by studies conducted so far in the country, despite the important insight this approach confers.

(ii) The study tests whether the response of economic growth to some positive and negative shocks to natural resources and oil rent is statistically different (a test of asymmetry).

(iii) Employing a multiple threshold nonlinear ARDL model, the study examines the impact of a minor shock, a moderate shock, and a major shock in natural resource and oil rent on economic growth.

(iv) The study investigates a linear and nonlinear causality between economic growth, natural resource rent, and oil rent in the Nigerian case.

The remainder of this paper is organized as follows: Section 2 provides a summary of the empirical literature review. Section 3 presents the method and material adopted in this study. In Section 4, results and discussion are given. Finally, a concluding remark is given in Section 5.

2. Literature Review

This section presents a review of the empirical literature on the relationship between natural resources and economic growth. The nexus between the variables has been extensively researched at both county and cross-country levels with varied methodological approaches.

In addition to the investigation of the direct impact of natural resources on economic growth, an analysis of the conditional variables on which the effect of natural resources depends is getting attention in most recent studies. However, it can be observed from prior studies that neither the direct nor indirect effects of natural resources are conclusively established (Thalassinos *et al.,* 2022).

Several studies confirmed the "resource curse" hypotheses based on quite different methodological approaches. Using ARDL bounds test approach, Guessan and Zambe (2014) documented negative effect of natural resource on economic growth of Cote d'Ivoire from 1960-2012. Using augmented mean group method, Rahim *et al.* (2021) found detrimental impact of natural resource on economic growth for the case of the next eleven countries from 1990-2019.

Evidence from panel data analysis on 30 Chinese provinces over the period covering 2003-2016 also vividly confirmed the 'resource curse' hypothesis. The study was conducted by Cheng *et al.* (2020) and it was found that China's green economic growth is adversely affected in provinces that are resource abundant. One of the notable resource-rich African countries is republic of Congo.

According to the study by Mbingui *et al.* (2021), evidence from Error Correction Model (ECM) seems that the country suffers from the 'resource curse' hypothesis. For the case of Papua New Guinea**,** Avalos *et al.* (2015) found that natural resource is a curse to the country on account of the so called 'Dutch diseases'. On the other hand, a number of empirical studies appear to defy the 'resource curse' hypothesis (Alexeev and Chernyavskiy, 2014; Aljarallah, 2020; 2021; Alley *et al.*, 2014; Amini, 2018; Hayat and Tahir, 2021; Redmond and Nasir, 2020).

Abundance of resource as a limit to growth, also known as 'paradox of plenty', seems an odd at first sight. In fact, this puzzle provoked subsequent studies to shift toward examination of channels through which natural resource impact economic growth negatively. A noteworthy of such studies is an influential work of Sachs and Warner (1995).

The authors pointed out that the negative relationship between natural resource and economic growth is robust to different specification and it comes about on account of government sector inefficiencies manifested in poor quality of institutions. The argument of poor institutional quality as a road to dwindling economic growth was also stressed by Bulte *et al.* (2004).

Based on seemingly unrelated regression model (SUR), Akpan and Chuku (2014) identified poor institutional quality as a channel through which the negative impact of natural resource is transmitted to economic growth in Nigeria.

From their study on Nigeria, Sala-I-Martin and Subramanian (2003) robustly concluded that corruption and waste, not Dutch disease, is responsible for resource curse in Nigeria. Ofori and Grechyna (2021) found that it takes Sub Saharan African countries to attract remittance of 66.08% of GDP to turn the negative effect of natural resource in to positive.

According to the study by Erdoğan *et al.* (2020), natural resource is blessing in the next eleven countries when financial deepening of 45% of GDP is attained. The study is based on dynamic panel threshold regression.

Even though limited in number, some previous studies have explored the asymmetric relationship between natural resource and economic growth. Akinsola and Odhiambo (2020) studied asymmetric effect of oil price on economic growth of seven low-income oil importing Sub Saharan African countries over the period covering 1990-2018 using panel NARDL model. The study found that a positive shock to oil price is detrimental to economic growth while the effect of negative shock is beneficial.

Ampofo *et al.* (2020) studied asymmetric effect and direction of causality between total natural resource rent and economic growth of top nine resource-rich world countries by employing NARDL model and nonlinear granger causality test over the period 1981-2017.

While bidirectional causality between total natural resources and economic growth is absent, mixed unidirectional causality (where causality runs from total natural resources to economic growth in some countries and just the reverse in others) was obtained in the study. The study also provided empirical support for both the "resource curse" and "resource blessing" hypotheses among the countries considered.

For the case of Kingdom of Saudi Arabia, Ben Dhiab *et al.* (2021) studied asymmetric effect of oil price on economic growth and real exchange rate from

1980-2020. Similar to the result obtained by Aljarallah (2021) from linear model, the study confirmed the ‘resource blessing’ hypothesis in both the short run and long run using NARD model. In their study on five ASEAN countries plus Japan and Korea from 1973-2018, Nusair and Olson (2021) detected asymmetric relationship between oil price and economic growth in all of the countries using NARDL model.

In five out of the seven countries, the ‘resource curse’ hypothesis is confirmed in both short and long run while a unidirectional causality running from oil price to output is observed for all countries. Based on NARDL framework applied to data collected over the period covering 2010-2019, Adabor and Buabeng (2021) found that the effect of oil resource is positive while the effect of natural gas is negative for the case of Ghana.

3. Research Methodology

3.1 Data

The current study explores the nature of the relationship between natural resources and economic growth in Nigeria over the period 1972-2019. In this study, real GDP per capita was used as a proxy variable for economic growth, and it was sourced from the World Bank's database of world development indicators. As a measure of natural resources, the study used total natural resource rent expressed as a percent of GDP. Oil is represented by oil rent as a percent of GDP. The data on these variables was collected from world development indicators of the World Bank.

Based on theories of growth determinants, two control variables, namely trade openness and financial development, were used. Trade openness is given by the sum of exports and imports of goods and services as a percent of GDP, and it was gathered from world development indicators of the World Bank.

Financial development is represented by domestic credit to the private sector, which was obtained from the global financial development database. All variables are expressed in natural logarithms.

3.2 Model Specification

3.2.1 ARDL Model

A linear effect of natural resource on economic growth can be captured by ARDL model developed by Pesaran *et al.* (2001) as given in equation 1. Four advantages associated with model are worth mentioning. Firstly, the model is appropriate in case variables considered are integrated of mixed order, but none of the variables is integrated of order 2. Secondly, model estimates are unbiased for small sample size. Thirdly, according to Pesaran *et al.* (2001), the model allows independent variables to be endogenous. Fourthly, the model facilitates better analysis as it distinguishes short run and long run interactions. The general linear ARDL model modified by including variables considered by the current study is given as follows.

$$\Delta lnY_t = \alpha_0 + \sum_{i=1}^{n1} \alpha_1 \Delta lnY_{t-j} + \sum_{i=0}^{n2} \alpha_2 \Delta lnR_{t-j} + \sum_{i=0}^{n3} \alpha_3 \Delta lnT_{t-j} + \sum_{i=0}^{n4} \alpha_4 \Delta lnF_{t-j} + \beta_0 lnY_{t-1} + \beta_1 lnR_{t-1} + \beta_2 lnT_{t-1} + \beta_3 lnF_{t-1} + u_t \quad (1) \qquad (1)$$

Where, *lnY* is natural logarithm of GDP per capita, *lnR* is natural logarithm of natural resource, *lnT* is natural logarithm of trade openness, and *lnF* is natural logarithm of financial development, α_1, α_2, . . ., α_4 are short run coefficients, β_0, β_1, . . ., β_3 are long run coefficients, and $n1$, $n2$, . . ., $n4$ are lag length.

Whether the variables indicated have long run relationship can be tested using the bounds test approach of Pesaran *et al.* (2001). The null hypothesis of the test states the absence of long run relationship between the variables, which means all of the long run coefficients (β_0, β_1, β_2 , β_3) are statistically not different from zero.

There are two critical values, namely, upper and lower critical values associated with test method. If the computed F statistic is greater than the upper bounds critical values at conventional significance levels, then the null hypothesis will be rejected. On the other hand, the null hypothesis of no co-integration cannot be rejected if the F statistic is lower than the lower bounds critical values.

3.2.2 NARDL Model

NARDL model is simply the nonlinear extension of the linear ARDL and it was developed by Shin *et al.* (2014). In the linear ARDL model, it is assumed that the influence of the independent variables is symmetric. However, this is not usually the case. It is possible that the dependent variable responds differently to drop and escalation in an independent variable of interest, and it is precisely this possibility that the NARDL model captures.

Some authors use phrases like natural resource *windfall* and natural resource *boom* to indicate a positive shock to natural resource. In the same vein, natural resource depletion, global pandemics like covid-19, and a fall in demand can be considered as a negative shock. Therefore, to examine whether economic growth responds asymmetrically to positive and negative shock to natural resource, natural resource is decomposed into positive and negative partial sums as follows:

$$lnR_t = lnR_0 + lnR_t^{\ +} + lnR_t^{\ -} \qquad (2)$$

Where, $lnR_t^{\ +}$, and $lnR_t^{\ -}$ respectively captures partial sum of escalation and drop of change in natural resource expressed as follows:

$$lnR_t^{\ +} = \sum_{i=1}^{t} \Delta lnR_i^{\ +} = \sum_{i=1}^{t} \max\left(\Delta lnR_i\ 0\right) \tag{3a}$$

$$lnR_t^{\ -} = \sum_{i=1}^{t} \Delta lnR_i^{\ -} = \sum_{i=1}^{t} \min\left(\Delta \mathrm{ln} R_i\ 0\right) \tag{3b}$$

Where, ΔR_t is the first difference of natural resource defined as $lnR_t - lnR_{t-1}$. By plugging the partial sum of natural resource into the ARDL framework, the nonlinear ARDL (NARDL) is given as:

$$\Delta lnY_t = \alpha_0 + \sum_{i=1}^{n1} \alpha_{1i} \Delta lnY_{t-j} + \sum_{i=0}^{n2} \alpha_{2i} \Delta lnT_{t-j} + \sum_{i=0}^{n3} \alpha_{3i} \Delta lnF_{t-j} + \sum_{i=0}^{n4} \alpha_{4i} \Delta lnR_{t-j}^{\ +} + \sum_{i=0}^{n5} \alpha_{5i} \Delta lnR_{t-j}^{\ -}$$

$$+\beta_0 lnY_{t-1} + \beta_1 lnT_{t-1} + \beta_2 lnF_{t-1} + \beta_3 lnR_{t-1}^{\ +} + \beta_4 lnR_{t-1}^{\ -} + u_t \tag{4}$$

The definition of variables and notations given in the preceding equations applies to equation 4 too. In equation 4, the test of asymmetry is performed by Wald test where the null hypothesis states symmetric relationship between natural resource and economic growth.

Accordingly, the long run symmetry ($\beta_3 = \beta_4$) and short run symmetry ($\alpha_{4i} = \alpha_{5i}$) will be tested against the alternative hypothesis of asymmetry. On the other hand, the long run relationship between the respective variables is tested with the use of bounds test approach where the null hypothesis of no co-integration is tested against the alternative hypothesis of co-integration.

3.2.3 MTNARDL Model

The NARDL model captures the response of dependent variable to changes in independent variable by decomposing the independent variables in two partial sums of positive and negative. The MTNARDL model developed by Pal and Mitra (2015) extends this by allowing decomposition of the independent variable further into more than 2.

The MTNARDL model is adopted in this study to examine the sensitivity of economic growth to minor, moderate, and major shocks exhibited by natural resources. Accordingly, the current study decomposes natural resources into three partial sums, taking the 30th and 70th quintiles as threshold levels, which are given in equation 5. Less than the 30th quintile, between the 30th and 70th quintiles, and above the 70th quintile are considered minor shocks, moderate shocks, and major shocks to natural resources, respectively, in this particular study.

Decomposing natural resources into 5 and even 10 quintiles allows for better and more rigorous analysis, but it is impossible to do so owing to the small number of data points (only 47 observations) considered by the study. According to Pal and Mitra (2019), this can cause the problem of data inadequacy that would seriously impair reliability of results obtained:

$$lnY_t = lnR_0 + lnR_t(\omega_1) + lnR_t(\omega_2) \quad (5)$$

Such that, $lnR_t(\omega_1)$ and $lnR_t(\omega_2)$ are the two partial sums of natural resource at 30th and 70th quartiles respectively. For each of the series, the thresholds are represented by $\tau_{70}$and τ_{30} are computed as follows:

$$lnR_t(\omega_1) = \sum_{j=1}^{t} \Delta lnR_j\left(\omega_j\right) = \sum_{j=1}^{t} \Delta lnR_j \, \mathrm{I}\{\Delta \mathrm{ln} R_i > \tau_{70}\} \quad (6a)$$

$$lnR_t(\omega_1) = \sum_{j=1}^{t} \Delta lnR\left(\omega_j\right) = \sum_{j=1}^{t} \Delta lnR_j \, \mathrm{I}\{\tau_{70} \geq \Delta \mathrm{ln} R_i > \tau_{30}\} \quad (6b)$$

$$lnR(\omega_1) = \sum_{j=1}^{t} \Delta lnR_j\left(\omega_j\right) = \sum_{j=1}^{t} \Delta lnR_j \, \mathrm{I}\{\Delta \mathrm{ln} R_i \leq \tau_{30}\} \quad (6c)$$

In equations (6a), (6b), and (6c), I$\{\tau\}$ indicate the indicator function taking a value of 1 if the condition is satisfied and 0 if not. Thus, the MTNARDL model can be specified as follows:

$$\Delta lnY_t = \alpha_0 + \sum_{j=1}^{n1} \alpha_{1\,j} \Delta lnY_{t-j} + \sum_{j=1}^{n2} \alpha_{2\,j} \Delta lnT_{t-j} + \sum_{j=1}^{n3} \alpha_{3\,j} \Delta lnF_{t-j} +$$

$$\sum_{i=1}^{3} \sum_{j=1}^{n4} \alpha_{\mathrm{k},\,\mathrm{i}} \Delta lnR_{t-j}(\omega_i) + \alpha_1 lnY_{t-1} + \alpha_2 lnT_{t-1} + \alpha_3 lnF$$

$$+ \sum_{i=1}^{3} \alpha_k lnR_{t-1}(\omega_i) + u_t \quad (7)$$

3.2.4 Causality Test

In order to complete the regression analysis, the study also performs a causality analysis. Co-integration analysis is not complete as it only tells whether the variables have a long-term relationship. Causality analysis fills this gap by ascertaining whether the variables have a causal relationship and, if so, the direction of causality. For this purpose, the study adopts the test method developed by Toda and Yamamotob (1995).

Compared to the standard Granger (1969) Granger (1969) causality test, Toda and Yamamotob (1995) test has some advantages. Firstly, it can be applied to a VAR model of mixed order (Sims *et al.*, 1990; Toda and Yamamoto, 1995).

Secondly, it accounts for a possible absence of stationary and co-integration Wolde-Rufael (2005). Toda and Yamamotob (1995) test is based on the modified Wald statistic and given in the equations (8a) through (8d).

$$lnY_t = \alpha_1 + \sum_{i=1}^{k+d_{max}} \beta_i lnY_{t-i} + \sum_{i=1}^{k+d_{max}} \gamma_i lnR_{t-i} + \varepsilon_t \qquad 8a$$

$$lnR_t = \alpha_2 + \sum_{i=1}^{k+d_{max}} \varphi_i lnY_{t-i} + \sum_{i=1}^{k+d_{max}} \theta_i lnR_{t-i} + \mu_t \qquad 8b$$

$$lnY_t = \alpha_3 + \sum_{i=1}^{k+d_{max}} \omega_i lnY_{t-i} + \sum_{i=1}^{k+d_{max}} \delta_i lnO_{t-i} + u_t \qquad 8c$$

$$lnO_t = \alpha_4 + \sum_{i=1}^{k+d_{max}} \emptyset_i lnY_{t-i} + \sum_{i=1}^{k+d_{max}} \rho_i lnO_{t-i} + v_t \qquad 8d$$

Where, α_1, α_2, α_3, α_4, β_i, φ_i, ω_i, $\emptyset_i$, γ_i, θ_i, δ_i, and ρ_i are parameter estimates, ε_t, μ_t, u_t, and v_t are disturbance terms at time t, t indexes time, k is the optimal lag length determined by the standard information criteria, d_{max} is the maximum order of integration.

4. Results and Discussion

The summary of descriptive statistics for variables considered by the study is given in Table 1. The standard deviation of all of the variables is quite low, which indicates low volatility in the data distribution. Since average values of the variables lie between the corresponding minimum and maximum values, it means that the problem of extreme values is not present in the dataset.

The result reveals that the real GDP per capita of the country averaged 1863.105 USD (an analogue of 7.530) over the study period (roughly five decades). The results also shows that total natural resource rent's share of GDP is only a little above the share of oil's rent on average (13.013% versus 10.804%).

Table 1. *Descriptive statistics*

Variable	Obs.	Mean	SD	Min.	Max.
LnY	48	7.530	0.226	7.236	7.896
LnR	48	2.566	0.660	0.557	3.707
LnO	48	2.380	0.718	0.369	3.651
LnT	48	3.430	0.468	2.212	3.975
LnF	48	2.190	0.345	1.547	2.977

Source: *Own study.*

Result of the unit root test is reported in Table 2. Two conventional methods of unit root test namely ADF and PP are employed in this study. According to Gujarati (2003), these test methods account for potential serial correlation of error terms. In presence of structural shocks, however, these test methods will not produce reliable results (Perrone and Hornberger, 2014).

In order to account for this possibility, the study adopted the method of Zivot and Andrews (1992). Unlike the alternative method of Chow (1960), Zivot and Andrews (1992) assumes a break point is determined endogenously and this mitigates over rejection problem of the former. The results from the conventional unit root tests reveal that total natural resources, a positive shock to total natural resources, and oil are stationary at level, while the remaining variables become stationary only after the first difference.

Therefore, the variables considered by the study are in mixed order, integrated as I 0 and I 1, and none of the variables is I 2, justifying the appropriateness of the ARDL methodology.. The result from Zivot and Andrews (1992) method shows that all of the variables experienced shock in 1980s.

Table 2. *Unit root test*

		Unit root tests with break				
	At level		At first difference		Zivot-Andrews	
variable	ADF	PP	ADF	PP	t-stat	Break point
lnY	-2.220	-1.337	-3.467*	-5.168***	-4.550**	1981
lnR	-4.936***	-4.260***	-7.892***	-10.604***	-3.952***	1989
$\ln R^{+}$	-3.845**	-3.845**	-10.186***	-27.055***	-6.807***	1983
$\ln R^{-}$	-2.152	-2.209	-5.360***	-5.902***	-9.427***	1981
lnO	-4.671***	-4.797***	-6.675***	-15.298***	-4.178***	1989
$\ln O^{+}$	-1.594	-1.508	-6.618***	-12.700***	-3.427**	1983
$\ln O^{-}$	-2.218	-2.118	-5.589***	-5.992***	-3.780**	1986
lnT	-2.261	-2.523	-7.189***	-7.172***	-4.443***	1987
lnF	-2.883	-2.885	-7.056***	-8.171***	-5.476**	1987

Notes: **, ** and *** shows statistical significance avt 10%, 5% and 1% respectively. Optimal lag length for each variable was automatically determined. The test was performed with constant and constant and trend.*
Source: *Own study.*

The linear ARDL model result is shown in Table 3. The top part of the Table reports the long-run model result, while the middle and bottom parts report the results from the short-run model and F-statistics of the bounds test, respectively. Results from two models are reported in the table. The first model is the total natural resource model, while the second model is the oil model.

The result reported in Table 3 indicates that the null hypothesis of no co-integration is rejected at a 10% critical value for the total natural resource model and at 1% for the oil rent model. Therefore, the interaction between economic growth, natural resource availability, trade openness, and financial development is enduring in Nigeria.

As shown in the Table, Nigeria's economic growth is affected by the one-year lagged value of GDP per capita and financial development, and the effect of total natural resources and oil is statistically negligible in the long run. Specifically, economic growth in Nigeria decreases by 1.44% and 2.02% in Model 1 and Model 2, respectively, following a 10% increase in the one-year lagged value of GDP per capita and increases by 1.25% and 1.89% in Model 1 and Model 2, respectively, following a 10% increase in financial development.

The result from the short-run model reveals that both total natural resource rent and oil rent promote economic growth in Nigeria. A 10% increase in total natural resource rent and oil rent has the effect of boosting economic growth by 7.1% and 3.2%, respectively, in the short run. The result further shows that trade openness positively affects economic growth with one period lag in the total natural resource model, while the effect of current values of financial development is positive and its lagged values are negative in both of the models.

The error correction term, reported at the bottom part of table 3, is significant at 1% with the correct sign. Since the coefficient is between 0 and 1 in absolute value, there exists a monotonic type of adjustment process in which shocks occur in the short run towards their long-run equilibrium level at a speed of 14.4% for the total natural resource model and 20.2% for the oil rent model. Put in other words, it takes roughly 7 years and 5 years to restore equilibrium in the case of total natural resource and oil rent respectively.

Therefore, the linear model adopted by the current study presents evidence in support of the resource blessing hypothesis in the short run and in absence of the resource curse hypothesis in the long run.

The positive short run effect of total natural resource and oil rent on economic growth of the country might be due to the positive spillover effect of the same on revenue generation and GDP in Nigeria as found by Fubara *et al.* (2019). The result obtained in this study is consistent with what was established by Cavalcanti *et al.* (2019); Cotet and Tsui (2013); Olayungbo and Adediran (2017) while it starkly contrasts with that of Ofori and Grechyna (2021); Rahim *et al.* (2021).

Table 4 presents results from the NARDL model. As shown in the table, the long-run model result is very similar to that of the linear ARDL model. Only the lagged dependent variable and financial development are statistically significant in explaining the economic growth of Nigeria, with signs similar to those established by the linear ARDL model but with coefficients that are a bit inflated. Specifically, economic growth in Nigeria decreases by 1.85% and 2.4% in models 1 and 2, respectively, following a 10% increase in the one-year lagged value of GDP per capita and increases by 1.61% and 1.93% in models 1 and 2, respectively, following a 10% increase in financial development.

***Table 3.** ARDL model results*

Independent variables	1 ARDL (2 3 3 2)	2 ARDL (2 4 0 4)
Long run model		
C	0.740**	1.056***
lnY(-1)	-0.144***	-0.202***
lnR	0.006	
lnO		-0.004
lnT	0.016	0.021
lnF	0.125***	0.189***
Short run model		
D(lnY(-1))	0.255	0.173
D(lnR)	0.071***	
D(lnR(-1))	-0.020	
D(lnR(-2))	0.059***	
D(lnO)		0.032**
D(lnO(-1))		0.033**
D(lnO(-2))		0.030**
D(lnO(-3))		0.032***
D(lnT)	-0.010	
D(lnT(-1))	0.050*	
D(lnT(-2))	-0.042	
D(lnT(-3))		
D(lnF)	0.095**	0.070**
D(lnF(-1))	-0.071*	-0.099***
D(lnF(-2))		-0.051
D(lnF(-3))		-0.087***
The error correction term and bounds test		
ECT_{t-1}	-0.144***	-0.202***
F (bounds test)	3.29*	5.139***

Notes: **, ** and *** shows statistical significance avt 10%, 5% and 1% respectively. Optimal lag length was automatically determined.*

Source: *Own study.*

The results from the short run model shows that a negative shock to total natural resource rent harms economic growth of Nigeria because the variable (D(lnR^-) is statistically significant at 1% with positive sign. Likewise, a negative shock to oil rent seems harmful to the economy of the country, with a slightly lower marginal effect (0.057) compared to the effect of total natural resource rent.

The result also shows that a one period lagged positive shock to oil rent is marginally significant with positive sign. It indicates that the economic growth of Nigeria responds positively to some positive shocks to oil rent, though slightly weaker than that of a negative shock (0.047). While trade openness positively influences economic growth with one period lag in the case of Model 1, financial development exerts a negative effect on economic growth with time lags in both of the models.

The error correction term is significant at 1% with the correct sign. It shows that the speed of adjustment toward the long-run equilibrium is 18.5% and 24% in models 1 and 2, respectively. Similar to the findings of the current study, a negative shock to oil price adversely affect economic growth in the study by Ibrahim *et al*. (2014). However, it contradicts with that of Adabor and Buabeng (2021) for the case of Ghana

As vividly indicated in Table 4, the bounds test of co-integration reaffirms the presence of a long-run relationship between the variables considered by the study in both of the models at 1%. The result from the Wald test of asymmetry shows that there is an asymmetric effect of total natural resource rent and oil rent on economic growth only in the short run. That means, in the short run, economic growth responds differently to positive and negative shocks to total natural resource rent and oil rent, and that it is more sensitive to negative shocks.

The result from the MTNARDL model, a method used to unravel the effect of shocks of different extents on total natural resource rent and oil rent on economic growth, is provided in Table 5. As indicated, the economic growth of Nigeria responds positively to minor and major shocks to both total natural resource rent and oil rent and negatively to a moderate shock (though statistically insignificant in the case of total natural resource rent) in the long run.

As shown in the Table, the effect of total natural resource rent is stronger compared to that of oil rent. Similar to results from the preceding models, it was established by the MTNARDL model that the effect of financial development affects economic growth positively while the effect of trade openness is statistically negligible. Regarding the short run model, only the effect of a minor shock is statistically significant with a positive-sign coefficient in both of the models. This shows that a minor shock to total natural resource rent and oil rent stimulates economic growth in

Nigeria in both the short run and the long run, while the positive effect of a major shock is felt only in the long run.

Table 4. *NARDL model*

Independent variables	1 (1 0 4 0 4)	2 (3 2 4 0 4)
Long run model		
C	1.089***	1.459***
lnY(-1)	-0.185***	-0.240***
$\ln R^{+}$	-0.030	
$\ln R^{-}$	-0.027	
$\ln O^{+}$		-0.023
$\ln O^{-}$		-0.021
lnT	0.030	0.007
lnF	0.161***	0.193***
Short run model		
D(lnY(-1))	0.255	0.108
D(lnY(-1))		0.232
$D(\ln R^{-})$	0.070***	
$D(\ln R^{-}(-1))$	0.068**	
$D(\ln R^{-}(-2))$	0.064***	
$D(\ln R^{-}(-3))$	0.061***	
$D(\ln O^{+})$		-0.018
$D(\ln O^{+}(-1))$		0.047*
$D(\ln O^{-})$		0.057**
$D(\ln O^{-}(-1))$		0.042
$D(\ln O^{-}(-2))$		0.051**
$D(\ln O^{-}(-3))$		0.053**
D(lnT)	-0.010	
D(lnT(-1))	0.050*	
D(lnT(-2))	-0.042	
D(lnT(-3))		
D(lnF)	0.015	0.043
D(lnF(-1))	-0.089**	-0.093**
D(lnF(-2))	-0.043	-0.080**
D(lnF(-3))	-0.111***	-0.094**
The error correction term and bounds test		
ECT_{t-1}	-0.185***	-0.240***
F (bounds test)	8.861***	4.527***
WSR	12.477***	10.190***
WLR	0.087	0.886

Notes: *WSR and WLR are short run and long run Wald tests respectively. *, ** and *** shows statistical significance at 10%, 5% and 1% respectively. . Optimal lag length for each variable was automatically determined.*

Source: *Own study.*

Unlike its long-run effect, financial development exerts a negative effect in the short run and only in the total natural resource model. As shown in Table 5, the speed of long-run adjustment is somehow slower in the MTNARDL model. For the total natural resource rent model, it takes about a decade and a half to restore long-run equilibrium, while it takes about a year in the oil rent model.

The presence of a long-run relationship between the variables considered by the study was also confirmed by the statistical significance of the F statistic of the bounds test at 1% in both of the models. Coming to the test of asymmetric effect, however, only long run asymmetric effect is observed in case of the oil rent model.

Table 5. *MTNARDL model*

Independent variables	1 (1 1 2 1 0 1)	2 (3 1 1 1 0 2)
Long run model		
C	0.244	0.749**
lnY(-1)	-0.063	-0.132***
lnRreg1	0.039*	
lnRreg2	-0.061	
lnRreg3	0.048**	
lnOreg1		0.031*
lnOreg2		-0.184**
lnOreg3		0.034*
lnT	-0.004	-0.013
lnF	0.069**	0.104**
Short run model		
D(lnY(-1))	0.255	0.021
D(lnY(-2))		0.261**
D(lnY(-3))		
D(lnRreg1)	0.107***	
D(lnRreg2)	-0.009	
D(lnRreg2(-1))	-0.113	
D(lnRreg3)	-0.048	
D(lnOreg1)		0.089***
D(lnOreg2)		0.013
D(lnOreg3)		-0.046
D(lnT)		
D(lnT(-1))		
D(lnT(-2))		
D(lnT(-3))		
D(lnF)	-0.011**	0.024
D(lnF(-1))		-0.009
D(lnF(-2))		
D(lnF(-3))		
The error correction term and bounds test		
ECT_{t-1}	-0.063***	-0.132***
F (bounds test)	5.198***	4.416***
WSR	1.958	2.212
WLR	0.762	7.559***

Notes: *WSR and WLR are short run and long run Wald tests respectively. *, ** and *** shows statistical significance at 10%, 5% and 1% respectively. Optimal lag length was automatically determined.*
Source: *Own study.*

Table 6 reports results from the conventional diagnostic tests associated with the ARDL model and its nonlinear versions. As shown in the table, none of the models suffer from non-normality, serial correlation, heteroskedasticity, model misspecification, or model instability. Therefore, the results produced by the models are acceptable and reliable.

Table 6. *Diagnostic Tests*

Tests	Model	1	2
Normality	ARDL	0.692	0.208
	NARDL	0.193	0.226
	MTNARDL	0.893	0.483
Serial Correlation	ARDL	0.523	0.795
	NARDL	0.390	0.685
	MTNARDL	0.168	0.930
Heteroskedasticity	ARDL	0.594	0.410
	NARDL	0.965	0.978
	MTNARDL	0.323	0.527
Functional Form	ARDL	0.400	0.880
	NARDL	0.231	0.458
	MTNARDL	0.550	0.881
CUSUM	ARDL	Stable	Stable
	NARDL	Stable	Stable
	MTNARDL	Stable	Stable
CUSUMQ	ARDL	Stable	Stable
	NARDL	Stable	Stable
	MTNARDL	Stable	Stable

Notes: *Figures given in column 3 and 4 are probability values*
Source: *Own study.*

The linear and nonlinear causality test results are provided in Table 7. The linear causality test result shows that there is bidirectional causality between total natural resource rent and economic growth in Nigeria and unidirectional causality running from oil rent and financial development to economic growth. On the other hand, bidirectional causality is established by the nonlinear causality test between a positive shock to total natural resources and economic growth, a negative shock to natural resources and economic growth, and a positive shock to oil and economic growth (at 10%), while a unidirectional causality running from a negative shock to oil rent is detected at 10%.

Table 7. *Toda-Yamamoto non causality test*

	Natural resource model		Oil model	
	Test stat.	Prob.	Test stat.	Prob.
Linear non causality test				
lnY → LnR	11.065	0.0258		
lnR → LnY	22.932	0.0001		
LnY → LnO			6.450	0.1679
LnO → LnY			13.89	0.0079
LnY → LnT	2.473	0.6494	2.461	0.6515
LnT → LnY	2.905	0.5737	0.851	0.9315
LnY → LnF	2.799	0.5918	3.089	0.5430
LnF → LnY	11.371	0.0227	9.388	0.0521
Nonlinear non causality test				
LnY → LnR^{+}	16.602	0.0023		
LnR^{+} → LnY	13.102	0.0108		
LnY → LnR^{-}	10.002	0.0404		
LnR^{-} → LnY	12.771	0.0124		
LnY → LnO^{+}			7.870	0.0964
LnO^{+} → LnY			7.832	0.0979
LnY → LnO^{-}			7.293	0.4790
LnO^{-} → LnY			7.945	0.0936
LnY → LnT	6.594	0.1590	3.492	0.4790
LnT → LnY	3.816	0.4315	2.472	0.6495
LnY → LnF	3.391	0.4946	4.665	0.3234
LnF → LnY	6.015	0.1980	4.822	0.3059

Notes: *the maximum order of integration used is 1. The optimal lag length determination is based on Schwartz criteria.*
Source: *Own study.*

5. Conclusion

Every developing country on the face of the earth strives to attain a higher rate of economic growth as much as possible. To this effect, they have been undertaking and continue to undertake different measures depending on contexts. One of the measures we are observing is using the existing natural resources—a gift of nature.

Though seems bizarre, however, there are significant theoretical and empirical evidences that elucidate natural resource is rather harmful than beneficial to economies. Against this argument, there is also a tremendous amount of evidence in favor of the positive role of natural resources.

The current study employed linear and nonlinear models to explore the controversial issue of the nature of the relationship between natural resources and economic growth in the case of Nigeria.

The results from the linear and nonlinear models show that natural resources are growth neutral in the long run and that the "resource curse" hypothesis is not supported. In the short run, the linear model shows a favorable effect of natural resources. From the nonlinear model, it was established in this study that the relationship between natural resources and economic growth is asymmetric and that a negative shock to natural resources is harmful to economic growth while the effect of a minor or major shock to natural resources is positive in Nigeria.

In addition, the study found a feedback effect between natural resources and economic growth. Based on the results obtained, the study recommends that the government of Nigeria design effective strategies to mitigate a negative shock to natural resources and follow economic policies that enable the country to be competitive in international trade in natural resources. Similar future studies can build on the current study and investigate factors that cause negative shocks to natural resources and the drivers of natural resource rent in Nigeria.

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