GROWTH EFFECT OF ENERGY RESOURCES ON NIGERIA ECONOMY

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Abstract: *This paper investigated empirically the effect of energy resources on Nigerian economy, and long run relationship between energy resources and Nigerian economy. An econometric model was specified and verified. Changes in Gross Domestic Product were regressed on Electricity, Coal, Gas/Petroleum products. Unit root and co-integration tests were also employed. Data analysis showed that energy resources have positive effect on Nigerian economy and that a long run relationship exists between energy resources and Nigerian economy. The following recommendations are therefore made: Government programme of privatization of electricity generating and distribution should be sustained; other sources of generating energy such as sun, wind should be vigorously explored; all the challenges which confront exploration and distribution of petroleum products should be addressed appropriately; solid minerals exploitation should be given due attention.*

BACKGROUND OF THE STUDY

The developing countries of the world are not equally endowed with mineral deposits, raw materials, and fertile land. As Todaro and Smith (2011) pointed out, oil-rich Persian Gulf States have favourable physical resource endowment whereas Chad, Yemen, Haiti and Bangladesh are countries where resource endowment is relatively minimal. Nigeria is among the developing countries that are richly endowed with mineral and agricultural resources (Udabah, 1999). Quoting the Raw Materials Resource and Development Council, Oluwajomiloju (2009) classified natural resources in Nigeria into mineral raw materials and agro raw materials. Mineral raw materials include metallic minerals, fuel minerals, gemstone minerals and non-metallic minerals. Agro raw materials include cereals, tropical fruits, livestock, tree crops, root/tuber crops, industrial crops and forestry products. All the thirty six states of Nigeria and the Federal Capital Territory are littered with natural resources.

These natural resource endowments can be turned into stepping stones for economic progress of developing countries, especially Nigeria. Brandt (1980) recommended a programme of international development assistance to poor countries of Africa and Asia in such areas as solar energy development, mineral and petroleum exploration, afforestation projects etc. Lucas (2010) argued for a fundamental improvement in electric power supply in Nigeria. This is because cottage industries which boost economic activities would flourish with steady power supply.

STATEMENT OF THE PROBLEM

The lingering crisis in electricity supply causes suffering to ordinary citizens and financial loss to business people. Akinfenwa (2009) made reference to World Bank research report which showed that cost of energy in Nigeria was higher than what obtained in other countries studied. Electricity generation capacity was less than 4,000 watts in June, 2012 (Onokpegu, 2012). It was even less (2000 megawatts in 2009). The National Bureau of Statistics (2008) showed that the contribution of crude oil and gas to real GDP from 2003 to 2007 was less than 28%. By 2013, the contribution of crude oil to GDP was less than 40%. The quantity of coal produced in Nigeria was 144. 411 tones in 1986, 40.831 tones in 1993 and 20.00 tones in 1995.

Inspite of rich energy resource endowments, Nigeria does not seem to be taking maximum advantage of these resources. The enormous resources of mineral raw materials and agro raw materials are largely untapped. This is why this work focused on empirical investigation of the growth effect of energy resources on the economy of Nigeria. The investigation used time series data for the period 1980-2010.

RESEARCH QUESTIONS

The following questions guided this investigation:

i.   Do energy resources have significant effect on Nigerian Economy?
2.   Is there long run relationship between energy resources and Nigerian Economy?

OBJECTIVES OF THE STUDY

The objectives of this work are:

i.   To determine the effect of energy resources on Nigerian economy.
ii.   To ascertain the long run relationship between energy resources and Nigerian economy.

RESEARCH HYPOTHESES

1. $H_o : b_1 = O$: Energy resources do not have significant effect on Nigerian economy.
2. $H_o : b_1 = O$: There is no long run relationship between energy resources and Nigerian Economy.

REVIEW OF LITERATURE

This work is based on the Kaynesian theory. Classical economists restricted the role of the government to security and social services. Keynes, on the other hand, recognized the role of the government in overall well-being of the economy. Buhari (2001) distinguished between Kaynesian and classical economic theories. While classical economists believed in in-built capacity of the economy to produce the full employment level of output, Kaynes argued that there was nothing in-built in the economy to assure that equilibrium would always be achieved at the full employment level. According to Kaynes, unemployment could exist in a typical economy for a long time. Therefore, the government has important roles to play so as to guarantee smooth operation of the national economy. Government spending for example, can be used to stimulate economic activities. This is because increased spending by government would increase disposable incomes of individuals and increase aggregate demand for goods and services. Sustained increase in aggregate demand would enhance investment spending, employment, output, and national income.

According to Ray (1983), Kaynesian concepts and formulations are significant to developing economies in the following ways:
- The focus on national rather than sectorial view of things;
- The use of economics as a vehicle of public policy;
- The overlap of economics into the realms of politics and sociology.

   The impact of electricity supply on economic growth in Sri Lanka was investigated by Morimoto and Hope (2004). They used ordinary least squares technique and found that current and past values of electricity had a significant impact on real Gross Domestic Product. Clark (2001) maintained that, a direct relationship existed between the rate of energy consumption and the rate at which the economy expanded. Nnaji (2008) used time series data (for 1970-2005) to study the impact of electricity supply on economic growth in Nigeria. He found out that current and past values of electricity had a significant impact on manufacturing output and national income.

ANALYSIS

Regression analysis based on the linear regression model (Ordinary Least Squares Technique) is chosen in this work. Unit root test and co-integration test were used so as to avoid false result, and to determine the long run relationship between dependent and independent variables under study.

The model is presented in a functional form as shown below:

GDP = F (ELE, COA, GASPET) 1

In a linear function, it is represented as follows:

GDP = b_0 + b_1ELE + b_2COA + b_3GASPET + U_t 2

Where:

b_0 = Constant term

b_1 = Regression coefficient of Electricity
b_2 = Regression coefficient of Coal
b_3 = Regression coefficient of Gas/Petroleum
U_t = Stochastic error term

DISCUSSION

Considering the estimated model, variables used are Gross Domestic Product (dependent variable), and the explanatory variables are: Electricity (ELE), Coal (COA), Gas/Petroleum (GASPET). It covers the period of 1980-2010

Modeling GDP by OLS

GDP = 2064203+ 169.1556ELE – 1699678COA + 1.871312GASPET

t^* =   (3.804553) (3.989133) (–2.919902) (6.498113)

S.E =   (542561.2) (42.40409) (582101.1) (0.287978)

F (3, 27) = 738.8509

$t_{0.05}$ = 2.052

$F_{0.05}$ = 4.64

R^2 = 0.988406

The calculated t-value for the regression coefficients of ELE, COA and Gas/Pet are 3.989133, –2.919902 and 6.498113 respectively. Using 5% level of significance, the tabulated t-value is 2.052. It is observed that the calculated t-values of ELE and GASPET are greater than 2.052 while calculated t-value of COA is less than 2.052. Thus, the regression coefficients of ELE and GASPET are statistically significant while COA is statistically insignificant. The standard error test of S (b_1) = 42.40409, S (b_2) = 582101.1, S (b_3) = 0.287978 and $b_1^{1/2}$ = 84.5779, $b_2^{1/2}$ = –849839 and $b_3^{1/2}$ = 0.935656. Since S (b_1 and b_3) < ($b_1^{1/2}$ and $b_3^{1/2}$), we conclude that their coefficient estimates are statistically significant. However, since S (b_2) > $b_2^{1/2}$, its coefficient estimate is statistically insignificant.

The F-calculated value is 738.8509 while the F-tabulated value is 4.64. Since the calculated value of F-statistic is greater than its tabulated value at 5% level of significance, we conclude that the regression plane is statistically significant. This means that the joint influence of the explanatory variables (ELE, COA and GAS/PET) on dependent variable GDP, is statistically significant. The computed coefficient of multiple determination (R^2 = 0.988406) shows that 98.8406% of the total variation in the dependent variable (GDP) is accounted for by the explanatory variables namely; Electricity (ELE), Coal (COA) and Gas/Petroleum (GASPET).

THE UNIT ROOT TEST

The Augmented Dickey-Fuller (ADF) was employed to test for the existence of unit roots in the data. The test results are as presented below:

Augmented Dickey-Fuller Unit Root Test

Trend and Intercept

Series	ADF Test Statistic	5% Critical Values	10% Critical Values	Order	Remark
GDP	-5.732403	-2.9750	-2.6265	1(2)	Stationary
ELE	-6.903956	-2.9750	-2.6265	1(2)	Stationary
COA	-5.840963	-2.9798	-2.6290	1(2)	Stationary
GASPET	-4.792730	-2.9750	-2.6265	1(2)	Stationary

The above empirical test shows that Gross Domestic Product (GDP), Electricity (ELE), Coal (COA) and Gas/Petroleum (GASPET) are integrated of order two. They are integrated of the same order; 1(2). From the above table, it was found that ADF, with trend and intercept, indicated that time series are integrated of the same order. The linear combination of series integrated of the same order are said to be co-integrated. The level of their integration indicates the number of times series have to be differenced before their stationarity is induced. Thus, the time series data were differenced twice before attaining stationarity level.

Co-Integration Test

The results manifest a long run relationship between the Gross Domestic Product and Electricity, Coal and Gas/Petroleum Products. First, the summary of the Johansen Co-integration Test is shown in the Table below.

Eigen Value	Likelihood Ratio	5% Critical Values	1% Critical Values	Hypothesized NO. of CE (s)
0.901989	168.4463	47.21	54.46	None[**]
0.871933	110.3806	29.68	35.65	At most 1[**]
0.701203	59.00068	15.41	20.04	At most 2[**]
0.684007	28.80089	3.76	6.65	At most 3[**]

*(**) denotes rejection of the hypothesis at 5% significance level.

In Johansen's method, the eigen value statistic is used to determine whether co-integrated variable exists. The likelihood ratio is higher than 5% critical value and the eigen values are found as 0.901989, 0.871933, 0.701203 and 0.684007. The likelihood ratio of GDP, ELE, COA and GASPET are greater than the critical values at both 5% and 1% levels of significance. Also, their eigen values are significantly greater than zero. In other words, the null hypothesis of no co-integration among the variables is rejected in at least four equations. The test result shows the existence of a long-run equilibrium relationship in four co-integration equations at 5% significance level

Test of Hypotheses

This research work is undertaken so as to evaluate the impact and long run relationship between energy resources and economic growth in Nigeria. With respect to this, the null hypotheses as follows;

H_0: $b_1 = 0$: energy resources do not have significant impact on economic growth in Nigeria

$H_0: b_1 = 0$: there is no long run relationship between energy resources and economic growth in Nigeria

In testing the first hypothesis, F-test is used. This is because, it captures the joint influence of all explanatory variables on the dependent variable. Since F-calculated value (738.8509) is greater than F-tabulated value (4.64), the null hypothesis of no significant impact of energy resources on economic growth in Nigeria is rejected, thereby accepting the alternative hypothesis on the notion that energy resources have significant impact on economic growth in Nigeria. In testing the second hypothesis, co-integration test is employed in testing the hypothesis. This test will help to capture the long run relationship between dependent and independent variables under study.

DECISION RULE
Since the likelihood ratio of ELE, COA and GASPET is higher than 5% critical value and the eigen values which are found as 0.901989, 0.871933, 0.701203 and 0.684007 are statistically different from zero, we conclude that there is long run relationship between energy resources and economic growth in Nigeria.

THE FINDINGS
On the application of advanced econometric techniques such as unit root and co-integration mechanism, the following information surfaced: those energy resources have positive impact on economic growth within the period under study (1980-2010), and there is a long run relationship between energy resources and economic growth in Nigeria. It is estimated from the result that 1% increase in Electricity, and Gas/Petroleum Product consumption, will bring about increase by 169.1556% and 1.871312% in GDP.

However, 1% increase in Coal, on the average, will bring about decrease of 1699678% in GDP in Nigeria. The sign borne by the parameter estimates met theoretical expectations. If consumption of Electricity and Gas/Petroleum Product increases, industries can operate effectively at a cheaper cost there by accelerating GDP. However, although coal has been a key energy resource in Nigeria over the years, it has brought with it environmental consequences such as air pollution. In the light of new technologies to reduce them, government has to divert funds to prevent air pollution by channeling them to what can boost the economy.

CONCLUSION
From the findings of the study, the following can be inferred:
- There is a positive relationship between energy resources and economic growth in Nigeria within the period of 1980-2010;

- There exists a long run relationship between energy resources and economic growth in Nigeria.

The coefficient of determination (R^2) is found to be high which indicates that the explanatory variables were able to account for the total variations of the dependent variable – Gross Domestic Product (GDP).

POLICY RECOMMENDATIONS
The research work therefore recommends the following measures:
1. Government programme of privatization of electricity generation and distribution should be sustained.
2. Other sources of generating energy such as Sun, Wind should be vigorously explored,
3. All the challenges which confront exploration and distribution of petroleum products should be addressed appropriately.
4. Solid minerals exploitation should be given due attention.

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