The Impact of Natural Resource Abundance on Economic Growth in Nigeria: A Look at History for the Sake of Future.

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Abstract

One of the most disturbing characteristics of modern economic growth history is that economics that are well-endowed with natural resources have tended to grow slower than economies not well endowed with natural resources. While economic historians and development economists have been puzzled over the addity of resource-poor countries outperforming the resource-rich ones in their living standards, this study examines the impact of natural resource dependency on economic growth in Nigeria within the framework of autoregressive methodology. Exploiting a time series data for the period 1970 – 2014, the study found the speed of adjustment (1 - λ) at which per capita income returns to its steady state equilibrium position to be about 39 percent after it wonders away within two years and that natural resource dependency has not significantly enhance economic growth in Nigeria. Based on this finding, it is recommended that sustainable growth of income per capita can be achieved by initiating appropriate macroeconomic policies that are aimed at improving the efficiency and effectiveness of natural resource exploitation in the economy, and a revision of fiscal and budgeting systems.

1. INTRODUCTION

One of the most surprising characteristics of modern economic history is that resource-poor economies tend to grow faster than resource-rich economies in living standards. In recent times, both economic historians and development economists have been puzzled with the realism of the resource-poor regions outperforming the resource-rich ones in their process of economic transformation. For instance, during the 17th century, a resource-poor Netherlands eclipsed Spain a resource-rich economy – despite the over flow of gold and silver from the Spanish colonies in the New world. In the 19th and 20th centuries, resource-poor countries such as Switzerland and Japan surged ahead of resource-rich economies like Russia and some other Soviet Union members. At the dawn of the 21st century, the World's star economic performers like the East-Asian countries of Korea, Taiwan, Hong Kong and Singapore which were hitherto resource-poor were outperforming many of the oil-rich economies like Mexico, Nigeria, Venezuela among others. A number of possible explanations have been provided for these economic development paradoxes – some of which were social, political and others, economic.

This paper attempts to unearth some of the key issues in the debate by systematically tracing out the Nigeria's experience within the context of natural resource exploitation for sustainable development. The rest of the paper is structured as follows: section 2 presents some theoretical issues and facts about natural resources exploitation; section 3 presents the theoretical framework and model specification. Section four presents the empirical findings while section 5 summarized the findings and concluded the study.

2. SOME THEORETICAL ISSUES AND BASIC EMPIRICAL FACTS ABOUT THE EVOLUTION OF NATURAL RESOURCE SCARCITY AND SUSTAINABLE DEVELOPMENT

Many years ago, a 14th century philosopher, Ibn Khaldun (1332 – 1406) raised concern over the impact of great wealth on a society in which he identifies the fifth stage of the "state" as one of waste and squandering (Ibn Khaldun, 1967). This concern precipitated into a heated debate among development economists in the 1950s and 1960s. Earlier, Nurkse (1953) and Rostow (1960) accentuated the positive impact of natural resources on economic development within the context of the Prebisch (1950) Singler (1950) hypotheses in which lies the argument that primary product exporters would find themselves disadvantaged in trading with the industrialized countries (the Centre) because of deteriorating terms of trade.

This position was reinforced by Hirschman (1958), Seers (1964) and Baldwin (1966) who argued that linkages from primary product exporters would be limited compared to manufacturing within the structural mechanisms of the Dutch Disease hypothesis. This section attempts to evaluate the linkages between natural resource scarcity and its evolution during the last centuries, by bringing out the key debates over the years in order to shape the future of resource exploitations.

2.1 The First Debate: The British Classical Economists.

An 18th century philosopher, Thomas Malthus published his well known essay on the principles of population in which he argued against theories raised by the growth optimists and some philosophers (such as Nicolas de Condercet) who believed that the human and technological development would solve all obstacles to future progress in economic growth. According to Malthus (1798), the human race would always breed until the limits of natural resources are met, and at that equilibrium, societies are characterized by misery, starvation and a subsistence level of wages. Other classical economists like John Stuart Mill were not as pessimistic as the earlier philosophers. According to Mill (1862), the limited quantity of natural resources could in principle, constrain increases in production such that this limit had not yet been reached and would not be reached in any country over any meaningful time frame. According to Mill, a world where the environment is used completely for industrial and agricultural purposes is not an ideal world.

2.2 The Second Debate: The conservationist movement in the U.S and the Hotelling-Barnett and Morse studies.

Between 1890 and 1920, a conservation movement with the (then) U.S President Theodore Roosevelt as one of its leaders launched a highly successful political ideology which claimed that economic growth has clear physical boundaries that cannot be avoided by technological development. This group claimed that too rapid use of non renewable resources was considered a major threat to future generations. They argued further that the lower the use of non renewable resources, the better and that Government control of natural resources was deemed desirable.

In a slight reaction to the conservation movement, Harold Hotelling (1931) published a study entitled "The Economics of Exhaustible Resources" in which he constructed a theoretical model which opined that social well-being from non-renewable resources was maximized over an infinitely long period and in a market economy, profit maximizing mining firms would extract non-renewable resources at the "socially optimal rate". While this study was widely accepted by economists, some thirty years later, Barnett and Morse (1963) in their study "Scarcity and growth" collected price and cost time series data on minerals, agriculture, and renewable resources with the main objective of testing the hypothesis that increasing natural resource scarcity could obtain empirical support. The result showed that for agriculture and minerals, price and production costs had fallen or remained constant within the period 1870- 1957. Only the price level in forestry had shown an upward trend. This study believed that technological development which produces substitutes for scarce resources decreases extraction costs of minerals, and thus expands the size of economic reserves.

Unfortunately, natural resource scarcity played little part in the 19th century neoclassical economics, from which the traditional Keynesian theories were derived. The classical economists had regarded income as the return to three kinds of assets, namely; natural resources, human resources and invested capital (land, labour and capital). According to Repetto et al (1992), the neoclassical economist virtually dropped natural resources from their model and concentrated on labour and invested capital. When these theories were applied after the second world war (WW II) to the problems of economic development in developing countries, human resources were also left out on the grounds that labour was "surplus" and development was seen almost entirely as a matter of savings and investments in physical capital (Higgins, 1959; Yotopoulos and Nugent, 1976).

2.3 The Third Debate: The Limits to Growth Report for the Club of Rome.

According to Meadows et al (1972), the limit to Growth report for the club of Rome was based on new digital computers and on a modeling method called "System analysis". This study presented a large new type of model in order to predict the future development of five global variables such as: population, food, industrialization, nonrenewable resources, and pollution. According to this study, the future world population level, food production and industrialization would first grow exponentially but then collapse during the next century. The collapse follows because the world economy will reach its physical limit in terms of non-renewable resources, agricultural production, and excessive pollution may result and that eleven vital minerals could be exhausted before the end of this century. Among these vital minerals, Tahvonen (2000) listed to include copper, gold, lead, mercury, natural gas, oil, silver, tin, and zinc. This prediction was rather pessimistic and subsequently failed as the world's proven reserves has been on the increase. One major problem with this study was the dependency of the authors on personal intuition and not on any statistical data. There was also the neglect of the price system and the dynamics of the market economy and thus, the prediction largely possessed a strong Malthusian tendency. As a consequence, Wassily Leontief (1977) carried out a study (based on the request of the United Nations) on whether natural resources will be exhausted before the end of the century. Leontief, in his study, took into account the fact that demand may respond to higher prices and that only two minerals were in the danger of being exhausted.

2.4 The Fourth Debate: The "Pre-Sustainability" Research in Economics (1974 till date).

Consequent upon the first energy crisis of 1973, Partha Dasgupta and Greffrey Heal (1974) in their study on "The optimal depletion of natural resources", an economic growth and nonrenewable resource model questioned the view that the world was entering into a future of increasing scarcity of energy and natural resources. According to them, it is possible to maintain a positive consumption level forever only if capital can be substituted for nonrenewable resources without technical difficulties, if the substitution possibilities are limited, future consumption per capita must finally fall to zero. Secondly, their study posited that even in cases where it would be possible to maintain positive consumption forever and thus achieve sustainable development, the market system may lead to an outcome where consumption per capita in the long-run falls to zero. Perhaps, this outcome may occur if consumers are unwilling to save a high proportion of their income or invest in capital, or if population growth rises too rapid.

In some other studies, Solow (1974), Stiglitz (1974) and Hartwick (1977) showed the possibility that market economies may not lead to sustainable outcome even if it is technically possible. They showed that sustainable development may be possible if the economy invest all of its economic surplus or profits from using nonrenewable resources in capital accumulation. In such an economy, government may have to create an incentive for this to occur either by taxation or other fiscal measures. As a way of changing the pessimistic views as noted above, Dasgupta and Stiglitz (1981) argued that in a model of longrun economic growth that could incorporate renewable resources like solar and wind energy, the economy may first uses up its nonrenewable resources and simultaneously invest in some revolutionary technology that decreases the cost of using renewable energy.

Against the background of these views, Tahvonen and Salo (2000) concluded that nonrenewable resource price may decline if markets are not able to anticipate new discoveries and new substitutes for those resources that are becoming more scarce.

Secondly, another important reason for the declining resource prices is continuous technical progress in nonrenewable resource extraction. As the market mechanisms continue to be efficient, nonrenewable resources would definitely be saved from exhaustion.

3. THEORETICAL FRAMEWORK AND MODEL SPECIFICATION

3.1 THEORETICAL FRAMEWORK

Past developments in natural resource scarcity showed clearly that theories which neglected technological change have always failed. Prior to the mid-1980s, technological change was taken as exogenous – not explained in the growth model. With the emergence of "endogenous growth theory", technological development is seen as a continuous progress that originates from innovations that are made in firms and can be speeded up by government investments in research and development and in general education.

Some recent and highly optimistic studies on growth and natural resources showed that the physical limits to natural resource supply do not cause any serious effects on economic growth. This is because growth is seen to be dependent more strongly on technological development, education and economic policy (Tahvonen, 2000). In such growth theories, explanations are provided to the factors that determine the rate of growth of gross domestic products (GDP) that are left unexplained and are exogenously determined in the Solow-Swan neoclassical growth equations. Consequently, the existence of increasing returns to scale and the divergent long-term growth patterns are explained in such a way that exogenous changes in technology are no longer necessary to explain long-term growth. The relative importance of this theory has implications for the role of government in economic growth process and the direction to which natural resources could be exploited towards the attainment of sustainable economic development.

3.2 MODEL SPECIFICATION

Following the neoclassical growth models of closed economies presented by Ramsey (1928), Solow (1956), Cass (1965), Koopmans (1965) and the empirical cross-country growth equations described in Barro (1991) and adopted by several authors, there exist an evidence of inverse association between natural resource abundance and economic growth for the period 1970 – 2014. Starting with the familiar production function in its intensive form:

$$Y_t = A_t F(K_t L_t) - 1$$

Where Y_t = output at time t; A_t = technology at time t; K_t = the level of physical capital at time t; and L_t = the level of labour at time t.

The neoclassical theories assume the following properties for the above production function:

1. F(*) is concave in K and L. this implies a positive and diminishing marginal productivity of each input.

   $F_K(*) > 0$ and $F_{KK}(*) < 0$ for all $K > 0$ and $L > 0$

   $F_L(*) > 0$ and $F_{LL}(*) < 0$ for all $K > 0$ and $L > 0$

2. F(*) exhibit constant returns to scale

   $F(\delta K_t \, \delta L_t) = \delta . F(K_t \, L_t)$ for all $\delta > 0$

3. F(*) satisfies the Inada conditions:

   $Lim_K \to 0 \, (F_K) \Rightarrow Lim_L \to 0 \, (F_L) \Rightarrow \infty$

   $Lim_K \to \infty \, (F_K) \Rightarrow Lim_L \to 0 \, (F_L) \Rightarrow 0$

Within the neoclassical framework, the growth equation has the following general form:

$$\ln(^{y_{(T)}}/_{y_{(0)}})/T = \alpha_0 + \alpha_1 \ln(y_{(0)}) + \alpha_2 Z + \varepsilon - - - - - - - - - - - - - 2$$

Equation (2) states that per capita income at time T depends more fundamentally on per capita output at a starting period (0) and a vector of economic characteristics (the Z's) that determines a country's steady state income level.

While this study acknowledge the fact that the above specification varies across studies, the overall objective here is to test the hypothesis that growth experience in Nigeria can be explained by transitional dynamics and how the country adjust to her steady state income with a speed that is less than infinite. The sign of the coefficient, α_1 provides a crucial test of this hypothesis. A negative α_1 implies that the adjustment path to the steady state is concave, with the speed of adjustment faster at the beginning when the country is furthest from its steady state income level. The purpose is to test whether measures of natural resource intensity are among the Z's. for this reason, the measure of natural resource dependency is the ratio of primary product exports to GDP in 1970 which is denoted as MNRD.

Since both per capita income and output depend on the availability of both natural and other resources, the estimating equation is restricted to:

$$GDPPC_t = \alpha_0 + \alpha_1 MNRD + (1 - \lambda)GDPPC_{t-2} \quad ---------------- 3$$

Where $GDPPC_t$ = per capita income over the period of time;

MNRD = measure of natural resource dependency;

α_0 = the intercept and α_1 = the coefficient which defines the speed of transition to steady state income level. t – k is the length of lag (2 periods)

3.3 DATA AND ESTIMATION PROCEDURE

Equation (3) was estimated using annual data for per capita income and the measure of natural resource dependency for the period 1970 – 2014. The data were obtained from the Statistical Bulletin of the Central Bank of Nigeria and the Annual Abstract of Statistics of the National Bureau of Statistics. An Augmented Dickey-Fuller (ADF) Test is carried out to place the regression results on a sound footing. All regression equations were estimated using the Ordinary Least Square (OLS) technique. An e-view software (version 7.0) was used in estimating the parameters.

4. EMPIRICAL ANALYSIS

4.1 MODEL ESTIMATION: Stationarity and Cointegration

Based on the unit root characteristics of the variables, the Augmented Dickey-Fuller test was carried out. Since the response variable (GDP per capita) has the same order of integration with the policy variable (Natural resource endowment), the linear combination of the variables were estimated at a level form without the intercept and their residual obtained and subjected to cointegration test as shown on table 1 below

Table 1: Test of Unit Root

Variable	Critical	ADF Stat	Status
GDPPC	-4.202011	-2.9320	1(1)
NREND	-6.702937	-2.9320	1(1)

Level of significance, 5%.

The result show the presence of cointegration between the response variable and the policy variable, depicting a long run relationship between real GDP growth and the intensity of natural resources. The ADF test result showed that the variables are integrated of order 1 at 05 percent critical level. This implies that the null hypothesis of no cointegration among the variables cannot be rejected.

Table 2: Regression Results of the Impact of Natural Resource Endowment on Economic Growth

Dependent Variable : Real GDP

Method : Least Squares

Sample: 1970 – 2014

Included observations: 45

Variable	Coefficient	Std Error	t-Statistic	Prob
Constant	1.550689	0.328314	4.723193	0.0000
$GDPPC_{t-2}$	0.610798	0.086650	7.049056	0.0000
NREND	0.033205	0.016457	2.017753	0.0500
R-Squared	0.689991	Mean dep. Variable		4.136667
Adj.R-Sq	0.675229	S.D. dep variable		0.965995
S.E of regression	0.550508	Akainke info. Criterion		1.708388
Sum of Sq.Res.	12.72846	Schwartz Criterion		1.828832
Log Likelihood	-34.43873	F-Statistic		46.74006
Durbin-Watson Stat	2.165674	Prob (F-Statistic)		0.00000

Source: Own computation

Significance at 5 percent level.

4.2 DISCUSSION OF RESULTS

The regression results as presented in table 2 above is carried out in line with the empirical model for this study as specified in equation (3). The least squares estimates were done at 5 percent level of significance to show the relationship between natural resource endowment and economic growth in Nigeria for period 1970 – 2014. The results are plausible because the estimated t-ratios corresponding to the coefficients are statistically high while the coefficient of determination defined by R^2 which measures the goodness of fit of the model is equally high. This means that the explanatory power of the regression equation are high. Since the value of the Durbin-Watson Statistic is 2.165674, autocorrelation is not a serious problem.

The results present an overwhelming evidence that GDP per capita depends more fundamentally on its past values than the natural resource endowment. As a matter of fact, the result shows that per capita income would rise by about 61 percent for every one unit change in the previous years GDP per capita, holding natural resource endowment constant. This imply that per capita income growth takes place along the path of economic growth with the speed of adjustment $(1 - \lambda)$ of about 39 percent (0.389202) for long run equilibrium income to be realized.

On the other hand, GDP per capita would rise by about 3 percent for every unit change in natural resource abundance, holding previous levels of income constant. Usually, natural resource abundance is often found to exhibit negative sign in most studies, due to the "Dutch disease: effect. The Dutch disease hypothesis demonstrates that high price of natural resources would attract factors from other sectors to flow into the resource sector so that at the long-run, economies would tend to rely solely on the resource sector to decrease the growth rate because of decreases in marginal rate of returns from the single sector. The positive sign exhibited by the natural resource endowment parameter imply that as the economy experience resource boom, it took advantage of the competitive condition that prevail within the economy to ensure the maximization of economic growth through the efficiency of the market.

This study is however, not advocating a change of focus away from exploiting the available natural resources for optimal economic growth but call on the government to tap the existing natural resources in a manner that guarantee economic sustainability.

5. SUMMARY AND CONCLUSION

This study was conducted with the broad objective of investigating the impact of natural resource abundance on economic growth in Nigeria for the period 1970 – 2014. It exploits time-series data for the variables under consideration and built its model within the framework of autoregressive (AR) econometrics. It found out that while natural resource abundance is critical in explaining long-term growth, growth in real per capita income is influenced more fundamentally by previous levels of income, thus, calling for more empirical analysis in determining the relationship between economic growth and resource abundance. It recommends that achieving a sustainable growth of income per capita, there is need to get the fundamental basics right by way of revising the macroeconomic policies that are aimed at improving the efficiency and effectiveness of natural resources exploitation and allocation in the economy. This can be achieved by converting natural resources into productive activities through a revision of the country's fiscal and budgeting systems.

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