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Article

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IJEEP
INTERNATIONAL JOURNAL OF ENERGY ECONOMICS AND POLICY
EJ EconJournals
ISSN: 2146-4553

International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2018, 8(2), 188-195.

EJ EconJournals

Dynamic Impact of Energy Consumption on the Growth of Nigeria Economy (1986-2016): Evidence from Symmetrical Autoregressive Distributed Lag Model

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ABSTRACT

This paper empirically examined the dynamic impact of energy consumption on the growth of Nigeria economy between 1986 and 2016 using symmetrical autoregressive distributed lag model approach. Findings from the study revealed that electricity consumption has not had a significant impact on the growth of the Nigerian economy. It shows that due to fluctuations in electricity supply, the growth of Nigerian economy has been on the decline. However, petroleum consumption was discovered to have a significant impact on economic growth in Nigeria; while gas consumption was discovered to have no significant impact on the growth of Nigeria economy. This was attributed to gas flaring activities and other environmental abuses that had caused major Niger-delta crisis and attendant consequences like pipeline vandalization and hostage taking. Suggestive from the study therefore are that government should undertake a cogent approach towards reforming the electricity supply sector as its paramount for the country's quest for industrialization.

Keywords: Energy Consumption, Economic Growth, Petroleum, Gas and Electricity
JEL Classifications: O13, P28, O44

1. INTRODUCTION

Over the years, one of the impelling forces that boost industrial production and economic growth has been energy, Onakoya et al. (2013). The essential role played by energy in boosting economic activity in any nation cannot be over emphasized. Being that for instance, foreign earnings are generated from exportation of energy products, labor force recruitment in energy industries reduce unemployment rate as justified by American Petroleum institute which estimated that the energy sector supports more than 9 million jobs directly and indirectly, which is over 5% of America's total employment. Energy consumption has an influential impact on a country's effort to increase standard of living and economic growth in the long run as well as promoting various aspects of economic activities, Rezitis and Ahammad, (2015). Energy consumption is crucial to the wellbeing and prosperity across the globe. Hence, meeting the growing demand for energy in a safe and environmentally responsible manner has been a key challenge (Adegbulugbe, 2013). World energy review showed that the average growth rate of World's primary energy consumption between 2005 and 2015 is 1.8% and grew by 1% from 2015 to 2016 (World Economic Forum, 2017) This is equally in line with Sustainable Development Goals (SDGs) number seven which aims at ensuring access to affordable, reliable and sustainable energy to be achieved in 2030 which emphasizes the importance of energy consumption to economic growth and development. Ojinaka (2008), also states that the scale of energy consumption per capita is an important indicator of economic modernization as energy consumption tracks with national products.

Nigeria in spite of being one of the largest oil producers in the world and with varied energy sources, 70% of her over 160 million people live below the poverty line. Energy sector deficiencies have kept over 40% of the population living without electricity, while those with access suffered poor quality of service. A substantial part of the country is unconnected to the grid (Iwayemi, 2012).

The efficient use of energy is what turns its access into development and in return it is what ensures that investment is electricity infrastructure are economically viable. Having emphasized the importance of energy to the economy at large, its lack therefore has adverse effect on various sectors of the economy some of which include manufacturing/industrial sector, trade, agriculture, just to mention a few. The increased subsistence level of agricultural activities of farmers in Nigeria can be attributed to lack of access to energy for productive activities. On average, as noted by Ngilari (2009), citizens in most regions on a daily basis are supplied with 6 h of electricity at most. There are many rural areas in the country that are yet to even have access to any electrical power. They still rely on some other mechanical sources of energy like fuelwood. Others, who can afford to, acquire privately owned generators which are barely cost-effective. The lack of infrastructural development makes the energy security problem in Nigeria amongst the worst in the world. Iwayemi (2012), observes that the current and protracted electricity crisis illustrates the most visible dimension of Nigeria's recent energy conundrum.

Thus alternative sources of power supply have greatly increased the cost of production and subsequently an increase in the prices of goods and services. The increase in the prices of goods and services reduces the standard of living of the people and this poses a serious problem to the economy. It is worth noting that firms that could not meet these rising costs of production had to close down thus worsening the productive capacity of the economy.

Previous studies such as Al-Iriani (2006), Chen et al. (2007), Mehrara (2007). Lee and Chang (2008), and Nondo et al. (2010) just to mention a few have investigated the relationship between energy consumption and economic growth using bi-variate model however there is likely to be omitted variable bias Lütkepohl (1982) that is why this study applies multivariate approach in order to incorporate more variables and reduce chances of bias thereby adding to the body of literature and also using up to date time series data.

It is imperative therefore to examine energy consumption and economic growth relationships in Nigeria with view of proffering answers to the following questions:

1. To what extent has electricity consumption (EC) enhanced the growth of Nigeria's economy?
2. What relationship exists between petroleum consumption (PC) and economic growth in Nigeria?
3. What impact does gas consumption (GC) have on the growth of Nigeria economy?

In-line with the above questions, the following hypothesis were tested:

$H0_1$: EC have not significantly enhanced the growth of the Nigerian economy

$H0_2$: PC have no significant impact on economic growth in Nigeria

$H0_3$: GC has no significant impact on the growth of Nigeria economy.

2. LITERATURE REVIEW

Providing conclusive empirical evidence on the dynamics of energy consumption and economic growth has been a challenging endeavor. Several studies have been carried out as regard this topic some of which are examined below.

Odhiambo (2009) using autoregressive distributed lag (ARDL) bounce test and granger causality test examined the relationship between energy consumption and economic growth in Tanzania from 1971 to 2006. The result revealed a long run relationship between energy consumption and economic growth which the granger causality sowed a unidirectional causality running from energy consumption to economic growth as well as EC to economic growth. The results imply that energy conservation policies would have damaging repercussions on economic growth for Tanzania.

Noor and Siddiqi (2010) employed cointegration and ordinary least square techniques to analyse the relationship between per capita energy consumption and per capita gross domestic product (GDP) in Nigeria (1971-2006). The cointegration result shows a strong long run relationship between variables in the model. The long run estimated equation shows a negative relationship between the per capita energy consumption and per capita GDP, while the causality test reveals a unidirectional causality running from GDP to EC in the short run.

Ziramba (2009) concluded that the oil consumption and natural GC contributed significantly to industrial production in South Africa.

Coming down to Nigeria, Elijah and Nsikak (2013) realized that non-renewable energy in form of natural gas, coal, and petroleum and EC contribute significantly to industrial growth in Nigeria.

Dantama et al. (2012) studied the impact of energy consumption on economic growth in Nigeria over the period of 30 years with the application of the ARDL cointegration technique. Findings shows a long run relationship exist between energy consumption and economic growth in addition the speed of adjustment in the model estimated aligned with its expected sign and level of significance.

With the use of descriptive statistics, Uzochukwu and Nwogwugwu (2012) examined federal government spending on the energy sector with emphasis on the electricity subsector it was discovered that despite the significant reforms and increased spending in the sector, the output in terms of production, transmission and distribution of electricity is far from the realization of it led down reform objectives.

Ohwofasa et al. (2015) examined the impact of electricity supply on economic growth in the period 1980 to 2010 using error correction method. The findings revealed no long run relationship between the explanatory and dependent variables. While the short run relationship exhibits a strong positive impact of consumption, government expenditure and investment on per capita income. See also Akpan and Akpan (2012), Abalaba and Dada (2013), Alege et al. (2016), Ogundipe et al. (2016) studies on Nigeria.

3. MODEL AND DATA

The methodology section outlines the plan and method that how the study is conducted. This includes Universe of the study, sample of the study, Data and Sources of Data, study's variables and analytical framework. The details are as follows;

3.1. Data and Sources of Data

The data for this study are obtained mainly from secondary sources such as CBN statistical Bulletin (2016) and NNPC statistical bulletin (2016). The time series data covers a period of 31 years i.e., 1986-2016 and was used to estimate the specified model.

3.2. Theoretical Framework

3.2.1. Endogenous growth theory

The theoretical base of this work rest upon the endogenous growth model. This theory was developed by economists including Paul Romer and Robert Lucas in the mid-1980s, the theory came about as a result of the increasingly dissatisfaction of the neoclassical growth model that did not explain where technological changes in economies come from. This theory states that economy growth is generated by internal forces and not by external forces as stated by the neoclassical theory. Consequently, the Endogenous (new) growth theory emerged due to some flaws in the exogenous growth theory and holds that economic growth is primarily the result of endogenous and not external forces (Romer, 1994).

This theory aims at explaining the long run growth by endogenizing productivity, growth or technical progress. The main assumptions of this theory includes increasing returns scale because of positive externalities, human capital and production of new technologies are essential for long run growth, private investments in research and development are necessary for technological progress, knowledge or technical advances are non-rival good.

The model predicts that the economy can grow forever as long as it does not run out of new ideas or technological advancement. Endogenous growth theory similar to exogenous growth theory professes convergence of nations by diffusion of technology.

Romer states that production function of a firm in the following form:

$$Y = A(R)f(Ri,Ki,Li,) \qquad (1)$$

Where;

A – Public stock of knowledge from research and development (R),

Ri – Stock of results from stock of expenditure on research and development

Ki – Capital stock of firm i

Li – Labour stock of firm i

The Ri actually represents the technology prevalent at the time in firm i. Any new research technology spill over quickly across the entire nation. Technological progress (advancement) implies the development of new ideas which resemble public goods because they are non-rival. When the new ideas are added as factors of production the returns to scale tend to be increasing.

In this model new technology is the ultimate determinant for long run growth and it is itself determined by investment in research technology. Therefore, Romer takes investment in research technology as endogenous factor in terms of the acquisition of new knowledge by rational profit maximization firms. From the forgoing, we can derive the aggregate production function of the endogenous theory as follow:

$$Y = f(A,K,L) \qquad (2)$$

Where;

Y = Aggregate real output

K = Stock of capital

L = Stock of labour

A = Technology (or technological advancement)

It is important to note that "A" is based on the investment on research technology. In this study technology can be viewed as the endogenous factor which relates to energy. Most technology as given per time is dependent on the availability of useful energy to power it. The technology referred to here is that such as plants, machinery and the likes. Without adequate energy supply (in this case electricity or petroleum) then these technologies are practically useless. Huge investments must then be made on energy not only to produce but to attain energy efficiency.

3.3. Statistical Tools and Econometric Models

This section elaborates the proper statistical/econometric/financial models which are being used to forward the study from data towards inferences. The detail of methodology is given as follows.

3.3.1. Descriptive statistics

Descriptive Statics has been used to find the maximum, minimum, standard deviation, mean and normally distribution of the data of all the variables of the study.

3.3.1.1. Unit root test

Time series data are generally characterized by stochastic trend which can be removed by differencing. Unit root test therefore is a test of stationarity or non-stationarity of series data used in the model. This is to find out if the relationship between economic variables is spurious. The Augmented Dickey-Fuller (ADF) Techniques was adopted to verify the unit root property of the series and stationarity of the model.

3.3.2. Symmetrical ARDL model

The ARDL Bounce testing procedure developed by Pesaran et al. (2001) to examine long-run relationship amongst energy consumption and economic growth in Nigeria as well as short run dynamics. The bound test was adopted for the following reasons:

1. It does not require that the variables under study must be integrated of the same other unlike the Johansen Cointegration approach.
2. The bound test is suitable for small or infinite sample data unlike the conventional approach which requires a large sample size.
3. It allows the cointegration relationship to be estimated using the Ordinary Least Square method.

4. The long and short run parameters of the model can be estimated simultaneously.

3.3.2.1. Model specification

The paper is hinged on endogenous growth theory. In this theory, economic growth is being determined by endogenous forces rather than the exogenous forces as stated by the neoclassical growth theory (Jhingan, 2004). Thus, following the model specification of Elijah and Nsikak (2013) with slight modification, the mathematical relationship between energy consumption and economic growth is specified as:

$$GDP=f(EC,PC,GC) \quad (3)$$

Where;
EC = Electric power consumption
PC = Petroleum product consumption
GC = Gas consumption
GDP = Gross domestic product

Specifying equation (3) in a stochastic (linear regression) form we have:

$$GDP=\beta_0+\beta_0 EC+\beta_2+PC+\beta_3 GC+\mu_t \quad (4)$$

β_0 = The intercept or autonomous parameter estimate

B_1 to β_3 are the slope of the coefficients of the independent variables to be determined. They are the slope of the graph that measures the change in the GDP as a result of a unit change in EC, PC and GC

μ = Error term (or stochastic term).

The apriori expectations of the explanatory variables are as expressed as:

$\beta_0,\beta_1,\beta_0>0$; That is, EC, PC and GC are expected to have a positive impact on Nigeria's economic growth.

Model for symmetrical ARDL model

The bounds test procedure is captured with the following representation:

$$\Delta GDP_t = \beta_0 + \sum_{i=1}^{m} \beta_1^i \Delta GDP_{t-i} + \sum_{j=0}^{n} \beta_2^i \Delta EC_{t-j} + \sum_{j=0}^{0} \beta_3^i \Delta PC_{t-j} + \sum_{j=0}^{p} \beta_4^i \Delta GC_{t-j} + \beta_5 GDP_{t-1} + \beta_6 EC_{t-1} + \beta_7 PC_{t-1} + \beta_8 GC_{t-1} + \varepsilon_t \quad (5)$$

As a tradition, the test for null hypothesis of no Co-integration against alternative of the existence of a long run relationship is tested by using F-test such as;

$$H_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$$
$$H_1 = \beta_5 = \beta_6 = \beta_7 = \beta_8 \neq 0$$

If the computed F-statistics falls above the upper bound critical value of F-tabulated developed by Pesaran and Shin (2001), the null of no Cointegration is rejected which implies that long run relationship exists among the variables of interest. On contrary, if it falls below the lower bound, then the null of Co-integration cannot be rejected. Finally, if it lies between these two bounds, the result seems inconclusive.

After establishing the existence of long-run cointegration relationship between energy consumption and economic growth, the paper investigates both the long-run effects and the short-run dynamics using the (unrestricted) error correction model (ECM) approach. ECM was applied to find out the speed of adjustment the variables follow towards the long-run equilibrium path in response to any divergence that occurred in the short-run.

After establishing a long-run association between the variables, the study proceeded to examine the long-run effect and the short-run dynamics using unrestricted ECM approach. The ECM gives the short run coefficient without losing the long run information and specified as:

$$\Delta GDP_t = \beta_0 + \sum_{i=1}^{m} \beta_1^i \Delta GDP_{t-i} + \sum_{j=0}^{n} \beta_2^i \Delta EC_{t-j} + \sum_{j=0}^{o} \beta_3^i \Delta PC_{t-j} + \sum_{j=0}^{p} \beta_4^i \Delta GC_{t-j} + \delta ECT_{t-1} + \varepsilon_t \quad (6)$$

4. RESULTS AND DISCUSSIONS

4.1. Results of Descriptive Statics of Study Variables

Table 1 captured the results from the descriptive statistics. The results showed that BOP has deficit average -1134.28 (N' Billion), NER averaged 142.91 (N/$) between 1999 and 2016; MS grew by an average 8.51%, while CPI was found to have risen by an average of 5.21% between 1999 and 2016.

The analysis was also fortified by the value of the skewness and kurtosis of all the variables involved in the model. Two of the distributions are positively skewed GC and EC, while GDP and PC are negatively skewed. Variables with value of kurtosis <3 are called platykurtic (fat or short-tailed), GDP and EC variables qualified for this during the study period. On the other hand, variables whose kurtosis value is >3 are called leptokurtic (slim or long tailed) and GC and PC variables qualified for this during the study period.

Jarque-Bera test shows that the residuals are all normally distributed with all their probability values exceeding 5%. In summary, the descriptive statistics revealed that, the data sets are normally distributed.

4.2. Result of Unit Root Test

Table 2 shows that only variable, PC was found stationary at level form, and is of an integrated order zero {that is I(0)}. At this order of integration, its ADF test statistics (−3.588304) is greater that the critical test statistics (−3.574244) at 10% significant level.

However, the other three variables; GDP GDP, EC and GC were found stationary at first difference, and there are integrated of order one, that is *I*(1). At this order of integration, its ADF test statistics are greater than their critical test statistics at 10%, 1% and 1% level of significance respectively. Since all the variables were found to be integrated at different orders, they all satisfied the ARDL-bound testing approach which necessitates every variable in the equation to be static either at level or at first modification.

4.3. Lag Length Selection Criteria

Table 3 presents the appropriate lags for the ARDL bound test was conducted using VAR Lag Order Selection Criteria. Using the recommended lag by AIC, the study utilized lag 5 in building the ARDL bound test model.

4.4. Result of Co-integration Test

Table 4 presents the result of the ARDL bound test approach to Co-integration. The result revealed that there is an existence of co-integration among the variables. The f-statistics value of 9.99 is greater than the lower and upper bound values at 5% level of significance. Hence, there is a sufficient proof of the existence of a long-run equilibrium relationship between energy consumption and economic growth in Nigeria between 1986 and 2016. The result thus shows that energy consumption has long run impact on economic growth in Nigeria within the period under study.

Table 1: Descriptive statistics for selected variables

Variables	LOG (GDP)	LOG (GC)	LOG (EC)	LOG (PC)
Mean	8.88382	13.2906	4.65307	15.7837
Skewness	−0.3193	0.17641	0.25538	−0.6249
Kurtosis	1.82407	1.06452	1.65694	3.94487
Jarque-Bera	2.31286	4.99948	2.66689	3.17072
Probability	0.31461	0.08211	0.26357	0.20487
Observations	31	31	31	31

Source: Authors computations (2018), using Eviews-10. GDP: Gross domestic product, GC: Gas consumption, EC: Electricity consumption, PC: Petroleum consumption

Table 2: Summary of unit root test results (trend and intercept)

Variables	ADF test statistic (at first difference)	Order of integration
GDP	−3.406390 (−3.221728)***	I (1)
EC	−6.861991 (−4.309824)*	I (1)
PC	−3.588304 (−3.574244)**	I (0)
GC	−5.308166 (−4.309824)*	I (1)

Source: Authors computations (2018), using Eviews-10. ***, **and *significant at 10%, 5% and 1%, respectively. GDP: Gross domestic product, GC: Gas consumption, EC: Electricity consumption, PC: Petroleum consumption, ADF: Augmented Dickey-Fuller

4.5. ARDL-ECM RESULTS

The ARDL-ECM result examines how the final equation changes to the long-run equilibrium. Hendry (1987) methodology of "general-to-specific was employed to eliminate all insignificant lags. Accordingly, this led to an initial estimation of an ECM with three lagged differences of the explanatory variables, a constant term and error correction term lagged one (ECT_{t-1}) The dimensions of the parameter space were then reduced to a parsimonious ARDL-ECM specification by using omitted and redundant variable test to exclude the statistically insignificant lags. The results of the reduced short-run dynamic policy model are presented in Table 5.

As expected, the lagged error correction term is negative, less than unity and statistically significant at 5%. The coefficient revealed that once there is disequilibrium in the system, it takes an average (slow) speed of 0.4% to adjust itself back towards long-run equilibrium level. This finding was collaborated by Bannerjee, Dolado and Mestre (1998) who asserted that a highly significant lagged error correction terms proves the existence of long-run relationship between the variables and its ability to adjust from dis-equilibrium state towards equilibrium level.

The adjusted coefficient of determination (R-Bar-square), which was used to measure the goodness of fit of the estimated model, indicates that the model is reasonably fit in prediction. It showed that 66.35% changes in GDP were collectively due to EC, PC and GC while 66.65% unaccounted variations was captured by the white noise error term.

4.6. Statistical Test of Hypothesis

The three hypotheses formulated in this paper were tested using Wald test and the associated *p*-value. The level of significance for the study is 5% (for the two-tailed test). The Wald test computes a test statistic based on the unrestricted regression and tests for the joint significance of the coefficients. It is used to denote whether the joint impact of the explanatory (exogenous/independent variables) actually have a significant influence on the dependent variable.

The decision rule for accepting or rejecting the null hypothesis the hypothesis was be based on the Probability Value (PV). If the PV is <5% or 0.05 (that is, PV < 0.05), it implies that the regressor in question is statistically significant at 5% level; otherwise, it is not significant at that level.

H_{01}: EC have no significant impact on the growth of the Nigerian economy

Table 3: VAR lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	−1270.71	NA	4.52E+37	98.05443	98.24798	98.11016
1	−1170.1	162.5174	6.86E+34	91.54627	92.51404	91.82495
2	−1153.26	22.02447	7.11E+34	91.48148	93.22346	91.98311
3	−1122.81	30.44874	3.08E+34	90.37004	92.88623	91.09461
4	−1094.66	19.48685	2.27E+34	89.4356	92.72601	90.38312
5	−1003.252	35.15806*	3.01e+32*	83.63476*	87.69938*	84.80522*

Source: Authors computation, 2018 (Eviews-10). *indicates lag order selected by the criterion. LR: Sequential modified LR test statistic (each test at 5% level). FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion

The Wald-test in Table 6 indicated that the calculated F-value for Money supply is 8.28 and its probability value is 0.0030. Since the probability value is <0.05 at 5% level of significance, it thus falls in the acceptance region and hence, the first null hypothesis (H_{01}) was rejected. The result thus shows that EC has not significantly impacted the growth of the Nigerian economy between 1986 and 2016.

H_{02}: PC have no significant impact on economic growth in Nigeria

The Wald-test in Table 7, indicated that the calculated F-value for PC was found to be 5.12 and its probability value is 0.022. Since the probability value is <0.05 or 5% level of significance, which fell in the rejection region and hence, we reject the second null hypothesis (H_{02}) and conclude that PC has a significant impact on economic growth in Nigeria between 1986 and 2016.

H_{03}: GC has no significant impact on the growth of Nigeria economy

The Wald-test in Table 8, indicates that the F-value for GC was found to be 1.19 and its probability value is 0.4253. Since the probability value is >0.05 or 5% level of significance (and fell in the acceptance region) hence, we accept the third null hypothesis (H_{03}) and conclude that GC has no significant impact on the growth of Nigeria economy between 1986 and 2016

4.6. Stability Test Result

The paper conducted various post estimation diagnostic tests to ascertain the appropriateness and stability of the model as well as the robustness of the results. Thus, for reliability of estimates, we obtained series of residual and stability tests such as the serial correlation Lagragian Multiplier test (for higher order autocorrelation), the heteroscedasticity test, normality test and the Ramsey RESET specification test. Both the F-statistics and product of observation with the square coefficient of correlation (NR2) were obtained.

The decision rule for accepting the null hypothesis for any of these diagnostics tests is that the probability-value (p-value) of each has to be >0.05 or 5% level of significance.

Table 9 thus presents the Residual Test Results; the result revealed that there were no evidences of serial correlation and heteroskedasticity in the estimated ARDL-ECM model as the p-values of both (0.9661 and 0.4221) were found to be >0.05 or 5%. More so, the Ramsey RESET specification error test showed that the model was well mathematically specified as the p-value of 0.3740 was found to be >0.05 also. Furthermore, Jarque-bera test for normal distribution revealed that the result attained a normal distribution with a bell shaped symmetrical distribution at 5% significance level. Lastly, the CUSUM stability tests in Figure 1 revealed that the model is stable and the regression equation is correctly specified as the plots of the charts lie within the critical bounds at 5% significant level.

5. DISCUSSION

From the estimated empirical results, it was discovered that EC has had no significant impact on the growth of the Nigerian economy. It shows that due to erratic power supply or fluctuations in electricity supply, the growth of Nigerian economy has been on the decline. Frequent power failures and inability of government

Table 4: ARDL-cointegration test results

F-bounds test		Null hypothesis: No levels relationship		
Test Statistic	Value	Significance (%)	I (0)	I (1)
F-statistic	3.253	10	2.37	3.2
K	3	5	2.79	3.67
		2.50	3.15	4.08
		1	3.65	4.66

Source: Authors computation, 2018 (Eviews-10). ARDL: Autoregressive distributed lag. ***, ** and *significant at 10%, 5% and 1%, respectively

Table 5: Parsimonious ARDL (5,4,3,5)-ECM Results

Variable	Coefficient	t-Statistic	P
DLOG (GDP(−1))	0.36513	2.140275	0.0853
DLOG (GDP(−2))	−0.36344	−1.87701	0.1193
DLOG (GDP(−3))	0.10198	0.441501	0.6773
DLOG (GDP(−4))	−0.41267	−2.03424	0.0976
DLOG (EC)	0.371624	1.935901	0.1107
DLOG (EC(−1))	0.695727**	2.813686	0.0374
DLOG (EC(−2))	0.221991	0.931986	0.3941
DLOG (EC(−3))	0.578046**	2.616206	0.0473
DLOG (PC)	−0.30091***	−2.2998	0.0698
DLOG (PC(−1))	−0.19693	−1.6644	0.1569
DLOG (PC(−2))	−0.28655**	−2.80194	0.0379
DLOG (GC)	−0.03965	−3.01431	0.0296
DLOG (GC(−1))	−0.01431	−0.97884	0.3726
DLOG (GC(−2))	−0.05196**	−3.43808	0.0185
DLOG (GC(−3))	0.026707	1.890274	0.1173
DLOG (GC(−4))	−0.01512	−1.11966	0.3137
ECT(−1)*	−0.04009*	−5.24247	0.0033
R-squared	0.878881		
Adjusted R-squared	0.663554		
Durbin-Watson stat	2.017323		

Source: Authors computation, 2018 (Eviews-10). ***, ** and *indicate statistical significance at 10%, 5% and 1% levels, respectively. Figures in parenthesis are standard errors. GDP: Gross domestic product, GC: Gas consumption, EC: Electricity consumption, PC: Petroleum consumption, ADF: Augmented Dickey-Fuller, ECM: Error correction model

Table 6: Results of wald test on EC and economic growth in nigeria

Test statistic	Value	df	P
F-statistic	0.709492	(4, 5)	0.6192
Chi-square	2.837966	4	0.5853

Source: Authors computation, 2018 (Eviews-10). EC: Electricity consumption

Table 7: Results of wald test on PC and economic growth in Nigeria

Test statistic	Value	Df	P
F-statistic	5.129061	(3, 5)	0.0223
Chi-square	4.777184	3	0.2866

Source: Authors computation, 2018 (Eviews-10). PC: Petroleum consumption

Table 8: Results of wald test for GC and economic growth in Nigeria

Test Statistic	Value	df	P
F-statistic	1.193801	(5, 5)	0.4253
Chi-square	5.969004	5	0.3092

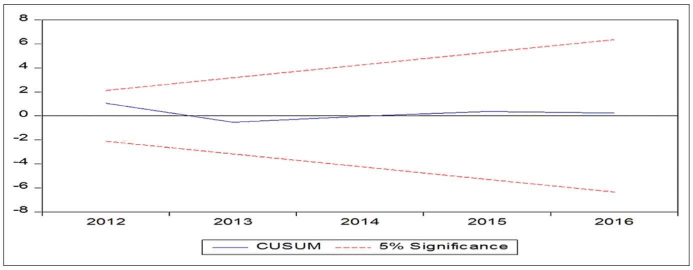
Source: Authors computation, 2018 (Eviews-10). GC: Gas consumption

Table 9: Residual test results

Tests	Outcomes	
	Coefficient	P
Heteroscedasticity-Breusch-Pagan-Godfrey Test		
F-stat.	0.483738	0.4221
NR^2	2.423376	0.0696
Breusch-Godfrey-Serial-Correlation Test		
F-stat	0.496604	0.9661
NR^2	22.06576	0.0721
Normality Test		
Jarque-Bera	1.114478	0.5728
Ramsey Reset		
F-stat	0.826987	0.3740

Source: Authors Compilation (2018), E-views 10

Figure 1: CUSUM stability tests



Source: Authors Compilation (2018), E-views 10

execution of independent power projects (IPP) had all negatively influenced investment levels in the country. This situation resulted to increased generator usage in the manufacturing production processes that tend to increase the cost-over heads; and all of these slows down the pace of economic growth as a result of disruption of production activities. At the microeconomic level, we have local producer losses which can be approximated by the downward shift in producers' profit level due to irregular production activities, low capacity utilization and the need for running and maintaining very expensive generators. Most producers however try to offset these costs through increase in product price to consumers so as to minimize losses and that ultimately impedes economic growth. The findings here are in agreement with Uzochukwu and Nwogwugwu (2012) that examined federal government spending on the energy sector with emphasis on the electricity subsector it was discovered that despite the significant reforms and increased spending in the sector, the output in terms of production, transmission and distribution of electricity is far from the realization of it led down reform objectives. However, PC was discovered to have a significant impact on economic growth in Nigeria between 1986 and 2016. This is in-line with Dantama et al. (2012) whose result indicates a long-run relationship between economic growth and energy consumption; and PC specifically was found to have a statistically significant impact on economic growth.

Above all, the empirical results showed that GC has no significant impact on the growth of Nigeria economy between 1986 and 2016. This is in-line with the findings of Raimi et al. (2013) who observed that gas flaring activities and other environmental abuses had caused major Niger-delta crisis and attendant consequences like pipeline vandalization and hostage taking. These activities had reduced GC and an eventual decline on its contribution to economic growth.

6. CONCLUSION AND POLICY RECOMMENDATIONS

One of the major obstacles to the attainment of Nigeria's vision to become one of the 20 developed economies in the world as well as attaining SDG number 7 which is ensuring access to affordable, reliable and sustainable energy in 2030 is energy. This is due to because of the direct effect it has on other economic indicators such unemployment rate, manufacturing capacity utilization, agricultural productivity just to mention a few. Though, the overall picture reveals availability of enormous energy resources in the country which far exceed energy requirement of the country. However, most of these resources are underutilized particularly natural gas. This suggests that Nigeria's energy problem is not a lack of it, but its development and utilization. Therefore, policy reforms should focus on encouraging a level-playing field for all energy forms. It should also in the spirit of economic liberalization fully deregulate the power sub-sector of the economy to allow for private sector participation in the generation, transmission and distribution of electricity. Also, improvement in the performance of electricity supply should be vigorously pursued. This is because it would affect energy use pattern and ultimately affect GDP when those who depend on more expensive alternatives (petrol and diesel generators) now depend on public power supply.

Based on the findings from the study, there is a need to address other issues that have been raised in this study: Local production of adequate refined gasoline, gas supply security and minimization of gas flaring activities, small power producers, maintenance of existing energy supply infrastructure, adequate coordination of activities among various stakeholders in the energy sector, expansion of transmission and distribution networks, and enlightenment of the public on issues of energy consumption efficiency. Other specific recommendations are:

1. Providing steady electricity supply is paramount for the country's quest towards industrialization, hence government should undertake a cogent approach towards reforming the electricity supply sector.
2. The nation should explore and adopt all viable financing options from local and international sources for cost effective exploitation of its gas resources being flared way in order to generate foreign exchange and increase employment generation to Nigerians.
3. Given the significant impact of the consumption of petrol on economic growth, great caution should be observed on the implementations of policies (such as subsidy removal policy and deregulation of the downstream sector of the oil sector) that can hamper the consumption of the product through price hike. A decline in consumption of petrol may impair economic growth and constitute a blockage to the achievement of sustained growth in Nigeria.
4. Furthermore, energy policy against petrol consumption would inhibit growth. Thus, to achieve growth and sustainable development, this study recommends the need for the

development of greener energy sources that would compensate for the reduction in petrol consumption in Nigeria.

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