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Original Research Article

Dynamics of Electricity Consumption and Its Impacts on Nigeria's Economic Growth: Empirical Evidence from (Nonlinear) Threshold Regression Model

Adam Abbas HAMID*, Aondoawase ASOOSO and Naziru Yusuf ABDULLAHI

The study examined the dynamic relationship between electricity consumption and economic growth in Nigeria. Econometric techniques of existing studies assumed linearity among the variables used in the study/model(s). Hence, this study presents a novel evidence of nonlinearity between electricity consumption and Nigeria's economic growth. The summary statistics of the variables of the study were observed. Afterward, the study employed nonlinear method of analysis to capture the actual relationship between the variables. The study employed Nonlinear Threshold Regression Model to address its objectives. Post-estimation Diagnostic Checks were conducted to validate the result, Bai-Perron (2003) multiple test of significance is employed to validate the results. It was found that there are positive and negative impact of electricity consumption and economic growth in Nigeria. Positive change in electricity consumption has a significant positive impact on economic growth, while a negative change in electricity consumption in Nigeria affects economic growth negatively. It is recommended that increasing electricity supply in the country will boost economic activities which will later translate to more economic growth. From there on, optimal production and utilization of electricity in the economy should be encouraged.

Keywords: Dynamics, Electricity, Non-linearity, Threshold-regression, Economic-growth.

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Author's Affiliation
Federal University of Kashere, PMB 0182, Gombe, Nigeria.
*Corresponding author Email:
adamabbas92.aa@gmail.com,
asooso1968@yahoo.com,
naziruyusuf565@yahoo.com

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INTRODUCTION

Economic activities of production, distribution and consumption require energy for smooth sailing. Energy is a vital input for economic growth and development. As Esso (2010) and Mensah (2014) put it, energy is regarded as a key driver of economic growth and industrialization. Several studies were conducted to understand the linkage(s) between Energy Consumption (EC) and macroeconomic variables (in most cases economic growth) due to the supposed significance of energy in an economy. Kraft and Kraft (1978) laid the foundation on the EC and economic growth debate. From thereon, a number of attempts were made to model the relationship using different methodologies, scopes, and model specifications. Perhaps this might account for the reason why the debate is still inconclusive, among other reasons.

One of the most important forms of energy is electricity. This is because electricity is a flexible form of energy and an essential resource for modern life, hence an essential infrastructural input for economic development. Obviously, households and companies have extensive demand for electricity. Factors that increase this demand include, population growth, industrialization, extensive urbanization, rising standard of living and modernization of the agricultural sector, among others.

The average power per capita (in watts) in the USA, Japan, South Africa, China, India and Nigeria were 1,363, 774, 496, 397, 85, and 12 respectively. According to the World fact book (2008), these figures approximately correlate with the country's GDP per capita in 2008. Paradoxically, as Nigerian commodities are exported, especially oil; the economy and citizenry suffer from inadequacy of these products. This can be deduced from the inadequate supply of electricity and other petroleum products. Electricity demand is predicted to rise from 5,746 MW in 2005 to 297,900MW in the year 2030 which translates to construction of 11,686MW every year to meet this demand (Sambo, 2008). The government owned power company (Power Holding Company of Nigeria) has been unbundled and privatized. This means the three hydro and seven thermal generating plants and eleven distribution companies (33kV and below) were all privately managed. Essentially, undertaking the wires, sales, billing, collection and customer care functions within various areas nationwide were privately set up. The above activities were with an exception for transmission function which is still government owned.

A lot of studies have been carried out to investigate the dynamical directions between economic growth and EC especially under the following four categories of hypothesis, they are: the growth hypothesis (electricity consumption causing economic growth), conservation hypothesis (economic growth causing electricity consumption), bidirectional causality hypothesis, and no causality relation between EC and economic growth (Jayathileke and Rathnayaka, 2013) but still a consensus is yet to be reached. In the view, this study intends to examine the dynamic relationship between electricity consumption and economic growth in Nigeria.

LITERATURE REVIEW

Fatai et al. (2004) modelled the causal relationship between energy consumption and GDP in New Zealand, Australia, India, Indonesia, The Philippines and Thailand. They found causality in New Zealand between GDP and various disaggregated energy data (Coal, Natural gas, Electricity and Oil). They suggest that energy conservation policies may not have significant impacts on real GDP growth in industrialized countries such as New Zealand and Australia compared to some Asian economies.

Narayan and Smyth (2007) examined the relationship between electricity consumption, employment and real income in Australia within a co-integration and causality framework. They found that electricity consumption, employment and real income granger cause electricity consumption, while in the short run there is weak unidirectional granger causality running from income to electricity consumption and from income to employment.

Yoo (2005) investigated the causality issues between electricity consumption and economic growth in Korea by applying co-integration and error-correction models. They found that there exists bi-directional causality electricity consumption and economic growth.

Narayan and Prasad (2008) examined causal effects between electricity consumption and real GDP using bootstrapped causality testing approach and found evidence in favor of electricity consumption causing real GDP in Australia, Iceland, Italy, the Slovak Republic, the Czech Republic, Korea, Portugal, and the UK.

Narayan et al. (2007) employed SVAR model and examine the impact of electricity consumption shocks on real GDP for the G7 countries. They found that except for the USA, electricity consumption has a statistically significant positive impact on real GDP over short horizons.

Bildirici (2013) estimates the causality relationship between electricity consumption and economic growth in per capita and aggregate levels. They employed ARDL method for some developed and developing countries. They found evidence in support of growth hypothesis in US, China, Canada and Brazil while evidence in support of conservation hypothesis for India, Turkey, South Africa, Japan, UK, France and Italy.

Masuduzzaman (2012) examined the causal relationship between economic growth, electricity consumption and investment in Bangladesh from 1981-2011 using ECM model. Found a unidirectional causal relationship runs from electricity consumption to investment and economic growth.

Kapila et al. (2018) conducted a Johansen co-integration with vector error correction model (VECM) and examine the dynamic links between the variables of the study. The result confirmed a long run bidirectional causal relation running between energy consumption and economic growth.

Iyke and Odhiambo (2014) examined the dynamic causal relationship between electricity consumption and economic growth in Ghana within a trivariate ARDL framework, for the period 1971-2012. They found a distinct causal flow from economic growth to electricity consumption.

Shahbaz and Lean (2012) examined the dynamics of electricity consumption and economic growth and explored their causality in Pakistan under the framework of vector error correction model. They found a unidirectional causality running from GDP to electricity consumption.

Yuxue and Haitao (2016) examined the causal relationship between electricity consumption and economic growth for China's Beijing-Tianjin-Heibei agglomeration, using annual data covering the period 1982-2008. The employed Johansen co-integration test and the granger causality test. They found that there is causality running from electricity consumption to economic growth in all the three locales.

Apergis and Payne (2009) examined the relationship between energy consumption and economic growth for six Central American countries over the period 1980-2004 within a multivariate framework. They employed a panel co-integration and error correction model. They found the presence of both short-run and long-run causality from energy consumption to economic growth which supports the growth hypothesis.

Iheanacho (2018) explored the relationship between globalization, energy consumption and economic growth for Nigeria from 1975 to 2011 and applied co-integration test and VECM Granger causality framework to establish the direction of causality over the period of the study. The study found a feedback relationship between globalization and energy consumption in the long-run. It also found a unidirectional causality running from energy consumption to financial development, economic growth.

Olufemi (2015) analyzed the relationship between electricity consumption and industrial growth in Nigeria for the period of 1980-2012. The study employed co-integration and error correction techniques. Evidence of positive relationship between industrial growth and electricity consumption was found while a negative relationship between industrial growth and capital input was also noted.

Okafor (2012) examined the causal relationship between energy consumption and economic growth in Nigeria and South Africa. The study applied the Hsiao Granger causality. It was found that economic growth causes total energy consumption in South Africa while energy consumption causes economic expansion in Nigeria.

Theory of Endogenous Growth

Endogenous growth theorists have demonstrated that technological knowledge is a form of capital accumulated through research and development (R&D) and other knowledge creating processes. In such a way, growth of capital here refers to the growth of a composite stock of capital and technological knowledge. Output rises as constant proportion of the composite capital stock and, therefore, it is not subject to diminishing returns because diminishing returns to manufactured capital are neutralized by exogenous technology growth.

These strands of growth models also do not consider any natural resources, including energy/electricity. The standard neoclassical models thus, conclude that technical conditions determine whether continuing growth is possible. Technical conditions have to do with the substitutability of renewable and non-renewable resources. In analyzing the neoclassical growth models, the class of growth models that include resources (energy) can account for mass balance and thermodynamic constraints with the 'essentiality condition'. If elasticity is greater than one, then resources are 'non-essential' if elasticity is less than or equal to one, then resources are 'essential'.

Theoretical Literature Gap

Given that most of the studies observed did not examine the intensity of the causal link between electricity consumption and gross domestic product (the magnitude of the coefficients associated with the causality tests). Hence, the study employs nonlinear threshold regression model in order to capture the relationship between electricity consumption and economic growth in Nigeria. To this end no study in Nigeria employ this methodology and such is considered a gap, which this study intends to fill. The study also intends to add a new variable, that is, government expenditure on electricity and measure the impact on economic growth.

MATERIALS AND METHOD

The data used in this research is sourced from Central Bank of Nigeria (CBN), National Bureau of Statistics (NBS), World Bank, World Development indicators (WDI) and International Energy Agency (IEA).

Type and Span of Data

The purpose of this research is to examine the dynamics of electricity consumption and its impact on economic growth. Hence, quarterly time series data covering 1981Q1 to 2017Q4 is used for the study.

Estimation Technique

The research is interested in examining the impact of electricity consumption and government expenditure on economic growth in Nigeria. For one threshold or two regions, the model is specified as follows:

$$GDPst = \delta_{10} + \delta_{11}lagGDP + \delta_{12}elec + \delta_{13}govt_e + \in_t if -\infty < lagGDP \leq \gamma \quad (1)$$

$$GDPst = \delta_{20} + \delta_{21}lagGDP + \delta_{22}elec + \delta_{23}govt_e + \in_t if\gamma < lagGDP < \infty \quad (2)$$

Non-linear Threshold Regression Model

The nonlinear threshold regression model allows the examination of electricity consumption limit and its impact on GDP (i.e economic growth) to better prescribe economic and energy policies to those before and after the critical limits. Interested in the impact of electricity consumption on economic growth, the research intends to employ nonlinear threshold model in order to capture the impact of electricity consumption on Nigeria's economic growth or vice versa.

Model with a Single Threshold

Coefficients are allowed to differ across regions under the nonlinear threshold regression model. Nonlinear threshold regression model is an extension of linear regression model. Regions are identified by a threshold variable being above or below a certain threshold value. Multiple thresholds can occur, and one can either specify a known number of thresholds or allow the model to find it by minimizing an information criterion. Hansen (2011) provide a detailed survey of threshold regression models.

Consider a threshold regression with two regions defined by a threshold specified as follows:

$$y_t = x_t\beta + Z_t\delta_1 + \epsilon_t \; if - \infty < \omega_t < \gamma \quad (3)$$
$$y_t = x_t\beta + Z_t\delta_2 + \epsilon_t \; if \gamma < \omega_t < \infty \quad (4)$$

where the dependent variable y_t and, x_t is a $1 \times k$ vector of covariates possibly containing lagged values of y_t, β is a $k \times 1$ vector of region-invariant parameters, ϵ_t is an IID error with mean 0 and variance σ^2, Z_t is a vector of exogenous variables with region-specific coefficient vectors δ_1 and δ_2, and ω_t is a threshold variable that may also be one of the variables in x_t or Z_t.

The estimated threshold ($\dot{\hat{\gamma}}$) is one of the values in the threshold variable ω_t.To estimate the threshold the least squares of the following regression with T observations and two regions, will be minimized,

$$y_t = X_t\beta + Z_t\delta_1 I(-\infty < \omega_t < \gamma) + Z_t\delta_2 I(\gamma < \omega_t < \infty) + \epsilon_t \quad (5)$$

for a sequence of T_1 values in ω_t, where $T1 < T$. The default trimming percentage is set to 10%, which implies that $T1$ corresponds to the number of observations between the $10th$ and the $90th$ percentile of ω_t . The estimator for the threshold is

$$\dot{\hat{\gamma}} = \arg\min_{\gamma\in\Gamma} \mathrm{S}_{\mathrm{T}_1}(\gamma) \quad (6)$$

where $\Gamma = (-\infty, \infty)$,

$$S_{TI}(\gamma) = \sum_{t=1}^{T}\{y_t - X_t\beta - Z_t\delta_1 I(-\infty < \omega_t < \gamma) - Z_t\delta_2 I(\gamma < \omega_t < \infty)\}^2 \quad (7)$$

is a $T1 \times 1$ vector of SSR, and γ is a $T1 \times 1$ vector of tentative thresholds.

Model with More Than Two Regions

The general threshold regression model with m thresholds has $m + 1$ regions. Let $j = 1, \dots, m + 1$ index the regions. The model can be specified as follows:

$$y_t = X_t\beta + Z_t\delta_1 I_1(\gamma_1, \omega_t) + \dots + Z_t\delta_{m+1} I_{m+1}(\gamma_{m+1}\omega_t) + \epsilon_t \quad (8)$$

$$y_t = X_t\beta \sum_{j+1}^{m+1} Z_t\delta_j I_j(\gamma_j, \omega_t) + \epsilon_t \quad (9)$$

Where $\gamma_1 < \gamma_2 < \dots < \gamma_m$ are ordered thresholds with $\gamma_0 = -\infty$ and $\gamma_{m+1} = \infty. I_j(\gamma_j, \omega_t) = I(\gamma_{j-1} < \omega_t \leq \gamma_j)$ is an indicator for the j_{th} region. Conditional on all estimated thresholds $(\widehat{\gamma_1}, \dots, \widehat{\gamma_m})$ the threshold regression model is linear, and the remaining parameters are estimated using least squares.

The thresholds are estimated sequentially as described below. Let $\gamma_1^*, \dots, \gamma_m^*$ represent the m thresholds in the order of estimation. Gonzalo and Pitarakis (2002) show that the thresholds estimated sequentially are T consistent. The first threshold (γ_1^*) is estimated assuming a model with two regions as described in the previous section. Conditional on the first threshold, the second threshold is estimated as the value that yields the minimum sum of squared errors over all observations in wt excluding the first threshold. The estimator of the second threshold γ_2^* is obtained by minimizing the least squares of a regression with three regions conditional on the first estimated threshold $\hat{\gamma}_1^*$. The estimator is given by

$$\hat{\gamma}_2^* = \arg min_{\gamma_2^*\Gamma_2} S_{T_2}(\frac{\gamma_2^*}{\hat{\gamma}_1^*}) \quad (10)$$

Where $\Gamma_2 = (\gamma_0, \hat{\gamma}_1^*) \cup (\hat{\gamma}_1^*, \gamma_3)$and $T_2 < T_1$.

In general, the lth threshold minimizes the SSR conditional on the $l - 1$ estimated thresholds and is given by

$$\hat{\gamma}_l^* = argmin_{\gamma_l^*\in\Gamma2} S_{T_l}(\frac{\gamma_l^*}{\hat{\gamma}_1^*}, \dots, \hat{\gamma}_{l-1}^*) \quad (11)$$

Where $\Gamma_l = (\gamma_0, \gamma_{m+1})$ excluding $\hat{\gamma}_1^*, \dots, \hat{\gamma}_{l-1}^*$

When the number of thresholds is not known a priori, threshold selects the optimal number of thresholds based on AIC, BIC, or HQIC, which is defined based on SSR from the fitted model as

$$AIC = Tln(SSR = T) + 2k \quad (12)$$

$$BIC = Tln(SSR = T) + kln(T) \quad (13)$$

$$HQIC = Tln(SSR = T) + 2klnfln(T)g \quad (14)$$

Where k is the number of parameters in the model. See Gonzalo and Pitarakis (2002) for Monte Carlo studies of selecting the number of thresholds based on information criteria.

Table 1. Series Summary Statistics.

	LGDP	LOGELECT_CONS	LOGEXPE_PWR
Mean	17.15267	2.409145	3.006992
Std. Dev.	0.543542	0.475638	2.277534
Jarque-Bera	14.27993	15.05608	35.60749
Probability	0.000793	0.000538	0.000000
Observations	148	148	148

Source: Authors' Computation using EVIEWS version 10 Software.

RESULT AND DISCUSSION

This section presents and discusses results and findings of the research. It presents the summary statistics of the variables used in the research and explores the characteristics of the variables used.

Summary Statistics

Summary statistics are used to summarize a research data in order to communicate large amount of information in a simple way. From the summary statistic of all the data set used, it can quickly be perceived, the amount of information such data contained. Table 1 presents the summary statistic of the variables used in this study. Where LGDP means (log of Gross Domestic Product), LOGELECT_CONS means (log of electricity consumption), LOGEXPE_PWR means (log of government expenditure on power).

From Table 1, it can be seen that the mean of LGDP which is 17.15267 is highest among the other variables, LOGELEC_CONS (2.409145) and LOGEXPE_PWR (3.006992). Mean of LGDP in this respect means the average LGDP of Nigeria in the years of 1981Q1 to 2017Q4. The same also applies to the electricity consumption every quarter in Nigeria from 1981 to 2017, the average electricity consumed is 2.409145 every quarter. On average federal government of Nigeria spend 3.006992bn on power to enhance the sector for an improved power supply (from Table 1).

Standard deviation provide signal of deviation among the remaining observations in a data set. It tells whether there are significant outliers or exceptionally large or too little observation among the remaining observations. The standard at which all the observations deviate from the mean (i.e the average) can also be observed from Table 1. The standard deviation of LGDP is 0.543542 which is far from the mean and this means little or no evidence of outliers in the data. It also means not much are the other observations deviate from the mean of LGDP, LOGELEC_CONS and LOGEXPE_PWR that have 0.475638 and 2.277534 respectively as well.

The Jacque-bera statistic (and the probability value) reported [14.27993 (0.000793) for LGDP, 15.05608, (0.000538) for LOG_ELECT_CONS and 35.60749(0.000000)] in Table 1 indicates the rejection of the null hypothesis of normality in distribution of the series. Hence, the series can be thought of as having fat-tail which is typical of most time series. There are 148 observations per all the variables used.

Graph of the Variables

Graphs produce a better understanding of the broad meaning and importance of data used. It depicts the graphical behavior of the variables used. From the graphs presented below, it can be seen that all the three variables tend to fluctuate over time indicating element of inconsistency and nonlinearity inherent in them. Graphical fluctuation of this variable tells a lot about their behavior.

From Figure 1, the behavior of Nigeria's LGDP can be observed, initially from 1981 to 1984 there was a drop in GDP before it took up from 1985 and continued to grow on a steady path. The average growth rate of GDP per capita has been 1.7 percent per year (Akinwunmi, 2017). Prior to the adoption of 1986 Structural Adjustment Program (SAP) in the country, the average per capita was almost US$ 1544 between 1960 and 1985 (Akinwunmi, 2017). The dynamics of political system and regimes in the country contribute to the level of its economic activities. Perhaps, this may account for the level of nonlinearity exhibited in the data.

From 2000 (New millennium), rapid growth has been witnessed in the country's GDP, this can be attributed to increase in economic activities from the new millennium. From this same period (2000 onward) a sharp increase in the level of electricity consumption was witnessed in the country. Therefore, evidence of long-run relationship among these variables can be observed from both Figures 1 and 2 respectively. The behavioral nature of the variable suggest element of nonlinearity inherent in the variable.

From Figure 2, Nigeria has witnessed an upward trend in electricity consumption. A steady decline phase was witnessed from 1986 up to 1998 before it slightly increased up to 2001. A sharp increase was witnessed in 2001 up to 2003, then ever since a fluctuating nature has been witnessed up to 2015, and then settled on slightly steady

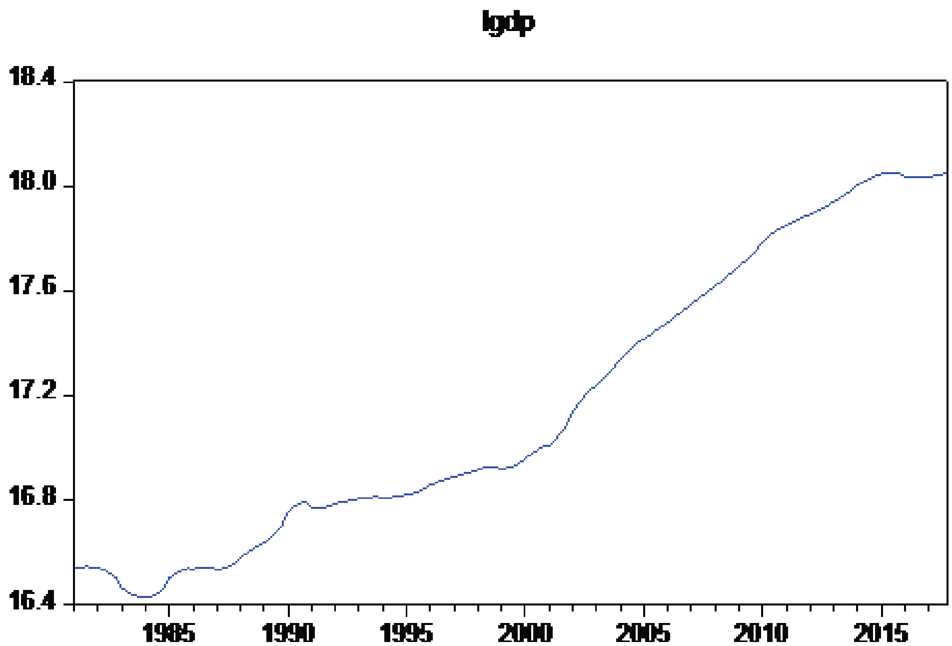

Figure 1. LGDP (log of Gross Domestic Product).

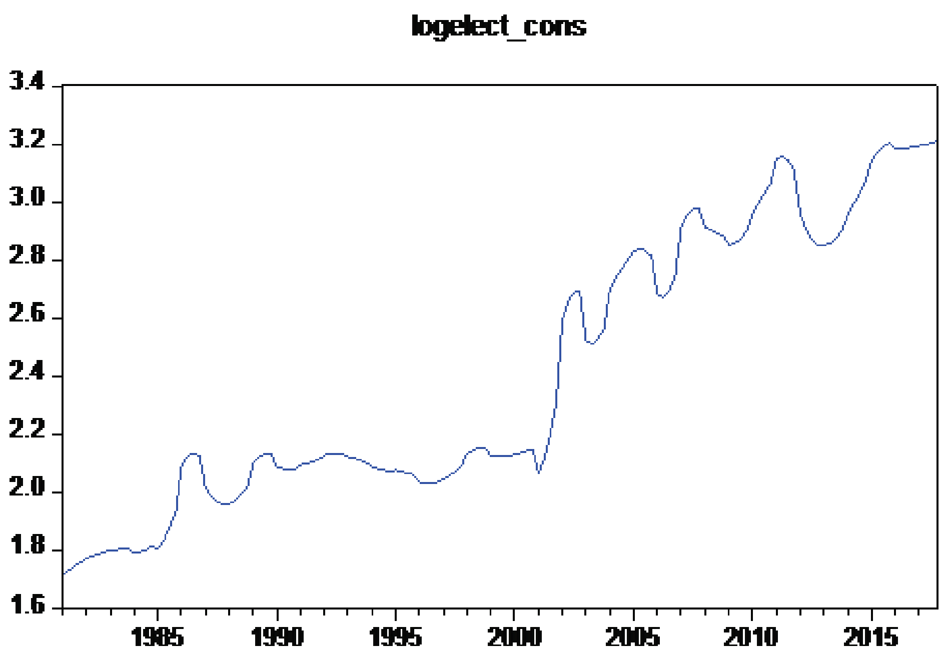

Figure 2. Logelect_cons (log of electricity consumption).

phase.

The fluctuation in electricity consumption in Nigeria hinders smooth running of economic activities as electricity is a vital infrastructure in most economic activities in Nigeria. Hence, evidence of relationship can be observed among electricity consumption and Nigeria's economic growth from Figures 1 and 2. The fluctuation in electricity consumption also indicates that the variable is nonlinear.

From Figure 3, it can be observed that from 1981 to 1982, government expenditure on power reduced. From 1982 steady increased on government expenditure on power was witnessed up to 1986, and then a sharp increase was

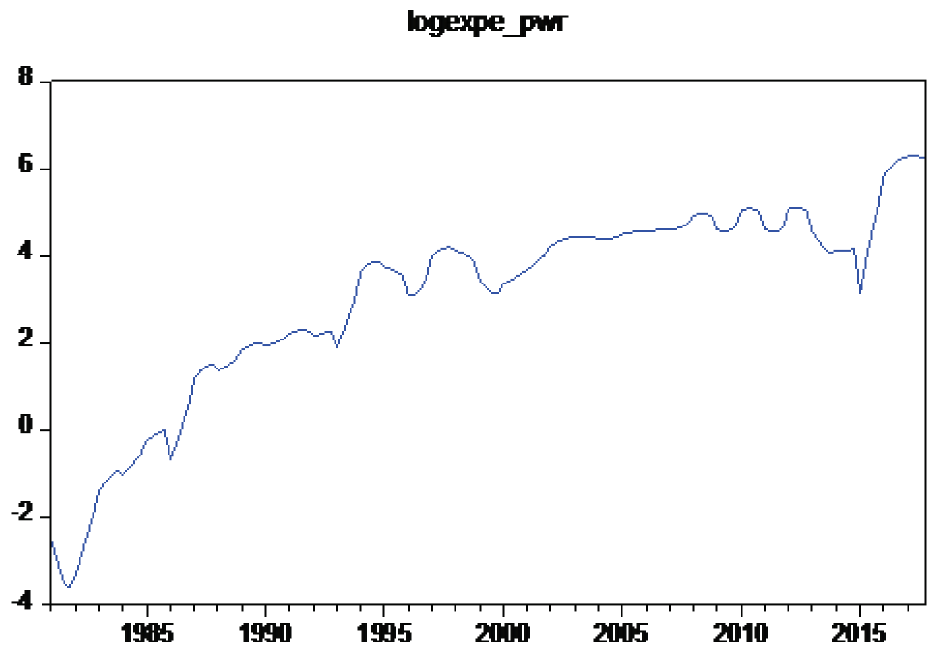

Figure 3. Logexpe_pwr (log of government expenditure on power).

Table 2. Estimated Threshold Values.

1:	2.8482649				
2:	1.8783049	2.8482649			
3:	1.8783049	2.8482649	2.9934639		
4:	1.8035179	2.0298489	2.8482649	2.9934639	
5:	1.8035179	2.0298489	2.1416569	2.8482649	2.9934639

Source: Authors' Computation using EVIEWS version 10 Software.

witnessed also. From 1988 up to 1994 there was steady increase on the expenditure. From 1995 to 2000, there was steady phase of gradual increase in the expenditure. But from 2008 to 2013 another phase of fluctuation in the government expenditure on power was witnessed. It lasted up to 2014 where it declined, and then a sudden increase from 2015 to 2017 was witnessed. This is because the sector was merged with works, power and housing in 2015. The trend in government expenditure interestingly depicts the interest of the Nigerian government to enhance the power sector for more stable electricity in the economy due to its importance in enhancing economic activities. The impact of increasing expenditure on power can be observed from the steady increase in economic growth as more expenditure is incurred in the power sector.

Threshold Regression Model

Threshold regression model is a type of regression model that sort to analyze economic variables possessing step-like time paths. The dependent variable (economic growth) is assumed not to move until the concerted action of the independent variable (electricity consumption) and the error term induces it to overcome its reaction threshold. Threshold regression model is used in this study to analyze the extent of influence of electricity consumption on Nigeria's economic growth.

Table 2 presents the estimated thresholds on the variable of interest (i.e LOGELECT_CONS). E-views identified five threshold values on the variable. But Bai-Perron test will identify the significant thresholds among the 5 estimated thresholds.

In Table 3, Bai-Perron multiple test of significance is conducted to identify the most significant thresholds in the variable of interest to be considered on estimation. Also from Table 4, it can be seen that Bai-Perron threshold test identified only 2 threshold values as statistically significant. The asterisk (*) is what indicate the statistical significance of the thresholds at 5% level of significance (1 vs. 2*). Hence,

Table 3. Threshold Multiple Test of Significance.

Threshold Test	F-statistic	Scaled F-statistic	Critical Value**
0 vs. 1 *	8.271767	16.54353	12.25
1 vs. 2 *	13.54093	27.08187	13.83
2 vs. 3	2.363601	4.727202	14.73
3 vs. 4	1.462187	2.924373	15.46
4 vs. 5	1.631212	3.262424	16.13

* Significant at the 0.05 level

** Bai-Perron (Econometric Journal, 2003) critical values.

Source: Authors' Computation using EVIEWS version 10 Software.

Table 4. Threshold Regression Model Result.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGELECT_CONS < 1.8783049 -- 18 obs				
C	21.98541	1.351785	16.26399	0.0000
LOGELECT_CONS	-3.013610	0.747341	-4.032441	0.0001
1.8783049 <= LOGELECT_CONS < 2.8482649 -- 86 obs				
C	15.10356	0.139212	108.4929	0.0000
LOGELECT_CONS	0.723749	0.074018	9.778047	0.0000
2.8482649 <= LOGELECT_CONS -- 44 obs				
C	15.79592	0.864515	18.27143	0.0000
LOGELECT_CONS	0.579103	0.282300	2.051373	0.0421
Non-Threshold Variables				
LOGEXPE_PWR	0.067763	0.015410	4.397312	0.0000

Source: Authors' Computation using EVIEWS version 10 Software.

based on this identified thresholds, threshold regression model will be estimated for 1.8783049 and 2.8482649. More details on the figures from the tables can be found in the Appendix.

The first estimated threshold is 1.8783049 which tally with 18 observations. Anything of electricity consumption below the threshold will have a negative impact on economic growth by -3.014. If electricity consumption lies in between the first and second threshold values of 1.8783049 and 2.8482649, electricity consumption will have positive impact on economic growth by 0.723. But when electricity consumption exceeded the threshold value of 2.8482649, economic growth will be positively affected by 0.579, although this is not statistically significant. If on the other hand, a non-threshold variable of federal government expenditure on electricity (power) is increased by one unit, it will positively affect economic growth by 0.068.

From this analysis, it can be inferred that the extent of causality between electricity consumption and economic growth revolves around the identified threshold values. Electricity consumption positively influence economic growth, if it reaches 1.8783049 or lies in between 1.8783049 and 2.8482649. But if electricity consumption falls below 1.8783049 it will have a negative impact on economic growth. This therefore has a policy implication. Certain threshold level of electricity consumption has to be maintained in order to have a steady economic growth.

CONCLUSION

The study utilizes a time series data from 1981Q1 to 2017Q4 and examines the impact of electricity consumption on Nigeria's economic growth. Nonlinear threshold regression model is employed to examine the impact of electricity consumption on Nigeria's economic growth. Nonlinear threshold regression model is an extension of linear regression model. Based on the literature reviewed, it is discovered that no literature has employed the said methodology especially on Nigeria's data. Hence that is considered a gap that this study filled. After extensive exploration of the characteristics of the data, the result of the threshold regression model revealed the impact electricity consumption has on Nigeria's economic growth. The research prescribed policy intervention for the government and actors at play in Nigeria. The study concludes that electricity consumption has a strong impact on Nigeria's economic growth.

From the result of the study, it can be concluded that electricity consumption has a strong influence on Nigeria's economic growth. The importance of electricity consumption in Nigeria cannot be over emphasized. It is therefore of paramount importance, such a sector is given a very serious attention. The government should ensure that, electricity supply is adequately taken care of, so that more economic activities will have an enabling environment to flourish.

RECOMMENDATIONS

One of the vital sectors in an economy is the energy sector. Energy efficiency will be highly beneficial to the system; hence more research and development should be encouraged in order to tackle the deficiency in the sector. Government expenditure on the sector should be increased to foster more energy or electricity production in Nigeria. More private-public-partnership projects should be emulated to see to the advanced production in electricity in Nigeria, which in return will increase its consumption and further boost the economy to growth.

Conflict of Interests

The author(s) declare no conflict of interest.

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Appendix I

Table 6. Series Summary Statistics.

	LGDP	LOGELECT_CONS	LOGEXPE_PWR
Mean	17.15267	2.409145	3.006992
Median	16.92774	2.133251	3.862646
Maximum	18.05201	3.209734	6.293510
Minimum	16.42640	1.714293	-3.628255
Std. Dev.	0.543542	0.475638	2.277534
Skewness	0.393185	0.326015	-1.152699
Kurtosis	1.697201	1.580005	3.677736
Jarque-Bera	14.27993	15.05608	35.60749
Probability	0.000793	0.000538	0.000000
Sum	2538.595	356.5535	445.0348
Sum Sq. Dev.	43.42939	33.25601	762.5129
Observations	**148**	**148**	**148**

Table 7. Threshold Multiple Test of Significance.

Multiple threshold tests

Bai-Perron tests of L+1 vs. L globally determined Thresholds
Date: 12/20/18 Time: 13:16
Sample: 1981Q1 2017Q4
Included observations: 148
Threshold variable: LOGELECT_CONS
Threshold varying variables: C LOGELECT_CONS
Threshold non-varying variables: LOGEXPE_PWR
Threshold test options: Trimming 0.10, Max. thresholds 5, Sig. level 0.05
Test statistics employ HAC covariances (Bartlett kernel, Newey-West fixed bandwidth)

Sequential F-statistic determined thresholds: 2
Significant F-statistic largest thresholds: 2

Threshold Test	F-statistic	Scaled F-statistic	Critical Value**
0 vs. 1 *	8.271767	16.54353	12.25

Table 7. Contd.

1 vs. 2 *	13.54093	27.08187	13.83
2 vs. 3	2.363601	4.727202	14.73
3 vs. 4	1.462187	2.924373	15.46
4 vs. 5	1.631212	3.262424	16.13

* Significant at the 0.05 level
**Bai-Perron (Econometric Journal, 2003) critical values.

Table 8. Threshold Regression Model Result.

Dependent Variable: LGDP
Method: Discrete Threshold Regression
Date: 12/20/18 Time: 13:11
Sample: 1981Q1 2017Q4
Included observations: 148
Selection: Sequential evaluation, Trimming 0.10, , Sig. level 0.05
Threshold variable: LOGELECT_CONS
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 5.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGELECT_CONS < 1.8783049 -- 18 obs				
C	21.98541	1.351785	16.26399	0.0000
LOGELECT_CONS	-3.013610	0.747341	-4.032441	0.0001
1.8783049 <= LOGELECT_CONS < 2.8482649 -- 86 obs				
C	15.10356	0.139212	108.4929	0.0000
LOGELECT_CONS	0.723749	0.074018	9.778047	0.0000
2.8482649 <= LOGELECT_CONS -- 44 obs				
C	15.79592	0.864515	18.27143	0.0000
LOGELECT_CONS	0.579103	0.282300	2.051373	0.0421
Non-Threshold Variables				
LOGEXPE_PWR	0.067763	0.015410	4.397312	0.0000

R-squared	0.967171	Mean dependent var	17.15267
Adjusted R-squared	0.965774	S.D. dependent var	0.543542
S.E. of regression	0.100557	Akaike info criterion	-1.710050
Sum squared resid	1.425739	Schwarz criterion	-1.568290
Log likelihood	133.5437	Hannan-Quinn criter.	-1.652453
F-statistic	692.3327	Durbin-Watson stat	0.233139
Prob (F-statistic)	0.000000		