



NATURAL RESOURCE ENDOWMENT AND ECONOMIC GROWTH: EVIDENCE FROM SOME SELECTED SUB-SAHARAN AFRICAN COUNTRIES

Felix Gbenga Olaifa¹, Ebenezar Adesoji Olubiyi², Oluwasegun Olawale Benjamin,³ and Philip Olugbenga Adebayo⁴

¹Department of Economics and Development Studies, Kwara State University, Malete, Nigeria

²Department of Economics, Federal University of Agriculture, Abeokuta, Nigeria

³Research and Data Analysis Department, Lightway Research and Technology Centre, Ilorin, Nigeria

⁴Department of Business and Entrepreneurship, Kwara State University, Malete, Nigeria

Corresponding email: felix.olaifa@kwasu.edu.ng

Abstract

Sub-Saharan African (SSA) countries are on average blessed with relatively large number of natural resources when compared with other regions of the world. Despite this obvious natural resource endowment, economic growth on the sub-region has not been encouraging. This scenario has prompted studies geared towards examining the extent to which natural resource endowment has impacted on growth in resource rich Sub-Saharan African countries. The objective of this study is therefore to investigate the nexus between ownership of natural resources by some selected SSA countries and their performance in terms of growth. Seven countries in SSA were selected including, Cameroon, Cote d'Ivoire, Gambia, Ghana, Kenya, Nigeria, and South Africa. Data on economic growth, arable land, forest land rent, tertiary education enrolment, and labour force growth obtained from World Development Indicators of the World Bank were used. Using the Pedroni Panel cointegration estimation, result showed that overall, natural resource endowment does not translate to growth as is expected. Hence it is concluded that ownership of natural resources does not translate to growth in SSA. Although high rent on these resources increases government revenue in the immediate, the disincentive it creates to investors and cultivators of these resources in the long run should be the uppermost consideration. The study therefore recommends that while authorities are formulating and implementing policies as regards rent on natural resources, they should carefully bear in mind the possible long-run implications on growth.

Keywords: Natural resource, Economic growth, Sub-Saharan Africa, Endowment, Pedroni Panel cointegration.

JEL classification: O47, O49, Q34.

INTRODUCTION

Previous researchers have pointed out that the ownership of natural resources like oil, natural gas as well as other treasured mineral deposits may not automatically occasion economic growth. Classic examples are several African economies like Nigeria, Sudan, Sierra Leone, Angola, and the Congo that are endowed with oil, diamonds, and several other precious minerals while their populace still suffer low per capita income, poverty, illiteracy, and poor living standard. Conversely, East Asian countries such as Singapore, Korea, Japan, Taiwan, and Hong Kong have



attained giant development strides notwithstanding their rocky islands with practically few or no natural resources.

Many Africa economies were mainly reliant on agriculture for sustenance before the discovery of natural resources. Aside from The Gambia, Niger and Cape Verde, agriculture, fishing, and forestry remained the largest sector for every other country in Africa, representing approximately 60 percent of GDP (Collier and Goderis, 2020). West African countries are main producers of cocoa, timber, cotton, rubber. Liberia for instance is well-known for its large rubber plantations while Nigeria, Sierra Leone, Ghana, and Cote d'Ivoire are endowed with large cocoa and coffee agricultural estates. Similarly, Niger, Senegal, and Burkina Faso are blessed with huge potentials for Sorghum, cotton, and groundnut production, while Mali is prominent in the production of millet, rice, livestock, and cotton. Fishing also remains a key economic activity in many countries along the coast of West Africa, such as, Nigeria, Senegal, Guinea, Guinea Bissau, Sierra Leone, Liberia, Cote d'Ivoire, Ghana, Togo, and Benin Republic. From the foregoing, one would expect that the discovery of oil and other natural resources will bring about economic expansion to the system. But the discouraging performances of these economies have left much to be desired.

A relevant question that is pertinent in the minds of many is whether the discovery of natural resources in Sub-Sahara Africa has considerably exerted a positive impact on the region's economy. Several studies have tried to provide answers to this question. Such studies include Swanson and Philip (2002), Le Billon (2003) and Collier and Goderis (2020), among others albeit with divergent conclusions. From received evidence, there are at least three major reasons discerned to have contributed to the likely poor performance of resource-endowed economies. First, resource wealth possesses the ability to corrupt government officials through bribe rather than promoting the urge to invest in businesses and schemes that occasion long-term growth (Barbier, 2005). This occurrence is prevalent in some natural resources-rich economies such as Nigeria, Sudan, Congo, Sierra Leone, Venezuela, Angola, and Liberia (Mehlum, Moene, and Torvik 2005). The inherent inflows from natural resource deposits in these economies have been drastically lowered sequel to the rent-seeking tendencies of officials, assisted by foreign extractive industries.

Second, the volatile nature of the prices of natural resources makes long term planning and loans redemption very difficult. As prices of natural resources remain highly unpredictable, countries that heavily depend on these commodities often encounter disequilibrium in their terms of trade. According to Poelhekke and Van der Ploeg (2019), whenever natural resource revenues become volatile because of primary commodity price fluctuations, this unpredictability will depress the growth of these economies through a dysfunctional financial system. Third, the discovery of natural resources, especially oil and gas, crowd out other economic sectors, as well as human and social capital through constant transfer of skills endowments and innovation away from other export-oriented sectors of the economy, a situation called the dutch disease. This leads to retarded growth in these sectors. In most of these economies, most citizens clamour for white collar jobs,



rather than contributing to other sectors like the agricultural sector which hitherto served as the mainstay of the economy prior to the discovery of these resources.

Economic growth, which is a positive change, otherwise an increase in output is naturally expected to be aided by income accruals from rent on natural resources such as crude oil, other solid minerals, arable land, and forest land. This income which goes a long way in providing infrastructural facilities provides enabling environment for businesses and investments and is expected to support economic growth. The obvious paradox here is that this seems not to be the case, thus necessitating the question of if there is any significant linkage between natural resource endowments and economic growth in Sub-Sahara Africa. The quest for answers to this question leads to the objectives of the study. Specifically, this study seeks to establish the relationship between natural resource endowment and economic growth in Sub-Sahara Africa.

LITERATURE REVIEW

Conceptual clarification

Natural resources are often taken to be free gifts of nature and includes crude oil, coal, sunlight, metals, natural gas, trees, stones, sand and so on and life is practically impossible without them as they provide, food, water, wood, and energy. Natural resources are termed renewable when they cannot be depleted over time, and they are non-renewable if they can be depleted over time. Economic growth is an increase in production of goods and services in one period compared with a previous period. These outputs are measured as the Gross Domestic Product (GDP) of an economy, and it can be nominal or real when adjusted to account for inflation.

Resource Endowment Theories

Theories of resource endowment include the tragedy of the commons and the resource mobilization theory. The tragedy of the commons is a theory postulated by Hardin (1968). The theory was developed to address issues relating to the dreadful conditions of renewable free access resources as well as the teething troubles of common property resources. This runs riot over usage and the consequential exhaustion of a resource when the resource is subject to free access. In other words, the key prediction of the *tragedy of the commons* is that open access to resources will lead to overexploitation or degradation of all resources. On the other hand, is the dutch disease which is a syndrome that settles on an economy sequel to the discovery of a natural resources. In this situation, other sectors of the economy are crippled as attention is shifted away from them to the new thriving natural resource sector leading to unemployment and massive overdependence on the natural resource sector.

Theories of Economic Growth

Several theories have been adduced to explaining economic growth. The Classical economists opine that the law of variable proportion can be applied to gain an understanding of economic growth. In this regard, increasing either of the factors of production (labour or capital), while holding the other constant and assuming no technological change, will increase output, but at a diminishing rate that eventually will approach zero. Hence, the Classics suggest that what drive economic growth is capital accumulation while population (labour) grows at a constant rate so that



a continuous increase in physical capital (and constant technology) is enough to raise output, albeit, in the long run, economic growth will be constant.

A version of the classical economic growth is the Harrod-Domar model where saving is fundamental to economic growth (Harrod 1948). In this regard, economy must save a certain proportion of its national income, if only to replace worn-out or impaired capital goods (buildings, equipment, and materials). However, to grow, new investments representing net additions to the capital stock are necessary. Specifically, increase in investment made possible by increase in saving leads to increase in economic growth in a proportionate manner. Though Harrod-Domar model explained the importance of saving and investment in the growth process, most especially the growth process of the industrialized countries, it ignores other factors, including technological innovation, labour productivity and levels of corruption that affect economic growth.

Concerning the neoclassical growth theory, the general view of it is that economic growth is determined by certain factors, such as capital stock, supply of labour, and technological progress over time. The neoclassical theory was dominated by the work of Solow (1956) and the Solow's model indicates that labour, capital, and technological progress play a very important role in explaining the dimension of growth as well as the disparities in income across countries. The Solow's model has four major attributes namely, constant return to scale, positive and diminishing returns to private inputs, marginal product of capital (or labour) approaches infinity as capital (or labour) goes to zero and approaches zero as capital (or labour) goes to infinity and lastly, plausible input-output relationship.

Furthermore, Solow (1956) reveals that the opposition of necessary and natural rates results in the *long run* to flow from the fundamental assumption that production occurs under the circumstances of fixed proportions. It was Solow's accomplishment to design the first complete neoclassical growth theory in line with these assumptions as well as the assumption of constant flow equilibrium at the level of full employment which overrides the knife-edge problem. In summary, Solow's model indicates that market forces can bring both natural and necessary growth rates together. It can be deduced from the Solow's model that the long run growth rates are exogenously determined. Also, the income per capita in third world countries may grow faster than developed countries due to their low level of capital per person and output per person (Barro and Sala-i-Martin, 2003).

Though neoclassical growth model explains the process of economic growth, it fails to provide satisfactory explanations of the determinants of long run per capita growth rate. Neoclassical growth model only argued that the long run per capita growth rate is attributable to the rate of technological progress otherwise known as "Solow's residual" which is an exogenous variable. Romer (1980) and Robert Lucas (1990) developed the endogenous growth theory that incorporates a new concept of human capital, the skills and knowledge that make workers productive. Unlike physical capital, human capital has increasing rates of return. Endogenous growth theory has gained recognition for accounting for the empirical regularities in the growth process of developed



economies over the last hundred years. However, the model was unable to explain the qualitatively different empirical regularities that characterizes the growth process over longer time horizons in both developed and less developed economies.

The approach of Schumpeterian growth explains growth because of innovation and a process of creative destruction that captures the dual nature of technological progress: in terms of creation, entrepreneurs introduce new products or processes in the hope that they will enjoy temporary monopoly-like profits as they capture markets. In doing so, they make old technologies or products obsolete. This can be seen as an annulment of previous technologies, which makes them obsolete, and destroys the rents generated by previous innovations. Meanwhile, sufficient evidence has shown that economic growth does not only depend on innovation. There are other important factors like capital and labour that drive economic growth.

Empirical Evidence

Researchers have engaged most of the theories to explain the implication of resource endowment. These empirical studies which include Bah and Yibing (2019), Abbas (2018), Thorvaldur (2008) and Eric (2004) focused on the impact of natural resource endowment on economic growth in resource-rich countries.

Eric (2004) examined whether the resource curse hypothesis hold for growth in Guinea, Botswana, Gabon, Malaysia, Rwanda, and Zambia from 1970 to 1998 with the aid of Panel Least Squares (PLS) and found supporting evidence, but the growth disadvantage of resource-intensive economies is slightly weaker in terms of genuine income than GDP. Also, natural resource economies did relatively better in the 1990s compared to the two decades before. Consequently, natural resource-intensive countries really do suffer from a “resource curse”.

Thorvaldur (2008) evaluated incidence of development and growth in the mineral-rich OECD member countries from 1960 to 2006 using 22 non-industrial mineral-rich countries as test samples and found that correlations suggest an inverse relationship between natural resource dependence and growth via human capital. The human capital variables -education and fertility- account for more than a half of the increase in growth, while investment in real capital accounts for only ten percent. Natural resource dependence and democracy account for the remaining third, in roughly equal proportions.

Bah and Yibing (2019) investigated the impact of natural resources endowment on economic growth in Mali from 1990-2018, using the cointegration and Error Correction Model (ECM) regression technique. The result showed that, when natural resources export interacts with corruption, the impact on economic growth is negative. They however emphasized the need for the country to improve on the management of natural resources revenues by putting in place effective and robust policy measures to eliminate corruption in the public domain.

METHODOLOGY**Theoretical Framework**

The theoretical foundation of the study is established on the extended Solow growth model. Hence, the study profoundly draws from the output growth literature. One of the many discernments of the growth theory is that growth of capital stock, by and large, impacts on equilibrium growth rates. Consequently, the model is seen here as a broad-spectrum structure for growth. Following the Solow growth model, which focuses on how capital accumulation, labour, and productivity affect long run growth, the derivation of the growth model starts from the production function as specified below:

$$Y = Af(L, K) \dots\dots\dots 1$$

where Y is output, K is physical capital, L denotes number of worker, and A , is technology. By taking the derivatives of Equation 1, we arrive at:

$$\Delta Y = MPL \cdot \Delta L + MPK \cdot \Delta K + F(L, K) \cdot \Delta A \dots\dots\dots 2$$

where MPL and MPK are marginal productivities of labour and capital respectively. Dividing all through by $Y = AF(L, K)$ gives:

$$\frac{\Delta Y}{Y} = \frac{MPL}{Y} \cdot \Delta L + \frac{MPK}{Y} \cdot \Delta K + \frac{\Delta A}{A} \dots\dots\dots 3$$

Multiplying and dividing the first and second parts by L and K respectively will give:

$$\frac{\Delta Y}{Y} = \left(\frac{MPL}{Y} L \right) \frac{\Delta L}{L} + \left(\frac{MPK}{Y} K \right) \frac{\Delta K}{K} + \frac{\Delta A}{A} \dots\dots\dots 4$$

Labour and capital shares are therefore fractions of the total output $\frac{MPL}{Y} L$ and $\frac{MPK}{Y} K$ respectively

Denoting labour and capital shares (i.e. $\frac{MPL}{Y} L$ and $\frac{MPK}{Y} K$) by $1 - \alpha$ and α respectively gives the growth accounting Equation 5 below:

$$\frac{\Delta Y}{Y} = (1 - \alpha) \frac{\Delta L}{L} + (\alpha) \frac{\Delta K}{K} + \frac{\Delta A}{A} \dots\dots\dots 5$$

Model Specification

Based on the theoretical framework and relevant literature reviewed in the previous section, we postulate that other determinants will affect growth through the total factor productivity $\frac{\Delta A}{A}$.

According to Yibing (2016), the presence of natural resources, such as natural resource rent, including arable land and forest reserves is also an essential factor of productivity growth and, hence, economic growth since a country with a considerable deposit of natural resources is likely to grow faster. Therefore, following Yibing (2016), this study also includes these variables (natural resource rent, arable land, and forest land). Nevertheless, the experiential patterns of growth in some resource abundant economies are reversed as these countries develop at a slower pace than those with less natural wealth deposits. Some nations, particularly the large oil producers like Nigeria, Saudi Arabia, Equatorial Guinea, Niger, Bangladesh, Mauritania, Venezuela, Yemen, Finland, Macao, Iceland, etc. have endeavoured to use revenues from natural resources as their major source of financing several expanded investments and stimulate development of other sectors.

Incorporating total natural resource rent, including arable land and forest reserves as determinant of $\frac{\Delta A}{A}$ will give the equation below:

$$\frac{\Delta A}{A} = \beta_3 TER + \beta_4 TNR + \beta_5 ARL + \beta_6 FRL \dots\dots\dots 6$$

where TER is Tertiary enrolment, TNR is Total natural resources (excluding arable land and forests), ARL is Arable land, FRL is Forest land. It is expected that these variables, TER, TNR, ARL and FRL should positively affect efficiency. These variables do not have a direct bearing on growth but on productivity which in turn affects growth. Substituting Equation 6 into 5, using capital growth (CPG) $\frac{\Delta K}{K}$ and introducing the intercept α and time and country subscript it gives equation 7 below:

$$\frac{\Delta Y}{Y} = \alpha + \beta_1 \frac{\Delta L}{L} + \beta_2 CPG_{it} + \beta_3 TER_{it} + \beta_4 TNR_{it} + \beta_5 ARL_{it} + \beta_6 FRL_{it} + \varepsilon_{it} \dots\dots\dots 7$$

where $\frac{\Delta Y}{Y}$ represents GDP growth rate, $\frac{\Delta L}{L}$ is growth in labour force, CPG is Capital growth α is the intercept, β_1 to β_6 are the parameters that will be estimated, ε is the error term, subscript t indicates time period and subscript i is the specific country. The inclusion of the variables arable land and forest rent is informed by the fact that they are obvious components of natural resource in any country and also because they have been tested in some studies and this study also wishes to test their impacts on growth. Previous empirical studies examining the impacts of forest rent on economic growth include Hao and Zhang, (2018) and Oyetunji (2017); those that considered the role of labour force growth on economic growth includes Zulu and Banda (2015) and Young (2018). It is expected that the individual explanatory variables positively influence growth, hence the study postulates that each response measuring parameter is positive, that is greater than zero, ($\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6 > 0$).

Estimation Procedure/ Estimation Techniques

The procedure of data analysis involves three different stages; the first stage encompasses the Preliminary Analysis/Pre-Estimation; the second stage contains the estimation, and the final stage involves the Post-Estimation analysis. The preliminary analysis enables us to understand some salient characteristics of the variables utilised in this study. Such attributes are captured by presenting the measure of central tendencies, measure of dispersion and distribution of the series. Information about the stationarity of the series as well as presence/absence of long-run relationship among the series (cointegration), is provided. The estimation itself involves the estimation of parameters of the econometric model through a choice procedure. The post estimation analysis involves ascertaining the validity of the estimated parameters for inferential purposes and policy recommendation through several post estimation tests including the serial correlation, heteroskedasticity and normality tests.

Data sources and measurements

Annual data sets on the variables used viz: GDP growth rate, arable land, forest reserves, natural resource rent, tertiary enrolment rate, investment, labour force growth are obtained from World Development Indicators of the World Bank. The data set employed in this study cover a period of 43 years, over 1980-2022. The period is selected so as to aptly cover for the pre and post Structural

Adjustment Program (SAP) years; a programme that is seen to have affected the growth process of African countries. The study measured economic growth as the growth rate of gross domestic product, arable land was measured as a percentage of land area, investment and forest land resource rent were each measured as a percentage of GDP, labour force growth is in percentage while tertiary school enrolment rate is used as a proxy for human capital. The seven countries used for the analysis are Nigeria, Ghana, Ivory Coast, Gambia, South Africa, Kenya, and Cameroon. These countries are selected based on ease of data availability but also in a way to ensure that all parts of Sub-Saharan Africa are covered. Thus, while Cameroon is from central Africa, Kenya is from the east, South Africa is from the south and the rest; Nigeria, Ghana, Cote d'ivoire and Gambia are from west Africa.

RESULTS AND DISCUSSION

The descriptive statistics of the series reported includes the mean, minimum and maximum values of each of the series as presented in Table 4.1.

Table 4.1: Descriptive Statistics of the Variables used in the study

VARIABLES		CIV	CMR	GHA	GMB	KEN	NIG	SA	ALL
$\frac{\Delta Y}{Y}$	Mean	2.38	2.82	3.22	5.30	3.70	4.86	4.41	3.58
	Max	10.70	6.78	7.05	14.04	8.40	15.32	5.60	15.32
	Min	-4.38	-7.93	-4.29	2.178	-0.79	-2.03	-2.13	-7.93
ARL	Mean	8.91	12.73	29.99	17.28	9.31	36.81	10.77	17.97
	Max	9.43	13.11	44.46	20.74	10.36	40.62	11.38	44.46
	Min	7.64	12.56	15.90	11.86	8.20	30.93	9.91	7.64
CPG	Mean	14.78	12.55	31.64	22.88	17.40	19.46	23.81	21.37
	Max	17.11	16.73	34.61	26.80	21.24	23.44	28.05	24.04
	Min	12.82	9.88	25.86	19.77	13.59	15.70	17.33	18.38
FRL	Mean	3.09	3.21	4.19	7.81	4.12	2.41	0.82	3.66
	Max	4.97	5.86	8.98	13.90	7.28	5.25	1.21	13.90
	Min	2.02	2.12	2.00	4.34	2.68	0.97	0.48	0.48
$\frac{\Delta L}{L}$	Mean	2.4	1.6	1.3	1.8	5.0	2.7	3.5	2.6
	Max	5.2	3.1	2.8	4.8	7.4	3.6	2.5	3.7
	Min	1.3	0.8	1.0	1.6	2.1	1.3	1.1	1.2
TER	Mean	8.31	14.27	15.46	3.14	10.04	10.11	18.76	9.46
	Max	11.04	19.66	17.90	8.47	14.53	16.68	21.91	14.55
	Min	4.71	10.58	8.15	2.28	8.00	9.74	13.22	8.72
TNR	Mean	5.34	8.08	4.19	11.42	4.16	16.68	5.26	7.87
	Max	9.47	13.10	8.98	19.41	7.28	31.81	12.93	31.81
	Min	3.33	5.24	2.00	5.40	2.69	4.85	2.24	2.00

Source: Author's Compilation: where; Max = maximum value Min = minimum value, and where CIV is Cote d'ivoire, CMR is Cameroon, GHA is Ghana, GMB is Gambia, KEN is Kenya, NIG is Nigeria, SA is South Africa and ALL represents the average of the seven countries.

As shown in the table, the average economic growth rates of all the selected countries put together is 3.58% and the highest and lowest recorded by the countries on the average within the period of study is about 15.3% and -7.9% respectively. Gambia is shown to have recorded the highest average growth individually among the countries selected with an estimate of about 5.3%, followed by Nigeria with an estimate of about 4.87. This implies, on the average, Gambia was the fastest growing economy among all the countries being studied. Cote d'ivoire had the least average growth rate within the periods of study as it recorded about 2.38%.

Pairwise Correlation Analysis

The pairwise correlation result is presented in Table 4.2 below.

Table 4.2 Pairwise Correlation of the variables

	$\frac{\Delta Y}{Y}$	ARL	CPG	FRL	$\frac{\Delta L}{L}$	TER	TNR
$\frac{\Delta Y}{Y}$	1.0000						
ARL	0.5092 (0.007)	1.0000					
CPG	0.1209 (0.092)	0.4892 (0.057)	1.0000				
FRL	0.6681 (0.043)	0.0275 (0.055)	0.1575 (0.230)	1.0000			
$\frac{\Delta L}{L}$	0.2880 (0.087)	-0.4641 (0.492)	-0.5872 (0.003)	0.4234 (0.374)	1.0000		
TER	-0.7431 (0.117)	0.0056 (0.014)	0.2414 (0.567)	-0.7637 (0.073)	-0.4914 (0.003)	1.0000	
TNR	0.7477 (0.027)	0.6189 (0.000)	-0.1446 (0.004)	0.1461 (0.741)	-0.0138 (0.257)	-0.4195 (0.073)	1.0000

Source: Author's Compilation :where $\frac{\Delta Y}{Y}$ is GDP growth, ARL is arable land, CPG is capital growth, FRL is forest land, $\frac{\Delta L}{L}$ is labour force growth, TER is Tertiary education registration and TNR is Rent on natural resources. The p-values are in parenthesis below the coefficients and the decision rule is to conclude that a correlation coefficient is significant if the attached p-value is less than 0.05 (i.e., 5% significance level).

On the pairwise correlation between the variables, growth rate and total natural resource rent is the strongest with a value of 0.74, followed by that between forest rent and growth which is 0.66. The weakest correlation exists between forest rent and arable land and also between tertiary education enrolment and arable land having 0.02 and 0.03 respectively.

Unit Root Tests Results

In order to avoid running a spurious regression, it is essential that the stationarity property of the series in consideration is examined. Thus, for this study, the Levin, Lin and Chu panel unit root test was adopted to examine the stationarity property of the series. This is particularly important to ensure the series are level stationary or at most integrated of order 1. The test null hypothesis is that each of the series in question has a unit root, i.e., it is non-stationary, and the decision is to reject the null hypothesis when the attached p-value at either the constant or at constant and intercept is less than 5%.

Table 4.3: Levin, Li and Chu Unit Root Test Results

	Level			First Difference			I(d)
	None	Constant	Constant& Intercept	None	Constant	Constant& Intercept	
$\frac{\Delta Y}{Y}$	-2.845 (0.1504)	-2.471 (0.1154)	-2.316 (0.0141)				I(0)
ARL	-1.486 (0.2312)	-1.862 (0.1841)	-2.092 (0.1003)	-4.396	-2.617 (0.0944)	-2.105 (0.0462)	I(1)
CPG	3.284 (0.4192)	0.724 (0.2272)	-5.066 (0.1410)	-7.463 (0.0921)	-6.913 (0.1132)	-4.544 (0.0075)	I(1)
FRL	-1.098 (0.3121)	-0.293 (0.2528)	-0.594 (0.1332)	-9.954 (0.1004)	-4.306 (0.0721)	-2.981 (0.0059)	I(1)
$\frac{\Delta L}{L}$	3.485 (0.4522)	0.842 (0.3102)	-6.110 (0.1703)	-5.518 (0.1237)	-3.276 (0.0612)	-3.014 (0.0002)	I(1)
TER	-2.614 (0.1294)	-2.305 (0.1004)	-2.182 (0.0323)				I(0)
TNR	-1.390 (0.2601)	-0.941 (0.2183)	-0.194 (0.1611)	-11.823 (0.1403)	-7.610 (0.0021)		I(1)

Source: Author's Compilation where $\frac{\Delta Y}{Y}$ is GDP growth, ARL is arable land, CPG is capital growth, FRL is forest land, $\frac{\Delta L}{L}$ is labour force growth, TER is Tertiary education registration and TNR is Rent on natural resources. I(d) means Order of Integration and values in parentheses are the attached p-values. The decision is to reject the null hypothesis when p-value is below 5%.

From Table 4.3, it can be seen that the series are a combination of I(0) and I(1) series. Specifically, the table shows that for investment, forest rent, labour force and total natural resource rent, their respective series has to be differenced once before they become stationary, i.e. the null hypothesis of the test could only be rejected for the respective series after differencing once. Two of the variables, (i.e., GDP growth rate and tertiary education enrolment) are found to be level stationary. Since almost all of the variables of the study are differenced stationary, using the static panel estimation becomes inappropriate as the static panel model cannot accommodate I(1) series and, hence, the adoption of a more dynamic technique has to be resorted to. However, the choice

of estimation technique may not be ascertained until the co-integration property of the variables is evaluated. Accordingly, the co-integration test is conducted, and the result is as presented and evaluated below.

Co-Integration Test Results

Having examined the stationarity condition of the series in consideration, it is expedient that the co-integrating relationship among the variables is assessed, as this is necessary to determine the appropriate choice of modelling and estimation technique. The Pedroni Panel Co-Integration test is adopted. The test assumes that no co-integration exists among the variables. A p-value of less than 5% indicates significance and the null hypothesis of no long-run relationship can be rejected. The results of the tests are presented in Table 4.4. where the test is conducted for between cross-section dimensions, i.e., the co-integrating relation among the variables is assessed among all the countries put together.

From Table 4.4, it is seen that the reported probability values are less than 5%. This implies that when all the countries' data are pulled together, a long-run relationship exists among the variables. This therefore necessitates the adoption of Dynamic Panel Model otherwise known as Panel ARDL.

Table 4.4: Pedroni Panel Cointegration Test Results

	Model 1		Model 2	
	T-Statistic	P-Value	T-Statistic	P-Value
Between country Dimension				
Group rho-statistic	0.496691	0.6903	1.335643	0.0042
Group PP- statistic	-3.122146	0.0009	-12.36184	0.0000
Group Panel Statistic				
Group ADF-statistic	-1.933734	0.0266	-3.099905	0.0010

Source: Author's Compilation: A p-value of below 5% for any two of the three statistic indicates significance.

Regression Analysis Results

Based on the unit root and co-integration test results, the Dynamic Panel Model (Panel ARDL) is estimated to provide evidence of short-run and long-run relationship existing among the variables. The regression analysis is done first without the total natural resource rent variable and later with the variable to see if adding the variable will improve the existing result. The short-run and long run results for the two estimations are presented in Table 4.5 below.

Table 4.5: ARDL Results

Regression Estimate Without Natural Resource Rent			
Short Run Estimate			
Variable	Coefficient	t-statistics	p-value
ECC	-0.611	-5.117	0.004
$D(\frac{\Delta Y}{Y})$	0.071	1.400	0.162
D(ARL)	0.017	0.224	0.823

D(CPG)	28.892	1.580	0.115
D(FRL)	-6.456	-2.160	0.030
$D(\frac{\Delta L}{L})$	-11.569	-3.950	0.000
C	-0.075	-4.740	0.000
Long Run Estimate			
ECC	-0.741	-4.501	0.002
$\frac{\Delta Y}{Y}$	0.361	1.380	0.166
ARL	0.717	0.670	0.502
CPG	0.919	0.010	0.994
FRL	-1.299	-5.210	0.000
$\frac{\Delta L}{L}$	0.841	2.320	0.020
C	1.356	11.170	0.000
R-Squared	0.49	F stat (Prob F stat)	1749.69 (0.000)
Regression Estimate with Natural Resource Rent			
Short Run Estimate			
COINTEQ01	-0.206	-7.507	0.000
$D(\frac{\Delta Y}{Y})$	0.002	0.105	0.917
D(ARL)	0.019	1.018	0.309
D(INV)	-0.139	-1.871	0.062
D(FRL)	-6.456	-2.160	0.030
$D(\frac{\Delta L}{L})$	-4.292	-3.120	0.002
D(TNR)	0.211	1.790	0.073
Long Run Estimate			
$\frac{\Delta Y}{Y}$	0.758	1.260	0.207
ARL	23.658	1.160	0.246
INV	-1.649	-1.520	0.127
FRL	-2.010	-0.340	0.734
$\frac{\Delta L}{L}$	1.857	2.010	0.045
TNR	-5.025	-2.450	0.014
R-Squared	0.5903		
F stat (Prob F stat)	1200.86 (0.000)		

Source: Author's Compilation: Values in parentheses are the respective *p*-values attached to the coefficient and indicates significance below 5%.

Discussion

The R-squared value of 0.59 (59%) indicates that 59% of variations in growth is accounted for, and with a p-value of the F statistics of 0.08 (8%) indicates that the model is a good fit at 8% level of significance. From the short-run estimation result presented in Table 4.5, there seems to be no impact of most of the explanatory variables considered on economic growth. This is because the t-statistics reported for each of the explanatory variables is less than 1.96. This implies that the null hypothesis that each of the individual explanatory variables does not influence economic growth rate cannot be rejected. However, the Error Correction Coefficient (ECC), which shows how quickly the short-run converts to long-run, is estimated to be statistically significant, affirming that a long-run relationship truly exists among the variables. Having fulfilled the two conditions of significance, negativity and less than 1 in absolute term, the coefficient shows that about 74% of deviation in the short-run is adjusted for annually. This further implies that it takes approximately about three quarters of a year for every short-term deviation to be fully adjusted for the long run.

Table 4.5 also presents the long run results. As shown in the table, a negative relationship is found to exist between forest rent and economic growth in the long-run. With a statistically significant coefficient of -2.57, it is shown that forest rent has a negative influence on rate of economic growth in the long-run, such that for every 1% increase in forest rent as a percentage of GDP, economic growth decreases by approximately 2.57%. This finding goes contrary to the expectation expressed in Section 3 where it is posited that forest rent should have a positive effect on economic growth. It also contradicts the finding of Hao and Zhang (2018) as well as Oyetunji (2017). This unexpected finding may be because most of the forest resources are being informally exploited by illegal operators which is without proper documentation and record. Labour force growth on the other hand, records a positive and significant coefficient in equation for economic growth, with a 1% increase in labour force raising growth by 3.15%. This finding is in line with the Section 3 postulation where it is posited that labour force growth should have a positive effect on growth and in line with the findings of Zulu and Banda (2015) as well as Young (2018). However, the size of arable land and GDP growth rate lagged by a period, total natural resource rent and investment are all shown as having no effect on economic growth. This may be so because most arable lands are left uncultivated and high level of corruption in the administration of proceeds of natural resources rents.

The estimation results after inclusion of the total natural resource rent variable are also presented in Table 4.4. Although, the inclusion of the variable does not change the existing results significantly, its inclusion, however, improves the predictive ability of the model marginally from an R-Squared value of 49% to 51%. The error correction parameter also improved from about 74% of the short-term deviation adjusted for annually to about 77%. It also reduces the negative influence of forest rent on growth falling from -2.798% estimated earlier on to -2.57%.

CONCLUSION AND RECOMMENDATIONS

Based on the findings of this study, it can be concluded that no relationship exists between natural resource endowment and economic growth rates, as most of the natural resource endowment indicators considered in this study do not influence growth rate. Nonetheless, there is linkage

between a country's labour force and economic growth such that growth is enhanced with increase in the size of the labour force. However, forest reserves influence economic growth albeit negatively. The reason for this is not far-fetched, as excessive rental charge on forest cultivation or utilization can prevent further usage which, in the long-run, can significantly affect national output growth. High rent on some of these forest resources can also discourage foreign investors who might be interested in cultivating the forest land for mass production of woods and its by-products. Based on the findings of this study, the following recommendations are put forward:

- i. Evidence obtained in this study shows that rent on natural resources does not support growth as anticipated. Therefore, it is recommended that while authorities are formulating and implementing policies as regards rent on natural resources, they should carefully bear in mind the consequences. Although high rent on these resources increases government revenue in the immediate, the disincentive it creates to investors and cultivators of these resources in the long run should be the uppermost consideration of policy makers.
- ii. The study found that growth in labour force supports economic growth. It is therefore recommended that perhaps policies to enhance selective immigration of skilled manpower to augment available local labour force should be put in place to promote economic growth further still.
- iii. Since there is evidence of a positive linkage between the size of a country's arable land and economic growth, the coefficient is not significant, implying that arable land has no effect on economic growth. This can however be made significant if African countries fully embraced mechanized farming to ensure that the abundant arable land is fully utilized.

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