THE American Journal of Humanities and Social Sciences Research (THE AJHSSR) 2021
E-ISSN: 2581-8868
Volume-04, Issue-01, pp-64-74
www.theajhssr.com
Research Paper Open Access

Impact of Government Expenditure on Elecricitysupply in Nigeria: 1990-2017

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ABSTRACT

This study examined the impact of government expenditure on electricity supply in Nigeria for the period of 1990 to 2017. The study was guided by three research questions and objectives. Time series data for the study were sourced from International Energy Statistics; Energy Information Administration of United States, Central Bank of Nigeria (CBN) 2018 Publications, and World Development Indicators (WDI). Time series data and hypotheses were analyzed using Unit root test and Auto Regressive Distributed Lag (ARDL) techniques. The variables used in the models were Electricity supply (proxied by Electricity production) as a dependent variable while other explanatory variables were government expenditure, gross domestic product), gross capital formation, Inflation and Labour employed. The findings of the study show that government expenditure, gross domestic product, gross capital formation, inflation and total labour employed contribute significantly to electricity supply in Nigeria. In view of this, the study recommends that government in her fiscal policy should increase her budgetary allocation to power sector with the aim of meeting the capital and recurrent needs of the sector, among others were proffered.

KEYWORDS: Electricity Supply, Government Expenditure, Gross Capital Formation, Inflation, Nigeria.

I. INTRODUCTION

Poor access to electricity in Nigeria has been a major impediment to Nigeria's economic growth and development. Small and Medium scale Enterprises and other manufacturing activities have been adjudged as the engine of economic growth but its performance is grossly dismal due to inadequate power supply. The availability of reliable electricity to homes and businesses of Nigerians has attracted government attention without impressive outcome over the past decades (Segun, 2013). Despite being in possession of the world's seventh largest gas reserves which could be used to generate abundant electricity, Nigeria only generates enough to power a medium-sized European city (Segun, op. cit). More than half of Nigeria's estimated 170 million inhabitants live without electricity. Those who could afford personal provision, rely on expensive and air-polluting generators, run on diesel and petrol (Segun, op. cit). Electricity in its usefulness and applicability is directly needed in industries in the production of output, existing industries in Nigeria complain of inadequate electricity supply to power their machines and technologies to produce physical goods. When there is poor electricity power or in general energy sources, human capacities in the area of physical products remain just ideas crediting Solow model which listed the core components of growth as capital, labour and technological progress under which electricity falls (Matthew et al., 2010; Adeniran, et al., 2018; Osuma et al., 2018; Alege and Osabuohien, 2015; Matthew et al., 2018; Matthew et al., 2018).

Pambazuka (2013) notes that between 1999 and 2007 the Obasanjo government spent over $16 billion (over N2.4 trillion) on the power sector. Over 30% of this amount was spent on the existing Power Holding Company of Nigeria (PHCN) power plants without any tangible result. Pambazuka (op. cit) further attributed the problems of electricity supply in Nigeria to lack of access to over 60% of the population (with less than 10% of the rural dwellers having access). A large number of Nigerians hardly enjoy the benefits of electricity due to erratic supply occasioned by dilapidated infrastructure and outdated equipment. It should be noted that those who have contributed severally and collectively to this poor state of electricity supply in Nigeria are the same people now bidding to take over the carcass of PHCN.

It has, therefore, become imperative for the government to formulate policies that will ensure the required public expenditure to generate, transmit and supply electricity that will be sufficient to meet the socio-economic activities in Nigeria. Despite these policies framework, the results in electricity generation and supply have remained discouraging. This has led to involving direct private investors to solve the problem of shortage in electricity generation and supply in Nigeria. This ongoing private sector involvement may not be the panacea for the power generation and supply in Nigeria (Edwin E, Soni E &Oluseun A 2014). In so many developing countries of the world, it is discovered that lack of access to electric power and modern energy in general has a negative effect on productivity and has limited the economic opportunities available to developing countries (Daniel, 2005). This is compounded by the poor state of existing infrastructure, which creates the dual challenge of resources for maintenance and builds new power plants. The real situation of power generation deficiency in Nigeria is unimaginable even as the federal government has initiated many policies, projects and programs to tackle energy problems in Nigeria for many decades. However, the problems of power generation deficiency persisted given that power generation capability is not meeting up to Nigeria's population growth rate and national economic aspiration as power distribution, transmission, and regulation are still issues to the nation(Ibitoye and Adenikinju, 2007). In the same vein, Adanikin (2019) posited that electrical power often generated is literally not commensurate with the huge investments, and a large number of Nigerians seems not to be enjoying the benefits of electricity due to erratic supply occasioned by dilapidated infrastructure and outdated equipment. In addition, Enofe, Ibeh, and Ishola (2014) posited that the returns on investments have largely been discouraging as the federal government continued to pump in more resources in terms of budgetary allocations, loans among other interventions to ensure the nation meet its energy need.

Therefore, knowing the role of Nigeria government in the area of funding and policy formulation, it becomes pertinent to ascertain the impact of government expenditure on electricity supply and its performance in Nigeria.Specifically, the study intends to examine the impact of government expenditure on electricity supply in Nigeria, the existence of long-run relationship between government expenditure and electricity supply in Nigeria, and the existence of short-run relationship between government expenditure and electricity supply in Nigeria.There is no doubt that this study shall aid policy makers and electricity regulatory bodies in making and implementing policies in Nigeria.

II. LITERATURE REVIEW

Conceptual Issues

Government Expenditure : Government expenditures are the costs that are usually incurred by the government for the provision and maintenance of itself as an institution, the economy and society. Government expenditures usually tend to increase with time as the economy becomes large and more developed or as a result of increase in its scope of activities. Ogboru (2010) identified recurrent and capital budget as one of the major types of budget in an economy. It is sometimes referred to as revenue budget and it covers recurrent items or expenditure. The capital budget has to do with expenditures necessary to procure capital assets. According to Taiwo (2012), government's spending is a fiscal instrument which serves a useful role in the process of controlling inflation, unemployment, depression, balance of payment equilibrium and foreign exchange rate stability. In the period of depression and unemployment, government spending causes aggregate demand to rise and production and supply of goods and services follow the same direction.

As a result of the increase in the supply of goods and services with a rise in the aggregate demand exerts a downward pressure on unemployment and depression. In Nigeria, the federal government's expenditures are broadly divided into capital and recurrent expenditure. The recurrent expenditure consists of government expenditure on administration such as wages, salaries, interest on loans, maintenances etc. whereas the capital expenditure are on projects like roads, airport, health, education, electricity generation, telecommunication, water etc. Capital expenditures are investments with multiplier effects on the economy in terms of public benefits. In most cases government intervention has brought stability in income and employment in the economy. Public expenditure is therefore an important tool that brings about egalitarian society through the provision of welfare facilities (Ogba, 1999). Public expenditure is functionally classified into four (4) categories in Nigeria: administration, economic services, social and community services, and transfers with capital and recurrent expenditure consumption for each class (CBN, 2011).

Electricity Supply in Nigeria : Power generation in Nigeria dated back to 1886 when two (2) generating sets were installed to serve the then Colony of Lagos by an Act of Parliament in 1951, the Electricity Corporation of Nigeria (ECN) was established, and in 1962, the Niger Dams Authority (NDA) was also established for the development of hydroelectric power. A merger of the two

(2) organizations in 1972 resulted in the formation of the National Electric Power Authority (NEPA) which was saddled with the responsibility of generating, transmitting and distributing electricity for the whole country. In 2005, as a result of the power sector reform process, NEPA was unbundled and renamed Power Holding Company of Nigeria (PHCN) (Energy Commission of Nigeria, 2005). The Electric Power Sector Reform (EPSR) Act was signed into law in March 2005, enabling private companies to participate in electricity generation, transmission, and distribution. The government unbundled PHCN into eleven electricity distribution companies (DisCos), six generating companies (GenCos), and a transmission company (TCN). The Act also created the Nigerian Electricity Regulatory Commission (NERC) as an independent regulator for the sector.

In its effort to increase the level of power generation, the Federal Government in 2004, incorporated the Niger Delta Power Holding Company (NDPHC) as a public sector funded emergency intervention scheme. The company has a mandate to manage the National Integrated Power Projects (NIPP) which essentially involves the construction of identified critical infrastructure in the generation, transmission, distribution and natural gas supply sub-sectors of the electric power value chain (Matthew, Ede, Osabohien, Ejemeyovwi, Fasina, &Akinpelumi, 2018). In furtherance of the reform programme, the Nigerian Electricity Regulatory Commission (NERC) has in the past licensed several private Independent Power Producers (IPPs) some of which are at various stages of project development. The Commission has also enacted the Bulk Procurement Guidelines that will ensure the efficient and orderly procurement of large capacity generation in the future. This will enable the Commission to effectively predict the amount of power that can be added to the grid every year.

Theoretical Literature : There are a lot of theoretical reviews that are related to government expenditure, as well as its impact on electricity supplyin both developed and developing economies. However, this study theoretical reviews are based on theWagner's Law of Increasing Activities of State,Ecological Economics Approach, and Neoclassical Theory of Production.

Basic Theory of Electricity : Electricity is the flow of electrical power or charge. It is a secondary energy source which means that we get it from the conversion of other sources of energy, like coal, natural gas, oil, nuclear power and other natural sources, which are called primary sources. The energy sources we use to make electricity can be renewable or non-renewable, but electricity itself is neither renewable nor non-renewable. (Energy Information, 2007). This flow of electrical charge is referred to as electric current. There are two types of current, direct current (DC) and alternating current (AC). DC is current that flows in one direction with a constant voltage polarity while AC is current that changes direction periodically along with its voltage polarity. Thomas Edison and Alessandro Volta were pioneers in DC current and wrote much of electricity's history. But as societies grew the use of DC over long transmission distances became too inefficient. Nikola Tesla changed all that with the invention of alternating current electrical systems. With AC it is possible to produce the high voltages needed for long transmissions. Therefore, today, most portable devices use DC power while power plants produce AC(Energy Information, 2007). The most fundamental law in electricity is Ohm's law or V=IR. The V is for voltage, which means the potential difference between two charges.

Wagner's Law of Increasing Activities of State : This theory was stated by Adolph Wagner, a German political economist. He contends that there is absolute and a relative expansion of the public sector, through the expenditures of central and local government bodies and public enterprises, at the cost of the growth in the economy (Wagner, 1911).In other words, these increases in state activities necessitate increase in government funding. Enofe, Ibeh, and Ishola (2014) note that the idea behind Wagner's law is that goods and services provided by the government, including redistribution via transfers and, in particular, the activities of public enterprises, would increase with a county's industrialization, since as the economy grows, the following issues will come to bear: the administrative and protective functions of the state will rise; there will be a need for increased provision of social and cultural goods and services; and government intervention would be required to manage and finance natural monopolies as well as ensure the smooth operation of market forces.

The Ecological Economics Approach : The ecological economists derivedtheir view of the role of energy in economic growth from the biophysical foundations of the economy (Murphy and Hall, 2010).Ecological economists argued that substitution between capital and resources and technological progress can only play a limited role in mitigating the scarcity of resources. Some of the Ecological Economists such as Cleveland, Costanza, Hall andKaufmann (1984) andHall, Tharakan, Hallock, Cleveland and Jefferson(2003) also downplay the role of technological change, arguing that either increased energy use accounts for most apparent productivity growth, or that technological change is real but innovations mainly increase productivity by allowing the use of more energy. Therefore, increased energy use is the main or only cause of economic growth in any economy. Basically, a prominent tradition in ecological economics approach is represented by biophysical models that consider energy to be a primary factor of production and the only such primary factor. In this view, all value is derived from the action of energy that is directed by capital and labor. The flow of energy in the economy is the service of the reservoirs of fossil fuels and the sun, which represent the primary input in the terminology. On the other hand, capital and labor are treated as flows of capital consumption and labor services rather than as stocks, in other words, they are considered as intermediate inputs that are created and maintained by the primary input of energy and flows of matter. The value of the flows is computed in terms of the embodied energy use associated with them. Prices of commodities should then be determined by embodied energy cost or are actually correlated with energy cost (Common, 1995).

Neoclassical Theory of Production : This was first propounded by Robert Solow over 40 years ago. The model believes that a sustained increase in capital investments increased the growth rate only temporarily, because the ratio of capital to labour goes up. The marginal product of additional units is assumed to decline and thus an economy eventually moves back to a long term growth-path with the real GDP growing at the same rate as the growth of the workforce plus factor to reflect improving productivity (Romm, 2005). Neo-classical economists who subscribe to the Solow model believes that to raise an economy long term trend rate of growth requires an increase in labour supply and also a higher level of productivity of labour and capital. Differences in the rate of technological change between countries are said to explain much of the variation in growth rates. The neo-classical model treats productivity improvements as an exogenous variable which means that productivity improvements are assumed to be independent of the amount of capital investment (Uremadu, 2012). The Neoclassical economists believed that a long term rate of economic growth requires rising in the supply of labour and an improvement in labour or capital productivity.Neoclassical growth models tend to emphasize the simplicity of substitution among factors of production such as labour, capital, land or other essentials in the production of commodities, which allow the economy to achieve steady state growth. The theory also cited about the long run equilibrium of a competitive economy by paying attention to the accumulation of capital goods, growth in population, as technological progress.

Theoretical Framework : This study was anchored on the neoclassical theory of production. The neo-classicals assume a one sector closed economy which produces only one commodity. It uses two factors of production; labour and capital. They assumed that the economy uses the variable factor proportions neoclassical production function given by:

$$Y = f(A, K, L). \text{ ----------------------------(1)}$$

Where Y represents output, K stands for capital stock and L is the amount of labour employed and A is an index of technological progress. The production function exhibits diminishing returns; that is, marginal products are positive but declining. The production is further assumed to be linearly homogeneous, that is to exhibit constant return to scale. Given this assumption, the production function can be expressed in intensive form, thus:

$$y = f(k),\ f' > 0. \text{ -----------------------------(2)}$$

Where y = Y/L is output per head and k = K/L is capital per head or capital intensity. Growth is determined by the saving decision as all savings are invested and become part of capital stock. Labour is assumed to grow exogenously at a constant exponential rate. There is no technical change in the basic model. In this study, the neoclassical theory of production was modified to represent Y with electricity production in Nigeria. While capital was disaggregated into various inputs such as government expenditure, gross income, gross investment and inflation which capture the general price of inputs. Labours is as employed by the neo-classical theory.

Empirical Review : Abdullahi and Sani (2018) examined electricity consumption and economic growth in Nigeria, covering the period between 1990 to 2016. Secondary data for the study was sourced from Central bank statistical bulletin 2017. The ARDL approach was used to analyze time series data. The results indicated a positive and significant influence of electricity consumption on economic growth in both short-run and long-run. Bernard and Abu (2016) examined the nexus between government expenditure and energy consumption in Nigeria which covered the period between 1980 and 2015. Secondary data for the study was sourced from Central Bank publications 2016. The Johansen and Juselius co-integration test was employed for the data analysis. Their result revealed that government expenditure contributes significantly to energy consumption and bi-directional causality existed between government expenditure and energy consumption in Nigeria. Akomolafe and Danladi (2014) examined electricity consumption and economic growth in Nigeria. They adopted a multivariate investigation covering the period between 1990 to 2011. A Secondary data was sourced from Central bank of Nigeria statistical bulletin 2013. The Johansen and Juselius co-integration test was employed for the data analysis.

The result of their analysis revealed a unidirectional causality running from electricity consumption to economic growth. Iyke (2014) examined electricity consumption, government expenditure and economic growth in Nigeria, which covered the period between 1970 and 2011. Secondary data for the study was sourced from the Central Bank Publications 2013. The Trivariate VECM was employed to analyze the time series data. The result of the study support both linear and none linear co-integration relationship between electricity consumption, government expenditure, inflation and economic growth in Nigeria. However, Aguegboh and Madueme (2013) adopted the vector auto regression model and co-integration technique to examine energy consumption and economic growth nexus in Nigeria, which covered the period between 1980 and 2011. The secondary data for the study was sourced from Central bank of Nigeria publications 2012. The result showed that energy consumption does not contribute to economic growth in Nigeria. On the contrary, capital formation contributes to economic growth as opposed to labour force that does not contribute to GDP in Nigeria.

Bamidele and Mathew (2013) examined energy consumption and economic growth nexus in Nigeria which covered the period between 1971 and 2010. Secondary data for the study was sourced from Central Bank of Nigeria Publications 2012. The error correction mechanism was used to analyze data. The result of the study revealed that all the explanatory variables significantly influence output growth in the short-run. In examining the relationship between economic growth, domestic energy consumption, and energy prices in Nigeria, Olumuyiwa (2013) analyzed the study using the error correction method covering the period between 1980 and 2000. The secondary data for the study was sourced from Central Bank of Nigeria statistical bulletin 2012. The result revealed strong interactions between energy consumption, per capita income and Gross domestic product in Nigeria.

Similarly, Ogundipe (2013) examined electricity consumption and economic growth in Nigeria which covered the period between 1980 to 2008. Secondary data for the study was sourced from Central bank of Nigeria statistical bulletin 2012. Johansen and Juselius Co-integration technique based on the Cobb-Douglas growth model was used to analysed the data. From the result of the study, the variables are co-integrated in the long-run. Evidence of bi-directional causality between electricity consumption and economic growth was revealed.
Richard, Victoria and Olaoye (2013) examined electricity consumption and economic growth in Nigeria which covered the period between 1980 and 2000. The secondary data for the study was sourced from Central Bank Publications 2012. The Granger causality in quartiles test was used as the estimation technique. Based on their analysis, it was discovered that causality runs from electricity consumption to economic growth in Nigeria.

In addition, Akomolafe, Danladi, and Babalola (2012) examined electricity consumption and economic growth in Nigeria. They also adopted the Johansen and Juselius co-integration test to analyzed their study which covered between 1971-2000. The secondary data for the study was sourced from Central bank of Nigeria statistical bulletin 2013. The result of the granger causality test shows two ways causality between electricity consumption and Gross Domestic Product (GDP) in Nigeria. In other works, Akpan and Akpan (2012) examined electricity crises, carbon emission and economic growth in Nigeria using time series data from 1970 to 2008. A secondary data was sourced from Central Bank of Nigeria publication 2014. The Johansen and Juselius co-integration test was employed for the data analysis. Their findings showed that economic growth is associated with increase in electricity consumption and increase in electricity consumption leads to increase in carbon emission in Nigeria.

Using the same estimation technique of Granger Causality, Akinlo (2009) also examined energy consumption and economic growth for Nigeria covering the period between 1980 and 2006. The secondary data for the study was sourced from Central bank publications 2008. A co-integration technique was also used to analyze the data. The results of their estimation showed that real gross domestic product and electricity consumption were co-integrated and there is only unidirectional Granger causality running from electricity consumption to economic growth in Nigeria. While several literatures have examined energy consumption and economic growth in Nigeria, no empirical studies within the context of this study has identified the role of government expenditure on electricity supply and its performance in Nigeria. Therefore, the study fills the gap as it is important to examine the impact of government expenditure on electricity supply in Nigeria which will cover the period between 1990 and 2017.

III. METHODOLOGY

Analytical Techniques: The data was analyzed using descriptive and analytical tools. The descriptive tool involves the use of tables to present the data analyzed, while the analytical tool consists of Autoregressive Distributed Lag (ARDL) Model. The data used for this study was annual time series secondary data within the time frame of 1990-2017. These included data on electricity supply in Nigeria (proxied by electricity production) as dependent variable while Government Expenditure (GOE), National Income proxied by Gross domestic product (GDP), Investment proxied by Gross capital formation, Inflation and labour were the independent variables sourced from International Energy Statistics and Energy Information Administration of U.S., Central Bank of Nigeria (CBN) publications 2018, and World Development Indicators (WDI) 2018. The data span a period of 1990 to 2017. The base year of 2017 was as a result of the data available on electricity supply in Nigeria.

Autoregressive Distributed Lag (ARDL) Model : To correct for the short-run effect of the explanatory variables and to integrate it with the long-run, the Autoregressive Distributed Lag (ARDL) Model was used. This study adopted the Autoregressive Distributed Lag (ARDL) bounds testing approach developed by Pesaran, Shin, and Smith (2001). The bound testing approach has certain econometric advantages in comparison to other single co-integration procedures (Engle and Granger, 1987; Johansen, 1992; Johansen and Juselius, 1990). Firstly, endogeneity problems and inability to test hypotheses on the estimated coefficients in the long-run associated with the Engle-Granger (1987) method are avoided. Secondly, the long and short-run parameters of the model in question were estimated simultaneously. Thirdly, the econometric methodology is relieved of the burden of establishing the order of integration amongst the variables and of pre-testing for unit roots.

The ARDL approach to testing for the existence of a long-run relationship between the variables in levels is applicable irrespective of whether the underlying regressors are purely I(0), purely I(1), or fractionally integrated. Fourthly, the co-integration test is reliable with a small sample size. This is contrary to the Johansen co-integration where if the sample size is too small then the results will not be reliable and one should use Auto Regressive Distributed Lags (Pesaran, Shin, and Smith, 2001). Finally, as argued in Narayan and Smyth (2005), the small sample properties of the bounds testing approach are far superior to that of multivariate co-integration. The approach, therefore, modifies the Auto-Regressive Distributed Lag (ARDL) framework while overcoming the inadequacies associated with the presence of a mixture of I(0) and I(1) regressors in a Johansen-type framework. A priori we expect manufacturing sector output to be significantly influenced by energy consumption, bank credit to manufacturing and total employment in the manufacturing sector.

Model Specification : To specify the contribution of government expenditure on electricity supply in line with the Neo-classical production function in Equation [1], its implicit form of the model for the study used in achieving the objectives of the study is given as in Equation [3]:

$$ELS = f\,(GOE, INC, INV, INF, LAB) \text{ ----------------------------}(3)$$

In its linear functional form using the variable in their log form, Equation [3] is transformed as in Equation [4]:

$$\ln ELS_t = \alpha + \beta_1 \ln GOE_t + \beta_2 \ln INC_t + \beta_3 \ln INV_t + \beta_4 \ln INF_t + \beta_5 \ln LAB_t + U_{it} \text{-----}(4)$$

Where ELS is Electricity supply in Nigeria (proxied by electricity production). According to world bank statistical report in 2018, the major sources of electricity generation in Nigeria are hydro and gas. Hydro and gas contribute over 90 percent of electricity generation and supply in Nigeria. Therefore, the data employed covers the total electricity generated by hydro and gas in Nigeria. GOE is Government Expenditure, INC is Income [proxied by Gross Domestic Product (GDP)], INV is Investment (proxied by Gross Fixed Capital Formation in Nigeria), INF is Inflation rate in Nigeria, which is used as a proxy to explain the effect of general price increase which may include the rate of change in the cost of capital on power sector, while LAB is Labour, representing the total workforce that may affect activities in the power sector, and $U_{it}$are the error term over time. α and βs are the intercept and slope coefficients, t is the time periods, and ln denotes the natural logs of the variables.

$$\Delta \ln ELS_t = \beta_0 + \beta_1 \ln GOEt_{-1} + \beta_2 \ln INCt_{-1} + \beta_3 \ln INV_{t-1} + \beta_4 \ln INF_{t-1} + \beta_5 \ln LAB_{t-1} + \sum_{i=1}^{k} \alpha_1 \Delta \ln ELS_{t-i} + \sum_{i=1}^{k} \alpha_2 \Delta GOE_{t-i} + \sum_{i=1}^{k} \alpha_3 \Delta \ln INC_{t-i} + \sum_{i=1}^{k} \alpha_4 \Delta \ln INV_{t-i} + \sum_{i=1}^{k} \alpha_4 \Delta \ln INF_{t-i} + \sum_{i=1}^{k} \alpha_4 \Delta \ln LAB_{t-} + U_{it} \text{ ----------------------------}(5)$$

Where: $\mu_t$is the white noise or error term.

The first part of the write hand side of Equation [5] with parameter β_1 to β_6 represents the long-run parameters of the model and the second part with parameters α_1 to α_7 represent the short-run dynamics of the model.

IV. RESULTS AND DISCUSSION

To analyze the contributions of government expenditure on electricity supply in Nigeria, this study conducted some pre-estimation test.

These are test on the reliability of the data employed. In doing this, the study conducted a unit root test on the data employed. The data used for this study were sourced from the central bank of Nigeria and world development indicator. The result of the unit root test is presented on Table 1:

Table 1: Unit Root Test Result

ADF STATISTICS							
Variable							Remarks
	At Levels	Critical Values	Prob	At First Diff.	Critical Values	Prob	
LnELS	-3.5116	-3.5875	0.0582	-7.1304	-3.595	0.0000	I(1)
lnGOE	-1.9226	-3.5875	0.6157	-6.7959	3.595	0.0000	I(1)
lnINC	-4.2403	-3.5875	0.0115	-3.0888	3.595	0.2256	I(0)
lnINV	-0.1556	-3.5875	0.9908	-4.653	-3.595	0.0051	I(1)
INF	-2.757	-3.5875	0.2238	-4.2049	-3.595	0.0139	I(1)
LAB	-1.448	-3.5875	0.8214	-3.887	-3.6122	0.0024	I(1)

Source: Author's computation using Eviews 9.5

The result on Table 2 above provides evidence that the variables employed in this study are stationary in their first difference except income (INC). Using differenced variables for the estimation of regression would suggest a loss of valuable information about the long-run equilibrium between variables. Therefore, there is need to integrate the short-run dynamics with the long-run equilibrium. This study as specified in Equation 5 employed the ARDL approach. This approach accommodates variables that are integrated of mixed order. That is, I(0) and I(1). The ARDL model as earlier stated, generate both the short-run and long-run dynamics. To estimate the long-run equilibrium relationship among variables, the ARDL bounds test approach was employed. The bounds test is based on the following decision; if the computed F-statistics falls below the lower bound we would conclude that the variables are I(0), so no co-integration is possible, by definition. If the F-statistics exceeds the upper bounds, we conclude that we have co-integration. Finally, if the F-statistics falls between the bounds, the test is inconclusive.

Table 2: ARDL Bounds Test

ARDL Bounds Test
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	K
F-statistic	8.895203	5

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.08	3
5%	2.39	3.38
2.5%	2.7	3.73
1%	3.06	4.15

Source: Author's computation using Eviews 9.5

From the ARDL bounds test result on Table 2, the F-statistic value of 8.895203 is greater than upper bound I(1). We therefore conclude that the variables are co-integrated. Meaning, there is long-run equilibrium relationship among variables. Having established that the variables are co-integrated, this study preceded with the estimation of the ARDL short-run and long-run dynamics.

Table 3: ARDL Short-Run and Long-Run Result

ARDL Cointegrating And Long Run Form

Original dep. variable: LNELS

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNGOE)	0.056401	0.028810	1.957721	0.1452
D(LNGOE(-1))	0.234266	0.044238	5.295521	0.0131
D(LNGOE(-2))	0.449508	0.045055	9.976770	0.0021
D(LNINC)	0.875098	0.215919	4.052898	0.0271
D(LNINC(-1))	2.066398	0.251835	8.205357	0.0038
D(LNINC(-2))	0.941370	0.218875	4.300948	0.0030
D(LNINV)	0.091050	0.054702	1.664485	0.1946
D(LNINV(-1))	0.670947	0.056407	11.894648	0.0013
D(LNINV(-2))	-0.207634	0.054780	-3.790320	0.0322
D(LNINF)	-0.100952	0.018651	-5.412792	0.0124
D(LNINF(-1))	-0.170204	0.029697	-5.731375	0.0105
D(LNINF(-2))	-0.115113	0.015879	-7.249264	0.0054
D(LNLAB)	0.519983	0.060543	8.588656	0.0016
D(LNLAB(-1))	4.544159	2.287306	-1.986686	0.1411
D(LNLAB(-2))	0.491694	0.067031	-7.335356	0.0052
ECM(-1)	-0.313800	0.096126	-3.264465	0.0008

ECM = LNELS - (0.1290*LNGOE + 2.2952*LNINC -0.7143*LNINV + 0.0163*LNINF + 13.3161*LNLAB -63.0967)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGOE	0.129043	0.521471	0.247460	0.8205
LNINC	2.295176	2.356690	0.973898	0.4019
LNINV	-0.714301	1.116719	-0.639642	0.5679
LNINF	0.016343	0.064061	0.255116	0.8151
LNLAB	13.316095	24.042499	0.553857	0.6183
C	-63.096703	115.621718	-0.545717	0.6232

Source: Author's computation using Eviews 9.5

Table 3 above present the dynamic ARDL short-run and long-run estimated result.From the sign, magnitude and significance of the estimated parameters. It shows that the short-run dynamics is the most significance and accepted model. Most variables in their lag form aremore significant having a probability values less than 0.05(5%) in the short-run than in the long-run. The results indicated that, in the second period lag of government expenditure, a 1% increase in government expenditure on the average brings about 45% increase in electricity supply in Nigeria. Also, a 1% increase in Gross domestic product on the average brings about 94% increase in electricity supply. On a similar note, the estimated coefficients of one period lag of investment and the first difference of labour are positive and significant. By implication, a 1% increase in investment and labour on the average brings about 67% and 52% increase in electricity supply, respectively. However, the estimated coefficient of inflation is negative and properly sign. The estimated coefficient of the second period lag of inflation showed that, a 1% increase in inflation brings about 12% fall in electricity supply in Nigeria. The coefficient of the ECM term which captures the speed of adjustment towards the long-run equilibrium indicates that about 31 percent of the deviation is corrected within one year. The coefficient is properly signed and significant. The ARDL long-run result confirmed that the variables are not significant in the long. As such, the short model should be accepted.

V. DISCUSSION OF FINDINGS

The results from this work provide reliable guide on what ought to be the level of electricity supply given the level of government expenditure in Nigeria. First, it was observed that electricity supply was found to be positively related with government expenditure in the short-run. The implication is that an increase in government expenditure in the short run will bring about growth in electricity supplyin Nigeria. However, the inclusion of other explanatory variables such as GDP as proxy for income, gross fixed capital formation as proxy for investment, inflation and total labour employed to capture capital and labour in the model shows a significant contribution to electricity supply in Nigeria. By implication, an increase in general income, investment activities, and total labour employed in the short-run will contribute significantly to electricity supply in Nigeria. Further examination of the theoretical underpinning of this study has a very strong policy implication on electricity supply in Nigeria. This study has succeeded in identifying a unique contribution to the neoclassical production theory as a model for electricity supply in Nigeria. The adoption of this model may have some policy implications on electricity sector by increasing electricity output in Nigeria.

VI. CONCLUSION AND RECOMMENDATIONS

Conclusion : In this study, the ARDL model was used to examine the contribution of government expenditure to electricity supply in Nigeria. The evidence from this study shows that government expenditure contributes to electricity supply in Nigeria. It explains the current observation on government expenditure and electricity production in developing economy like Nigeria where intensive efforts are ongoing to drive activities in the power sector. Further evidence from national income, gross investment, inflation and total employmentconclude that increase in total income could increase disposable income which could have influence on electricity demand. Hence, the increases in electricity supply to meet demand. The increase in investment is a stimulant to electricity output as the objective of an average investor is to increase output to meet the expected revenue, given the prevailing market price of KW/h in Nigeria. The inclusion of inflation as determining factor revealed that a general increase in prices of commodities with electricity prices and cost of other inputs to electricity production inclusive could lead to a fall in electricity supply. There is no doubt that the activities of labour cannot be ruled out of electricity activities in Nigeria. This study therefore concludes that, that activity of labour in the economy is essential to electricity production as the increase in labour brings about significant increase in electricity production and supply in Nigeria. This study supportsthe theoretical underpinning of this study as a strong policy tool on electricity production in Nigeria.As all the variables employed conformed to the position of the neoclassical production theory. The adoption of this model may have some policy implications on electricity sector by increasing electricity output in Nigeria sector.

Recommendations

- ✓ Based on our findings the study recommends the following:
- ✓ From the result of the analysis, it was discovered that government expenditure (Recurrent and Capital expenditure) should be properly monitored in order to increase electricity supply in Nigeria.
- ✓ From the result of the analysis, it was discovered that the private investment in electricity production should be encouraged by government, in order to increase electricity supply in Nigeria.
- ✓ From the result of the analysis, it was discovered that labour employed remains the integral part in electricity supply, so there is need to enhance labour in the sector.

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