ELECTRICITY CONSUMPTION AND INDUSTRIAL OUTPUT IN NIGERIA

MOSES OYEYEMI, AGBEDE[1]*, M.sc &FAVOUR C. ONUOHA [2], Ph. D
ECONOMICS DEPARTMENT,
EVANGEL UNIVERSITY , AKAEZE,
EBONYI STATE .
yemi_agbede@yahoo.com[1*]&fc.onuoha@evangeluniversity.edu.ng[2]

Abstract

This study investigated the effect of electricity consumption on industrial output in Nigeria. Time series data were used for the study, sourced from the Central Bank of Nigeria Annual Report, Statistical Bulletin, World Bank Idicator and the National Bureau of Statistics which spanned from 1981 to 2017. The study used Augumented Dickey-Fuller (ADF) and Philip Perron (PP) unit root tests to analyze the stationary state of the data. The study employed bound test co-integration, Auto Regressive Distributed Lag (ARDL) and pairwise granger causality techniques for empirical analysis. The bound test co-integration results revealed that there is no long run relationship among the variables. The ARDL results revealed that IELEC (Industrial electricity consumption), ELECGE (electricity generation) at lag 1 and ECP (electricity consumption price) have positive relationship with IND but not statistically significant. Also, CRIND (credits to industries) has direct relationship with IND but significant at 10%. However, the causality test indicates the existence of unidirectional causality running from. Therefore, the study recommends vigorous government policies to improve electricity generation yearly in Nigeria, cogent approach should be geared toward reforming the power sector to meet industrial electricity consumption demand and credit allocated to the industrial sector should be improved upon for industrial development in Nigeria.

Keywords:Industrial Output, Industrial Electricity Consumption, Electricity Generation, Credit to Industry, Carbon Emission.

Introduction

Nigeria industrial development has been bedeviled by myriads of problems top among which is the erratic nature of electricity supply in the power sector. Every successive government had promised to do something drastic to stabilize the sector in order to drive growth in the industrial sector but all to no avail (Ologundudu, 2015). Electricity crisis has become a matter of grave concern not only to Nigerians but also, to the international community especially many foreign investors. Audu, Paul and Ameh (2017) affirm that the privatisation of the electricity industry in Nigeria is tainted with numerous challenges and these largely explain why the power sector reform programme in Nigeria has not translated to significant improvement in the nation's electricity supply. According to Oladosu (2016), a reduction in growth rate of per capita income by 2 per cent was as a result of inadequate electricity supply in sub-Saharan Africa.

Poor electricity supply in Nigeria and indeed the rest of Africa has posed the greatest challenge to productivity, investment growth, and competitiveness (Renneika and Svenson, 2002; ADB, 2009). Business firms respond to unreliable supply of electricity in a variety of ways which include choice of business, choice of location, output reduction, factor substitution and self-generation. Omoleke (2011) affirms that a lot of multi-national corporations have closed down and relocated to nearby countries especially Ghana that enjoy uninterrupted electricity-supply, this situation is proactive and worrisome and therefore requires investigation and further research. In Nigeria at the present time, the total installed capacity of the generating stations has not equated the energy demand of the people due to poor infrastructure and policies despite the government's increasing investments in this sector. Based on these premises, industrial electricity consumption and industrial output in Nigeria has not been adequately addressed. Against this background, this study is most relevant and indeed timely. The study is structured as follows; section one captures the background to the study, section two focuses on detailed theoretical underpinning and literature. Section three explains the method adopted to analyze the data while section four shows the results and the interpretations. Finally, section five gives the summary, conclusion and recommendations.

Theoretical Underpinning and Literature Review

This study is anchored on the liberalized electricity market theory, traditional theory of cost and the Schumpeterian theory of capitalist development reflecting issues bordered on electricity and manufacturing productivity growth. According to Osobase and Bakare (2014), the liberalized electricity market theory explains the right of firms to choose to invest in different types of power plants which allow production of electricity at different levels of marginal cost. The theory contends that, since electricity is not storable at reasonable cost, it is optimal for firms to invest in a differentiated portfolio of technologies in order to serve strongly fluctuating demand. Koutsoyiannis (1979) opines that the traditional theory of cost admits that the optimal level of output is attainable at a single level of output above which costs begin to rise. Therefore, the output capacity is fully utilized at a point where the marginal cost curve cuts the average cost curve at the minimum while the former start rising. Under the traditional theory of cost, firms do not build plants with varying productive capacity. Thus, excess capacity is often a phenomenon experienced by firms. The study also adopts the Schumpeterian theory of capitalist development in its contention that innovations and inventions are a major catalyst of economic development (Schumpeter, 1934). This informs the need for government, Non-Governmental Organizations (NGO), entrepreneurs/owners of manufacturing firms to device possible alternative ways of sourcing energy and adopting manufacturing machines/equipment that will require little electric power to function in order to reduce the adverse effect of erratic electricity power supply on the productivity of manufacturing firms in the country.

Empirical Review

Studies on the Relationship between Electricity Consumption and Industrial Output

Theophilus, Christopher and Paul (2016) examine the impact of electricity supply on industrial output in Nigeria from 1980-2013. Error correction model was employed to determine the speed of adjustment between the variables. The error term was found to be significant and negatively signed, other diagnostic tests appeared satisfactory. The study results showed that electricity supply and trade openness impact industrial production negatively in Nigeria. They were also not statistically significant. Ologundudu (2015) investigated the epileptic nature of electricity supply and its consequences on industrial and economic performance in Nigeria from 1972 – 2010. Employing Granger Causality test and the ARDL bounds test approach to co-integration, the result showed the existence of co-integration. Also, there is a bi-directional causality between GDP per capita and electricity supply and a unidirectional causality running from capital to GDP per capita.

Osobase and Bakare (2014) analysed the relationship between electricity generation/supply and manufacturing sector performance in Nigeria using time series data from 1975-2011. The work employed the correlation analysis, Granger Causality test and Johansen Co-integration test for the empirical analysis. The correlation result revealed a weak positive nexus between electricity generation and index of manufacturing production in Nigeria. A unidirectional causality was revealed between electricity generation and index of manufacturing sector production. Further test shows three co-integration equations at five percent level for the trace statistics, but no co-integration at five and one percent level for the Max-Eigen test. In view of the findings, it has been observed that, irregular electricity supply has been a major bane to output growth in the manufacturing sector.

Alao (2016) examined residential and industrial electricity consumption dynamics and economic growth in Nigeria from 1980 – 2010. Adopting Co-integration test, Granger causality test and Ordinary Least Square regression techniques, the study revealed a unidirectional causality running from industrial electricity consumption to residential electricity consumption and bidirectional causality between residential electricity consumption and per capita income growth in Nigeria for the period of study. Residential electricity consumption (LREC) is Positive and statistically significant, the industrial electricity consumption ratio (IEC) is positive and statistically significant in model 1but negative and statistically significant in models 2 and 3while the interaction between LREC and IEC ratio is positive and statistically significant in models 2 and 3. Hence, the study concludes that residential electricity consumption is constrained by industrial electricity consumption in Nigeria. Danmaraya and Hassan (2016) studied the relationship between electricity consumption and manufacturing sector productivity in Nigeria from 1980-2013. Using the autoregressive distributed lag technique and granger causality test, the result showed the existence of co-integration among electricity consumption, manufacturing productivity, and capital and bidirectional causality between manufacturing productivity and energy consumption.

Nwankwo and Njogo (2016) examined the effect of electricity supply on industrial production within the Nigerian economy. Employing a multiple regression technique, the result revealed that, the electricity (ELEC), Gross fixed capital formation (GFCF), industrial production (INDU) variables and population have the positive sign. That is, they are positively related to RGDP Per capita. Turning to theIndustrial production expenditure model, the electricity generation expenditure, gross fixed capital formation and population variables are positively related to GDP Per capita. Yahaya, Salisu and Umar (2015) explored the relationship between electricity supply and manufacturing sector's output in Nigeria using time series data from 1971 to 2010. Adopting the Autoregressive Distributed Lag (ARDL) bounds testing approach to co-integration, the result revealed a long run relationship between the variables. Also, a significant and negative error correction term was revealed. Manufacturing output is found to be positively dependent on electricity in both short run and long run, but only significant in the long run.

Nwajinka, Yousuo and John (2013) investigated the impact of national electric energy supply on industrial productivity in Nigeria from 1970 to 2010. Employing multiple regression analysis, the results showed that national energy supply have no significant impact on industrial productivity in Nigeria.Akiri, Ijuo and Apochi (2015) examined the impact of electricity supply (EGI) on the productivity of manufacturing industries in Nigeria between 1980 and 2012. The study employed the ordinary least square multiple regression technique and the result revealed that electricity generation and supply impacted positively on the manufacturing productivity growth, but the coefficient is very low due to inadequate and irregular supply of electricity especially to manufacturing subsector in the economy resulting from government's unnecessary spending on non-economic and unproductive sectors. The study of Audu, Paul and Ameh (2017) relied on the intellectual analysis of the relevant secondary data sources without any method of data analysis which do not make the research findings reliable. Ogunjobi (2015) examined the effects of Electricity Consumption on Industrial Growth in Nigeria from 1980 to2012. The study established that in the long-run, there is a significant positive relationship between industrial growth and electricity-consumption, electricity-generation, labour employment, and foreign exchange rates while a negative relationship existed between industrial growth and capital input. Mojekwu and Iwuji (2012) analyzed the impact of power-supply and macro-economic variables on the manufacturing sectors performance in Nigeria from 1981-2009. The multiple regression analysis (MRA) showed that power-supply has a positive significant impact on capacity utilization, while interest and inflation rates have adverse impacts on capacity- utilization in Nigeria.

Data and Methodology

Data and measurement

The study made use of annual time series data which were sourced from Central Bank of Nigeria (CBN) Statistical Bulletin and World Bank's World Development Indicators (WDI). It covered the period 1981 to 2017. 1981 was chosen as a base year because between 1981 and 1985, during the Fourth National Development Plan the oil boom increased power demand growth rate by over 10 Percent. While 2017 as a current year; this is used to provide better in-depth understanding on electricity consumption up till date. Industrial output (IND) is utilized in the model to capture the output of industrial sector, as well as the direction of manufacturing sector. Industrial electricity consumption (IELEC) is the aggregate amount of power supply by the Power Holding Company of Nigeria (PHCN) to industrial sector in megawatts per hours (MW/H). Electricity generation (ELECGE) is the amount of electricity generated in MW over a specific period of time. Electricity Price (ECP) Proxy of Consumer Index Price, measures the changes in the price of electricity consumed that may be fixed or changed at specified intervals, such as yearly by users over period of time. Carbon emission (CABEM), this indicator is used to measure the emission intensity of manufacturing industries expressed as the amount of pollutant discharged in atmosphere and water per unit of production of the manufacturing industries through the use of backup plant. Credit to industrial sector (CRIND), this measured the credit allocation to the manufacturing sector of industry. In line with the objectives, the study explores econometrics methodology to analyze the data.

Unit Root Tests

In order to avoid spurious result, we tested all the variables for stationarity using the conventional ADF (the Dickey–Fuller generalized least square) de-trending test as proposed by Elliot *et al*. (1996) and the Phillips–Perron (PP) test by Phillips and Perron (1988). Both unit roots complement each other, that is, where they agree at a particular order of integration, we accept and in a situation where they disagree, we take the first outcome. Hence the null hypothesis is: = 0 (i.e has a unit root), and the alternative hypothesis is 1 :< 0

Co-integration with Auto Regressive Distributed Lag (ARDL)

In order to empirically analyze the long-run relationships and short-run dynamic interactions among the variables of interest (IND, IELEC, ELECGE, CRIND, CABEM and ECP), the study adopts the autoregressive distributed lag (ARDL) and bound test for co-integration technique as a general vector autoregressive (VAR).

The ARDL co-integration approach developed by Pesaran and Shin (1999) and Pesaran*et al.* (2001) has some advantages over the traditional co-integration technique developed by (Johansen and Juselius, 1990). First is that it requires small sample size. Two set of critical values are provided, low and upper value bounds for all classification of explanatory variables into pure I(1), purely I(0) or mutually co-integrated. Secondly, Johensen's procedures require that the variables should be integrated of the same order, whereas ARDL approach does not require variable to be of the same order. Thirdly, ARDL approach provides unbiased long-run estimates with valid t' statistics if some of the model repressors are endogenous (Narayan 2005 and

Odhiambo, 2009). Fourthly, this approach provides a method of assessing the short run and long run effects of one variable on the other and as well separate both once an appropriate choice of the order of the ARDL model is made. Hence, Pesaran and Shin, (1999) explained that AIC and SC perform well in small sample, but SC is relatively superior to AIC. The generalized ARDL(p, q) model is specified as;

$Y_t = + + + \varepsilon_{jt}$(1)

Where Y_t is a vector and the variablesare to be purely I(0) or I(1) or co-integrated. B and are coefficients; is the constant; j=1,.,k; p,q are the optimal lag orders. is the vector of the error terms- unobservable zero mean white noise vector process?

Since our model involve six variables that is one dependent and five explanatory variables, so ARDL (p, q1, q2, q3, q4, q5) model is specified thus;

Where are the long run multipliers, is the intercept and ,ʋ is the white noise errors**.** The first step in the ARDL bound testing approach is to estimate equation (2) by the Ordinary Least Squares in order to test for the existence of a long run relationship among the variables by conducting an F- test for the joint significance of the coefficients of the lagged levels of the variables. That is:

H_0:= = 0 against the alternative hypothesis, that is:

H_1: ≠ .

Once co-integration is established, the conditional ARDL long run model can be established as:

The next step is to obtain the short run dynamics parameter by estimating an error correction model associated with the long run estimate. This is specified as:

All coefficients of the short run equation are coefficients relating to the short run dynamics of the model convergence to equilibrium and represent the speed of adjustment and the ECM is the error correction term. However, If not co-integrated, the ARDL in equation 2 will be interpreted as short run causal effect.

Method of Data Analysis

The study adopts the same method used by Abokyi*et al* (2018). The study used the Auto Regressive Distributed Lag (ARDL) techniques. The ARDL co-integration approach has numerous advantages in comparison with other co-integration methods. Unlike other co-integration techniques, the ARDL does not impose a restrictive assumption that all the variables under study must be integrated of the same order. In other words, the ARDL approach can be applied regardless of whether the underlying regressors are integrated of order I(1), order zero I(0) or are fractionally integrated. Secondly, while other co-integration techniques are sensitive to the size of the sample, the ARDL technique is suitable even if the sample size is small. Thirdly, the ARDL technique generally provides unbiased estimates of the long-run model and valid t statistics even when some of the regressors are endogenous.

Empirical Results

Result of the Unit Root Test

Both tests of unit root employed in this study Augumented Dickey-Fuller (ADF) and Philip Perron (PP) indicate that the variables are integrated of order one and zero. This means that some of the variables are stationary at levels while others are integrated at first difference. Hence the series are integrated of different orders. That is, a combination of both level- and first-difference stationarity; I(1) and I(0). This requires a further test of long run relationship which requires co-integration with bound test.

Both tests of unit root employed in this study Augumented Dickey-Fuller (ADF) and Philip Perron (PP) indicate that the variables are integrated of order one and zero. This means that some of the variables are stationary at levels while others are integrated at first difference. Hence the series are integrated of different orders. That is, a combination of both level- and first-difference stationarity; I(1) and I(0). This requires a further test of long run relationship which requires co-integration with bound test.

***Table 1**: Unit Root Test (ADF and PP)*

	Level I(0)		***Difference I(1)***		***Decision***
Variables	***ADF***	***PP***	***ADF***	***PP***	
IND	***-2.32058***	***- 2.32058***	***-6.13048******	***-19.9379******	
	(0.1713)	*(0.1713)*	*(0.0000)*	*(0.0001)*	*I(1)*
IELEC	***-1.372 5***	***- 2.30637***	***-6.89195******	***-8.76942******	
	(0.5844)	*(0.1755)*	*(0.0000)*	*(0.0000)*	*I(1)*
Elecge	***-1.354 4***	***- 1.32553***	***-6.72459******	***-6.72459******	
	(0.5934)	*(0.6071)*	*(0.0000)*	*(0.0000)*	*I(1)*
Crind	***3.624595***	***5.248215***	***- 2.118 4***	***-5.42002******	
	(1.0000)	*(1.0000)*	*(0.2390)*	*(0.0001)*	*I(1)*
Cabem	***-3.12518*****	***-2.99422* ****	***-6.52628******	***-13.6386******	
	(0.0335)	*(0.0450)*	*(0.0000)*	*(0.0000)*	*I(0)*
Ecp	***-3.34435*****	***- 2.73174 ****	***-6.13871******	***-9.39882******	
	(0.0160)	*(0.0786)*	*(0.0000)*	*(0.0000)*	*I(0)*

*Significant at 10%, **Significant at 5%, and ***Significant at 1%.

The asterisks indicate the rejection of null hypothesis of unit root

Source: Authors Computations using ADF and PP unit root test

The result of the bound test for co-integration indicates that there is no co-integration among the variables. The reason is that both values of F-statistics and t-statistics are less than the critical values at the upper bound I (1) and lower bound (I(0). This implies that there is no long run relationship among the variables. Hence, we conduct the Auto Regressive Distributed Lag (ARDL) short run analysis to estimate the short run causal effect.

F-Bound test

			F-statistic		
DEPVAR	Value	Signif	I(0)	I(1)	V
IND	2.389344	10%	2.26	3.35	-
		5%	2.62	3.79	
		2.5%	2.96	4.18	
		1%	3.41	4.68	

4.3 Results of Auto Regressive Distributed Lag (ARDL) for short run analysis

Since our bound test indicates no co-integration, we estimate the short run analysis using ARDL test. The result revealed that IELEC, ELECGE at lag 1, CRIND and ECP have positive relationship with IND but not statistically significant. Also, CABEM has inverse relationship with IND but significant at 10%.

Table 3: Auto Regressive Distributed Lag (ARDL)

Depvar	*IND(-1*	*IELEC*	*ELECGE*	*ELECGE(-1*	*CRIND*	*CABEM*	*ECP*
IND	0.335936*	0.036673	-2.20178	3.07592	0.03378*	-0.85862	0.118488
Prob	(0.0889)	(0.7106)	(0.2808)	(0.1182)	(0.0621)	(0.7183)	(0.7258)

*Significant at 10%, **Significant at 5%, and ***Significant at 1%.

Source: Authors Computations using ARDL in Eviews 10

Results of Pairwise Granger Causality Test

The granger causality test shows that a unidirectional causality existing between IND and IELEC, IND and ELECGE, IND and CABEM, CABEM and IELEC, IELEC and CRIND, CRIND and CABEM.

Table 4: TheGranger causality result

Null Hypothesis	*F-statistics*	*(Marginal sig value)*		*DIRECTION*
IND does not Granger Cause IELEC	3.24	(0.053)*	*	*IND I ELEC*
IND does not Granger Cause ELECGE	4.99	(0.013)*	*	*IND ELECGE*
INDdoes not Granger Cause CABEM	4.94	(0.014)*	*	*IND CABEM*
CABEM does not Granger Cause IELEC	3.44	(0.045)*	*	*CABEM IELEC*
IELEC does not Granger Cause CRIND	4.32	(0.022)*	*	*IELEC CRIND*
CRIND does not Granger Cause CABEM	4.44	(0.021)*	*	*CRIND CABEM*

*Significant at 10%, **Significant at 5%, and ***Significant at 1%.**Stability Test**

The cumulative sum of recursive residuals (CUSUM) and the CUSUM of square (CUSUMSQ) tests are applied to assess parameter stability (Pesaran and Pesaran, 1997). Fig 1 and 2 plots the results for CUSUM and CUSUMSQ tests. The results indicate the absence of an instability of the coefficients because the plot of the CUSUM and CUSUMSQ statistic fall inside the critical bands of the 5% confidence interval of parameter stability.

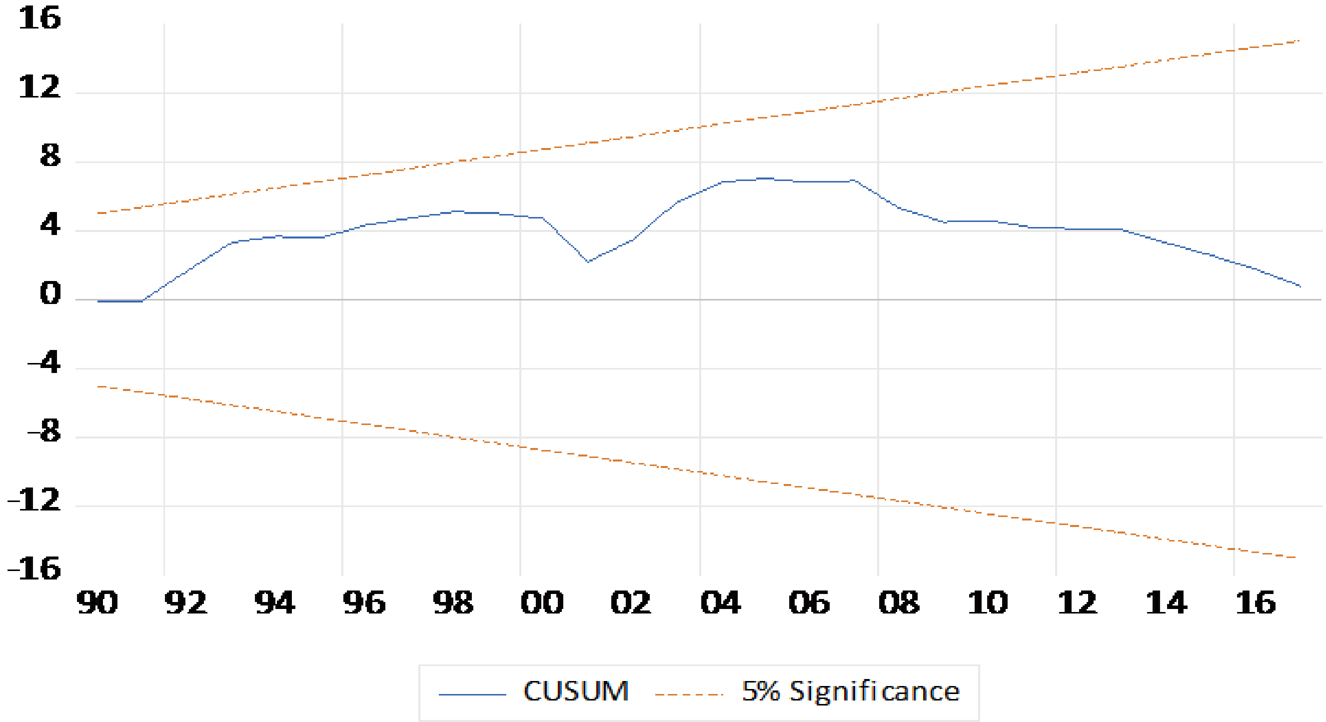

Figure 1

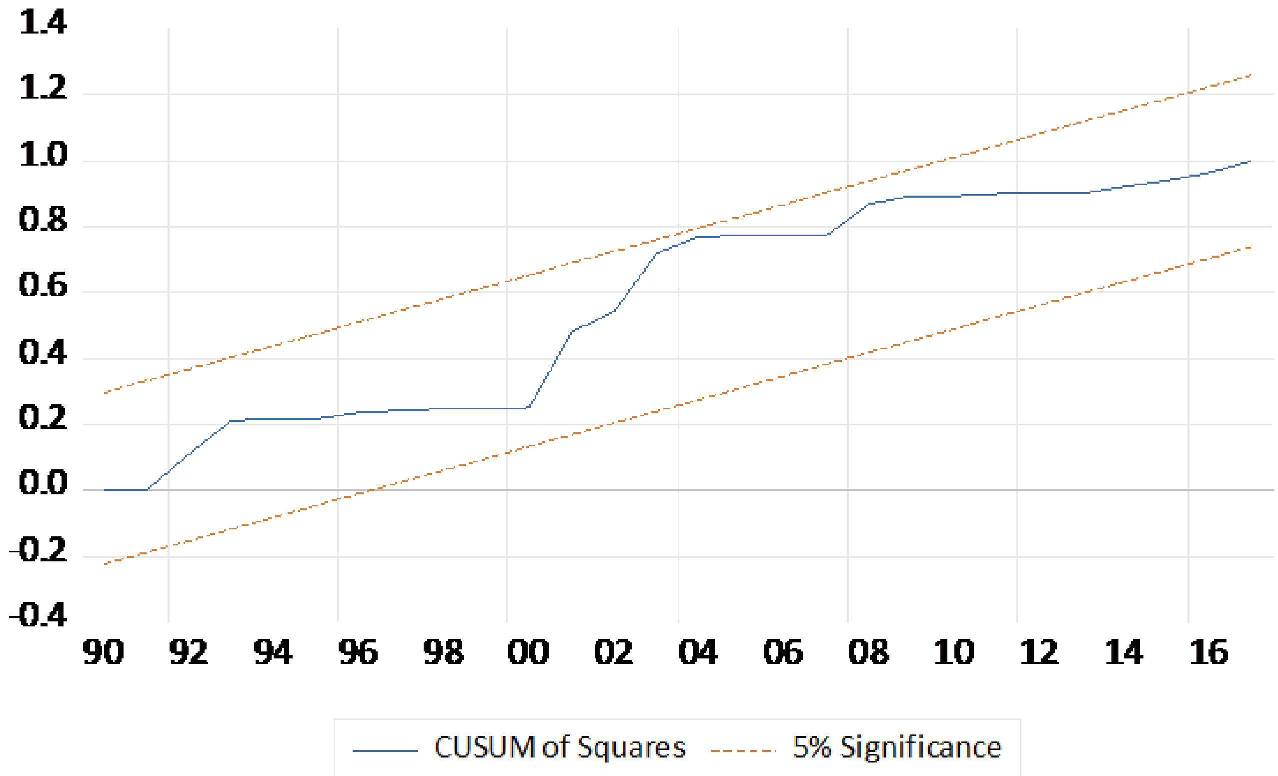

Figure 2

Discussion of findings

The findings from the bound test result is against the study of Ologundudu (2015) and Yahaya, Salisu and Umar (2015), this justified the adoption of Autoregressive Distributed Lag (ARDL) in the study. The positive relationship between industrial electricity consumption, electricity generation with industrial output is in line with the studies of Akiri, Ijuo and Apochi (2015), Ogunjobi (2015) and MojekwuandIwuji (2012). The findings show that credit to industrial sector is positive but insignificant impact on industrial development in Nigeria. The findings reveal that Carbon emission has indirect relationship with industrial output in Nigeria. The existence of a unidirectional causality between industrial output and electricity generated corroborate the studies of Osobase and Bakare (2014) while the findings of unidirectional causality between industrial output and industrial electricity consumption is against the studies Danmaraya and Hassan (2016) that demonstrated bidirectional causality between manufacturing productivity and energy consumption. However, the establishment of unidirectional causality exist between industrial output and carbon emission; carbon emission and industrial electricity consumption; industrial electricity consumption and credit to industries; credit to industries and carbon emission. The cumulative sum of recursive residuals and the CUSUM of square confirmed the stability of the variables/model investigated in the study.

Summary, Conclusions and Recommendations

The study examines the effects of industrial electricity consumption on industrial output in Nigeria from 1981 to 2017. The study adopts Augumented Dickey-Fuller (ADF) and Philip Perron (PP) for unit root tests and bound test co-integration approach. The study employed the ARDL technique for empirical examination. The unit root results of (ADF) and (PP) showed that industrial output, industrial electricity consumption, electricity generated and credits to industries were stationary at first difference of (ADF) and (PP) while carbon emission and electricity consumption became stationary at level and first differenced of both (ADF) and (PP). The bound test co-integration results revealed that there is no long run relationship among the variables which justified the Auto-Regressive Distributed Lag (ARDL) short-run analysis test to estimate the short-run causal effect. The ARDL results showed that industrial electricity consumption, electricity generated, credit to industries and electricity consumption price have direct relationship with industrial output while carbon emission has indirect relationship with industrial out-put in Nigeria. In conclusion, the major findings from the study revealed that, industrial electricity consumption, electricity generation and credits to industries have no significant impact on industrial out-put in Nigeria. Therefore, the study recommends proactive policies to improve electricity generation to drive industrial growth and development. Credits allocated to the industrial sector should be improved upon for industrial development and growth in Nigeria. There is need to develop a legislative framework or policies for mandatory reduction in the quantities of carbon emitted daily at all levels in Nigeria order to enhance industrial development and in Nigeria.

References

Abokyi, E., Appiah-Konadu, P., Sikayena, I., &Oteng-Abayie, E. F. (2018). Consumption of Electricity and Industrial Growth in the Case of Ghana. *Journal of Energy*, 1-11

ADB, (2009). Annual Report 2009 as cited by Oseni M O and Pollit M, 2013. Economic Costs of Unsupplied Electricity: Evidence from back up Generation among Firms in Africa. *EPRG Working Paper no* 1326, 2013.

Akiri, S. E., Ijuo, O. A., &Apochi, M. P. (2015). Electricity Supply and the Manufacturing Productivity in Nigeria. *IOSR Journal of Economics and Finance*, 6 (6) 90-94

Alao, A. A. (2016). Residential and Industrial Electricity Consumption Dynamics and Economic Growth in Nigeria 1980-2010. *International Journal of Economy, Energy and Environment*, 48-56.

Audu, E. Paul, S.O. &Ameh, A. (2017). Privatisation of power sector and poverty of power supply in Nigeria: A policy analysis. *International Journal of Development and Sustainability*, 6 (10), 1218-1231.

Danmaraya, I. A., & Hassan, S. (2016). Electricity consumption and manufacturing sector productivity in Nigeria: An ARDL-bound testing approach. *International Journal of Energy Economics and Policy*, *6* (2), 195-201.

Elliot, G., T.J. Rothenberg & J.H. Stock (1996). Efficient tests for an autoregressive unit root. Econometrica, 64 (4): 813-836.

Johansen, S., &Juselius, K., (1990). Maximum likelihood estimation and inference on co-integration with applications to the demand for money. *Oxford Bulletin of Economics and Statistics,* 52, 169–210.

Koutsoyiannis A. (1979). Theory of Costs in: Modern Microeconomics. Palgrave, London

Mojekwu, J. N., & Iwuji, I. I. (2012). Factors affecting capacity decision in Nigeria: A time series analysis. *International Business Research*. 5 (1).

Narayan, P., K (2005). The saving and investment nexus for China: evidence from co-integration tests, *Applied Economics*, 37:17, 1979-1990.

Nwajinka, C. C. A., Yousuo, J., & John, P. O. (2013). National Electric Energy Supply and Industrial Productivity in Nigeria from 1970 to 2010. *Journal of Economics and Sustainable Development*, 4 (14), 122-129

Nwankwo, O. C., &Njogo, B. O. (2013). The effect of electricity supply on industrial production within the Nigerian economy (1970–2010). *Journal of Energy Technologies and Policy*, 3 (4), 34-42.

Odhiambo, N. M. (2009). Energy consumption and economic growth nexus in Tanzania: An ARDL bounds testing approach. *Energy policy*, 37 (2), 617-622.

Ogunjobi, J. O. (2015). The Effects of Electricity Consumption on Industrial Growth in Nigeria. *Journal of Economics and Sustainable Development*. 6 (13): 54-59.

Oladosu (2016). Electricity Market Reform in Sub-Saharan Africa and the Power Africa Initiative: The Nigerian Case. *International Association for Energy Economics Forum,* 27-31.

Ologundudu M. M. (2015). The Epileptic Nature of Electricity Supply and its Consequences on Industrial and Economic Performance in Nigeria. *Global Journal of Researches in Engineering*, 14 (4), 27-39.

Omoleke, I. I. (2011). Management of electricity generation and supply in Africa: The Nigerian experience. *Journal of Public Administration and Policy Research,* 3 (10), 266-277

Osobase, A.O. & Bakare, T. A. (2014). The nexus between electricity generation, supply and manufacturing sector performance in Nigeria. *International Journal of Management Sciences and Humanitie,* 2 (2). 184-207.

Pesaran, H., & Shin, Y. (1999). An Autoregressive Distributed Lag Modelling Approach to Cointegration "chapter 11. In *Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium*.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of applied econometrics*, 16 (3), 289-326.

Pesaran, M. H., Shin, Y., & Smith, R. P. (1999). Pooled mean group estimation of dynamic heterogeneous panels. *Journal of the American Statistical Association*, 94 (446), 621-634

Phillips, P. C., &Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, 75 (2), 335-346.

Reinikka, R., &Svensson, J., (2002). Coping with Poor Public Capital. *Journal of Development Economics*. 69, 51 – 69.

Schumpeter, J. A. (1934). Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle, Cambridge, MA: Harvard University Press.

Theophilus I. U., Christopher K. D. & Paul O. E. (2016). Electricity Consumption and Industrial Production in Nigeria. *Journal of Policy and Development Studies*, 10 (2), 8-19

Yahaya, Y. Salisu, B. M. & Umar, B. (2015). Electricity Supply and Manufacturing Output in Nigeria: Autoregressive Distributed Lag (ARDL) Bound Testing Approach. *Journal of Economics and Sustainable Development*, 6 (17), 7-19