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THE STRUCTURAL EFFECT OF ENERGY POLICY AND INDUSTRIAL OUTPUT IN NIGERIA

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ABSTRACT

For the purpose of making energy available for consumption and as bye product for productive activities, the government of Nigeria formulated a comprehensive energy policy. The integrated policy captures policies non-renewable energy in the form of Oil, Gas, Electricity and Coal. This study therefore, examined the structural effect of the energy policy on industrial output in Nigeria between 1980 and 2013. Dummy variable regression technique was used to analyze data on energy consumption (Oil, Gas, Electricity and Coal) and Industrial output in Nigeria. A dummy variable was introduced to capture the period before energy policy in 2003 and the period of energy policy from 2003 in Nigeria. The sample paired t test was used to analyze the significance of the energy policy on industrial output in Nigeria. The result revealed that energy policy has significant influence on industrial output in Nigeria. Strong evidence of structural instability on industrial sector output in Nigeria was observed. Further evidence showed that the structural instability was attributed to the energy consumption variable in the model.

INTRODUCTION

Industrial development has been seen as a driving force of any economy wishing to move from a non industrial state to an industrial state. To achieve this, certain factors must be put in place to trigger the take off from non industrial economy to an industrial economy. Among these factors is the availability of energy resources to meet the demand of the industry, not only the resources should be available but to be efficiently utilised by the industrial sector. Evidence has shown that in Nigeria, the industrial sector is grossly underperforming due to obstacles posed by infrastructural deficit, involving inefficient energy supply. Despite the abundant reservoirs of energy resources in the country, the continued malfunctioning of various energy sources also means that growth and development of the industrial sector is greatly hindered or affected. The inadequate and epileptic power supply, the high cost of fossil fuel, shortage in natural gas supply has imposed severe cost on manufacturing firms. These costs are in the form of idle workers (workforce), spoilt materials, lost of output and damaged equipment and restart cost (Adenikinju, 2005). These effects have culminated in poor output level of the industrial sector in Nigeria. The continuous vandalization of oil pipelines within the oil producing region accounted for the lack of supply of energy sources such as petroleum product and gas. This shortage in supply affected the productivity of the industrial sector (Atoloye-Kayode, 2013). Statistical evidence has revealed that on the average, the share of the nation's industrial sector to Gross Domestic Product (GDP) was 51.4 percent in 1981; industrial contribution to GDP experienced a decrease from 51.4 percent to 49.1 percent between 1981 and 1985, while industrial share to GDP experienced a little increase to 50.1 percent in 1989 and remain sustainable till 1995. A fall was experienced from 50.3 percent in 1995 to 47.1 percent in 1999 and this fall continue to 42.8 percent in 2005 down to 39.3 percent in 2010 (CBN, 2012). This shows that industrial sector contribution to GDP over the years has not been encouraging.

This dismal performance of the industrial sector suggests that all is not well with the sector. This may be attributed to several factors including infrastructural decay, particularly, energy deficiency (Elijah and Nsikak, 2013). The industrial sector consists mainly of the primary (mining and quarrying and agriculture) and secondary (manufacturing) industries. The manufacturing sector is considered the major sector for determining the nation's economic growth and development. The sector is responsible for about 10 percent of the total GDP in Nigeria (NBS, 2010). The sector includes industries that use lots of energy as inputs such as food, chemical, refining, glass, cement, and aluminium industry (Atoloye-Kayode, 2013).

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As earlier mentioned in Adenikinju (2005), the industrial sector of Nigeria is grossly underperforming due to obstacles posed by infrastructural deficit which include inefficient energy supply. Statistical evidence has shown that the share of the nation's industrial sector to Gross Domestic Product (GDP) was 51.4 percent in 1981. The Industrial sector experienced a decrease from 51.4 percent in 1981 to 45.7 percent in1984. As compared with 1981, industrial contribution to GDP was not encouraging between 1984 and 1988. But from 1989 to 1992, the share of industrial contribution in total GDP experienced an upward growth from 53.1 percent to 58.9 percent respectively. But from 1992, the share of industry in total GDP continued on the downward trend except in 1996 and 2000. The industrial sector share to GDP between the year 2000 and 2012 was highly insignificant (CBN, 2013). These periods experienced the greatest decline even in the face of the most sustainable democratic dispensation in Nigeria. This statistical evidence shows that industrial sector contribution to GDP over the years has not been encouraging and this dismal performance may be attributed to several factors which include infrastructural decay, particularly energy deficiency.

In realizing the central role of energy in sustainable economic growth and development, the Nigerian government led by General Olusegun Obasanjo embarked on a radical policy and institutional reforms in the energy sector in 1999. Oil, Gas and Electricity was on top of the government's reform agenda. In this regard, the national energy policy was approved by the government in 2003. It basic aim was to provide for a well synchronized development, utilization, and management of all energy resources in Nigeria. In particular, it recognizes the alternative ways of meeting rural energy supply and demand with conventional energy (petroleum product, gas, coal and electricity) and non-conventional and renewable energy (solar, wind, hydro, biomass, fuel, and wood) (Iwayemi et'al, 2014).

Without doubt, these reforms are aimed at improving the industrial sector as a major driver of economic growth in Nigeria. Reviewing some studies aimed at ameliorating the problems associated with energy usage and industrial outputs, Sari and Ewing (2008) examined the contribution of energy consumption on industrial output, and they found that renewable energy contributed more to industrial output than the non renewable energy in U.S.A. In a similar view, Ziramba (2009) concluded that the oil consumption and natural gas consumption contributed significantly to industrial production in South Africa. Elijah and Nsikak (2013) realized that non-renewable energy in form of natural gas, coal, and petroleum and electricity consumption contribute significantly to industrial growth in Nigeria. The core of most studies is on the relationship between energy consumption and economic growth. Few studies on energy consumption and industrial output growth can be traced to the works of Elijah and Nsikak, 2013; Sari and Soytas, 2008; and Ziramba, 2009. Since the formulation of energy policy that accommodates all aspect of energy use in 2013, no study could be traced to examining the significance of such policy on some sectors of the economy. However, this study examined the structural effect and the significance of the Nigerian energy policy of 2003 on the output of industrial sector in Nigeria.

An empirical analysis of this issue is appropriate especially now that the federal government of Nigeria is facing economic challenges. Also, concerted efforts targeted at address the problem of industrial sector which is one of the major consumers of energy in a growing economy like Nigeria is necessary. Without doubt, the finding of this study is very central to addressing the challenges facing the industrial sectors of Nigeria.

Scope of the Study

The study examined the effect of energy policy on the industrial output in Nigeria. According to the North American Industrial Classification (NAIC) Codes of 2007, the industrial sector consists of Agriculture, Construction, Mining and Manufacturing. The study focused on the industrial sector in Nigeria.

Limitation of the Study

The study is faced with the inability to have access to current data up 2015. Most data on energy consumption and industrial output in Nigeria end at 2013. Also, data on industrial capacity utilization in Nigeria was not available, therefore limiting the study from examining the relationship between industrial output and industrial capacity utilization. The available data was on manufacturing capacity utilization which is just a subset industrial sector. Analysing manufacturing capacity utilization against industrial output could be misleading.

Literature Review

Conceptual issues

Energy Economics

By definition, Energy economics is a field of economics that studies human utilization of energy resources and energy commodity and the consequences of that utilization (Atoloye - Kayode, 2013). Energy commodity such as gasoline, diesel fuel, natural gas, propane, coal and electricity can be used to provide energy services for human activities such as lighting, space heating, water heating, cooking, motive power and electronic activities. Energy resources such as crude oil, natural gas, coal, biomass, hydro, wind, and sunlight or geo thermal deposit can be harvested to produce energy commodities. Energy is broadly classified into two main groups namely: renewable and non renewable energy.

Renewable energy is the energy generated from natural resources such as sun, wind, rain and tides and they can be generated again and again as at when required. Renewable energy could be in the form of solar energy, hydro power energy, geothermal energy, wind energy and tidal energy.Non renewable energy is the energy which is taken from the sources that are available on the earth in limited quantity and will vanish after certain period of time. They are called non renewable sources because they cannot be regenerated within a short period of time. Non-renewable sources of energy exist in the form of fossil fuels, natural gas, oil and coal (Atoloye-Kayode, 2013)

Energy Policy in Nigeria

The nature and extent of energy demand and utilization in a national economy are, to a large extent, indicative of its level of economic development. For a productive economy and for rapid and secure economic advancement, the country must pay maximum attention to the optimal development and Utilization of her energy resources and to the security of supply of her energy needs. To do this, the country needs to put in place a co-ordinated and coherent energy policy, which will serve as a blueprint for the sustainable development, supply and utilization of energy resources within the economy, and for the use of such resources in international trade and co-operation. The policy must also address the issues of energy manpower development, indigenous participation, domestic self-reliance, the energy needs of various sectors of the economy, energy sector financing, as well as private sector participation in the energy sector. Luckily, the country is endowed with many energy resource types, including oil, gas, coal, tar sands, solar, hydro, biofuels and other renewable energy resources. The national policy should therefore promote the harnessing of all the viable energy resources so as to have an optimal energy mix, while ensuring sustainable and environmentally friendly energy practices (Energy Policy Document, 2003). It is pertinent to note that the impact of energy goes beyond national boundaries. Energy supply can be used as an instrument of foreign policy in the promotion of international cooperation and development.

Need for a National Energy Policy

The level of energy utilization in an economy, coupled with the efficiency of conversion of energy resources to useful energy, is directly indicative of the level of development of the economy. In order to ensure optimal, adequate, reliable and secure supply of energy to, and its efficient utilization in the country, the Obasanjo government embarked on radical policy and institutional reforms in the energy sector in 1999 oil, gas and electricity were on top of the government's reform agenda. It is essential to put in place a co-ordinated, coherent and comprehensive energy policy. The policy will serve as a blueprint for the sustainable development, supply and utilization of energy resources within the economy, and for the use of such resources in international trade and co-operation.

Up till 2003, existing policies in the energy sector have been those of the separate energy sub-sectors, namely, electricity, oil and gas and solid minerals. There had also been energy related policies developed in sub-sectors whose activities are strongly dependent on those in the energy sector. These include transportation, agriculture, science and technology and environment, among others. The sub-sectoral policies, however, reflect the individual sub-sectoral perspectives. It is necessary to have an integrated energy policy, which will guide future energy related sub-sectoral policy developments, in order to avoid policy conflicts which may, otherwise, arise. An overall national energy policy is also normally needed and requested by foreign investors who wish to invest in the nation's economy. In 1984, the Federal Ministry of Science and Technology produced a Draft Energy Policy Guideline. The contents were however limited in scope and depth. The Energy Commission of Nigeria, in furtherance of its mandate, produced a Draft National Energy Policy in 1993. This was later reviewed in 1996 by an Inter-ministerial Committee, under the Chairmanship of the Minister of Science and Technology (Energy Policy Document, 2003). The document was yet to be approved by the Federal Executive Council. In view of significant changes in the orientation of the economy, especially as regards increased private sector participation, it had become necessary to review the 1996 document, prior to its approval.

Objectives of Energy Policy

The policy objectives and implementation strategies have been carefully defined with the fundamental guiding premises that energy is crucial to national development goals and that government has a prime role in meeting the energy challenges facing the nation. Furthermore, the dependence on oil can be reduced through the diversification of the nation's energy resources, aggressive research, development and demonstration (R D& D), human resources development, etc. Consequently, the overall energy policy objectives may be summarized as follows:

- To ensure the development of the nation's energy resources, with diversified energy resources option, for the achievement of national energy security and an efficient energy delivery system with an optimal energy resource mix.
- To guarantee increased contribution of energy productive activities to national income.
- To guarantee adequate, reliable and sustainable supply of energy at appropriate costs and in an environmentally friendly manner, to the various sectors of the economy, for national development.
- To guarantee an efficient and cost effective consumption pattern of energy resources.
- To accelerate the process of acquisition and diffusion of technology and managerial expertise in the energy sector and indigenous participation in energy sector industries, for stability and self-reliance.
- To promote increased investments and development of the energy sector industries with substantial private sector participation.
- To ensure a comprehensive, integrated and well informed energy sector plans and programmes for effective development.
- To foster international co-operation in energy trade and projects development in both the African region and the world at large.
- To successfully use the nation's abundant energy resources to promote international co-operation.

Theoretical Underpinning of the Study

Building on the second law of thermodynamics, this states that a minimum quantity of energy is required to carry out the transformation of matter. Therefore there must be limits to the substitution of other factors of production for energy (Stern, 2012). Since all production involves the transformation of inputs into output in some way, it therefore means that all such transformations require energy. In this way, ecological economists also consider energy as an essential factor of production. Therefore, this study employed neoclassical growth theory in the form of the frequently used Cobb-Douglas production function as used by Elijah and Nsikak (2013):

$Y = K^{\alpha} L^{\beta}$ ………………………1

Where: K is the stock of capital, L is the stock of labour and A is technological progress. And since A is endogenously determined in the new growth model, it is thought to relate to energy in some way. This is because the amount of technology per unit of time requires some level of energy to work. Technology in this regard refers to plants, machinery and equipment and without adequate supply of energy; this technological stock will be obsolete. This is justified through the law of thermodynamics which holds that no production can occur without conversion of energy. Thus, from the theoretical perspective of the endogenous growth model, energy can enter the equation as one of the factors of production. Based on this theoretical exposition, the empirical model for this study can be specified as follows:

Y=F (K,L,E) …………………...2

Where: Y= total output, K=capital stock, L=labour stock and E=index of energy infrastructure.

However, since the objective of this study is to examine the structural effect of energy policy on industrial growth, the empirical model in equation (1) is modified slightly with industrial output replacing total output. The study assumed that labour is fixed and there is abundant supply of labour. The energy index (E) plus capital (K) are assumed to be energy capital which is disaggregated into various sources (Natural Gas, Electricity, Coal and Oil) and used as independent variables. Therefore, the empirical model in its functional form can be specified as follows:

INDQ= f (OIL, GAS, ELEC, COAL,) ……………3

Where:

INDQ=Industrial output, Oil= Petroleum products consumption, GAS=Natural gas consumption, ELEC=Electricity consumption, COAL=Coal consumption, in its econometric linear form can be expressed as:

INDQ $=\alpha_o + \alpha_1 OIL + \alpha_2 GAS + \alpha_3 ELEC + \alpha_4 COAL + \varepsilon$- ……………..4

Where: α_o to α_4 =the parameters to be estimated and ε = the error term.

As far as energy infrastructure is concerned, ecological economists have strongly considered energy as an essential factor of production. According to the law of thermodynamics, no mechanized production can occur without the conversion of energy. For this reason, we expect the respective energy source to have a positive relationship with industrial output. The model in equation 4 was further modified by including energy policy which constitutes an instrumental variable that could influence the level of output of the industrial sector and energy policy is captured by dummy variable. The modified model is presented below.

INDQ $=\alpha_o + \alpha_1 DUMY + \alpha_2 OIL + \alpha_3 GAS + \alpha_4 ELEC + \alpha_5 COAL + \varepsilon$ ……………………….5

Empirical Literature

Large numbers of studies have been carried out to examine the relationship between energy consumption and economic growth, but few studies on energy consumption and industrial output exist in literature. However, earlier studies on energy consumption include Kraft and Kraft (1978), Yu and Choi (1985), Erol and Yu (1987), Abosedra and Baghestani (1989), Masih and Masih (1996), Stern (2006), Soytas and Sari (2003), and Wolde Rufail (2005), among others. This study however, reviews the recent studies in this regard.

Erbaykal (2008) examined the relationship between disaggregated energy consumption and economic growth with evidence from Turkey. A time series data on energy consumption and economic growth was analysed using the Auto Regressive Distributed Lag (ARDL) Bounds test developed by Pesaran et al. (2001). The bounds test revealed the existence of cointegration relationship between the variables. Employing the same method, Olusegun (2008), analyse the relationship between energy consumption and economic growth in Nigeria from 1970 to 2005. The result shows a long-run relationship between total energy consumption, oil consumption and economic growth while no long run relationship is found between gas consumption, electricity consumption and economic growth. Gbadebo and Okonkwo (2009) investigate the contribution of energy consumption on economic performance in Nigeria. Cointegration and error correction technique was employed. The results revealed that a long-run relationship exists between energy consumption and economic growth. The result further shows that a positive relationship exists between crude oil consumption, electricity consumption and real Gross Domestic Product in Nigeria. Noor and Siddiqi (2010) employed cointegration and Ordinary Least Square techniques to analyse the relationship between per capita energy consumption and per capita GDP in Nigeria (1971 to 2006). The cointegration result shows a strong long run relationship between variables in the model.

The long run estimated equation shows a negative relationship between the per capita energy consumption and per capita GDP, while the causality test reveals a unidirectional causality running from GDP to electricity consumption in the short run. Similar study on energy consumption and economic growth in Nigeria was carried out by Orhewere and Henry (2011). The Cointegration, Granger causality test and error correction mechanism was used to analyse the relationship between oil consumption, gas consumption, electricity consumption and economic growth in Nigeria. Time series data from 1970-2005 was used. The result shows that the variables are cointegrated. The long-run and short-run result revealed that unidirectional relationship from electricity consumption to GDP exist in both short and long-run, a unidirectional relationship from gas consumption to GDP was observed in the short-run, a bidirectional relationship was also observed between gas consumption and GDP in the long-run. Energy consumption and economic growth relationship was examined in Malaysia using the time series data between 1980 and 2010. The estimation techniques employed are co integration and Ganger causality test. The result of the study indicates a long-run relationship between variables. The causality test revealed a unidirectional causality running from GDP to electricity consumption, Gas to GDP in Malaysia (Shaari, Hussein and Ismail, 2012). Time series data between 1971-2010 on GDP per capita, electricity consumption, per capita foreign direct investment and total energy in Nigeria was employed to examine the relationship electricity consumption and economic growth. The result of the granger causality test shows two way causality between electricity consumption and GDP, a one way causality running from foreign direct investment to GDP, electricity consumption to foreign direct investment and energy used to foreign direct investment (Akomolafe, Danladi and Babalola, 2012). Shahbaz, Muhammad and Talat (2012) examined how energy consumption spur economic growth in Pakistan. The ARDL bounds testing approach was used to analyse the relationship between renewable energy consumption and non-renewable energy consumption, capital, labour, and economic growth. The result shows the existence of co integration between variables. The causality analysis using the VECM confirms the existence of feedback hypothesis between renewable and non-renewable energy consumption and economic growth in Pakistan.

The impact of petroleum on economic growth in Nigeria using time series data between 1981 to 2011 was examined by Baghedo and Atima (2013). The variables employed were GDP, oil revenue, corruption perception index and foreign direct investment in Nigeria. The error correction result revealed that all the explanatory variables contributes significantly to GDP in Nigeria. Olumuyiwa (2013) examined the interaction between economic growth, domestic energy consumption and energy prices in Nigeria. The error correction method was employed to measure the interaction between per capita energy consumption, per capita real Gross Domestic Product and domestic energy prices. The three variables were specified as endogenous variables. The models were specified having each variable influencing the other in a system of equations. The result revealed strong interactions between variables. Richard, Victoria and Olaoye (2013) examined the relationship between electricity consumption and economic growth in Nigeria. The Granger causality in quartiles test was used as the estimation technique. It was discovered that causality runs from electricity consumption to economic growth in Nigeria.

Further examination of the nexus between energy consumption and economic growth nexus with evidence from Nigeria was conducted by Aguegboh and Madueme (2013). The vector auto regression model and the co-integration technique were adopted. Their study contradicts other study on energy consumption and economic growth in Nigeria. A unidirectional causality was observed between petroleum consumption to GDP, gas consumption to GDP and capital to GDP. Also, the impulse response result shows that energy consumption do 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) examine energy consumption and economic growth nexus in Nigeria. The error correction mechanism was used to analyse the influence of total energy consumption, consumer price index, monetary policy rate, credit available to private sector on economic growth in Nigeria. The result of the study revealed that all the explanatory variables significantly influence output growth in the short-run. Empirical studies on the relationship between energy consumption and industrial output are not so prevalent in energy economic literature as compared with those that examine the relationship between energy consumption and economic growth as reviewed above. This could be attributed to the fact that research on energy consumption and industrial output is relatively a recent issue. However, studies in this area can be traced to the works of Sari *et al*(2008) for United States, Ziramba (2009) for South Africa, Qazi *et al*(2012) for Pakistan,. In Nigeria we have the works of Elijah and Nsikak (2013), Titilope (2013).

Sari, Ewing and Soytas (2008), employed time series data on energy consumption and industrial production in the United State to examine the relationship between disaggregated energy consumption and industrial production. The Auto Regressive Distributed Lag model was used. Variable employed in the model are both renewable and non-renewable energy sources in the form of fossil fuel, conventional hydroelectric power, solar, waste and wind energy, coal, natural gas and industrial output. The relationship between energy consumption and industrial output and employment was investigated in South Africa using annual time series data from 1980 to 2005. The co-integration and Toda-Yamamota (1995) technique to Granger causality test was used. The co-integration result revealed that industrial output and employment are strong force for driving electricity consumption in South Africa. A bi-directional causality was observed between oil consumption and industrial output. Causality was shown between employment and electricity consumption as well as coal consumption and employment in South Africa (Ziramba, 2009).

In Pakistan, the relationship between energy consumption and industrial output was examined. Annual time series data on disaggregated energy consumption and industrial output from 1972 to 2010 was analysed using Vector Auto Regressive method. The co-integration test result revealed that a long run equilibrium relationship exist between the variables in the model. The long run coefficient of the model shows that disaggregated energy consumption has positive and significant effect on industrial output in Pakistan (Qazi, Ahmed and Mudassar, 2012). Most studies were on energy consumption and economic growth. Few studies on energy consumption and industrial sector can only be traced to the work of Sari, Ewing and Soytas (2008),Ziramb (2009), Titilpoe (2013) and Elijah and Nsikak (2013). The major emphasis of their studies is on the relationship rather than their contributions. Also, they did not consider the structural effect of most national energy policy on industrial output in their area of study. There is no doubt, energy policies may have affected the output of industrial sectors in those countries. These gaps were filled in this study.

METHODOLOGY AND DATA

Time series data on aggregate energy consumption that span a period of 1980 to 2013 was used. Relevant data on non-renewable energy such as petroleum, natural gas, electricity and coal consumption in Nigeria were employed. The period 1980 and 2013 was selected to capture the period when the economy of Nigeria has experienced some key policy reforms such as Structural Adjustment Programme (SAP), vision 20: 2020, and Nigeria energy policy of 2003. These policies were without doubt aimed at affecting the industrial sector of Nigeria. The energy policy was selected as the explanatory variable because most developed and developing economies of the world are developing energy policies to drive their industrial sector. Nigeria as one of the major player in the energy sector needs to be examined to know the significance of her energy policy on the industrial sector. The use of dummy variable was considered as a test of stability of the estimated parameters in a regression equation. When an equation includes both a dummy variable for the intercept and a multiplicative dummy variable for each of the explanatory variables, the intercept and each partial slope is allowed to vary, implying different underlying structures for the two conditions (0 and 1) associated with the dummy variable. Therefore, using dummy variables is like conducting a test for structural stability. In essence, two different equations are being estimated from the coefficients of a single equation model. So, in this study the differential impact of Nigeria energy policy on industrial sector output is estimated using dummy variable technique.

The dummy variable regression equation is specified as follows:

$INDQ_t = \alpha_o + \alpha_1 DUMY_t + \alpha_2 OIL_t + \alpha_3 GAS_t + \alpha_4 ELEC_t + \alpha_5 COAL_t + \alpha_6 DUMY*OIL*GAS*ELEC*COAL + U_t$ --- 3.1.1

where

$DUMY$ = Dumy Variable, OIL_t = Petroleum Consumption, GAS_t = Gas consumption, $ELEC_t$ = Electricity consumption, $COAL_t$ = Coal Consumption, α_0 = Intercept, α_1 = Differential Intercept and α_6 = differential slope coefficient.

The differential intercept indicates how much the intercept of the second period of the INDQ function (the category that receives the dummy value of 1) differs from that of the first period. The differential slope coefficient indicates how much the slope coefficient of the second period's INDQ function (the category that receives the dummy value of 1) differs from that of the first period. The probability value of the t statistic from the slope coefficient indicates the significant influence of energy policy proxied by the dummy variable on industrial output in Nigeria (Gujarati, 2003).

Dummy variable = 0 for observations in 1980-2003 and dummy variable =1 for observations in 2004 -2013, while 1 indicates the presence of energy policy, 0 indicates the absence of energy policy.

The F-statistic is interpreted following these decisions: if F-calculated is greater than the F-tabulated, we reject the null hypothesis that the parameters are stable for the entire data set and conclude that there is evidence of structural instability. It is based on the following assumptions: $V_1 = K-1$ and $V_2 = N-K$

Where: K = number of parameters, N= number of observations

Data Analysis

Table 4.1.1 shows the dummy variable regression results. From the results, it was found that the values of differential intercept and differential slope coefficient are 10.36046 and 0.097980 respectively. The result shows that the intercept of the second period's of INDQ function is equal to the intercept of the first period's INDG function. The result also shows that the slope coefficient of the second period of INDQ function is greater than the first period's of INDQ function by 0.097980. These results indicate that the intercepts of the first period is the same as the second period and slopes of the INDQ functions for the first and second periods are different. This is the case of dissimilar regressions for the two time periods. The F statistic is significant at 95 percent confidence level. The F statistic result support the evidence of structural instability arising from energy policy in Nigeria. This is shown by the F calculated value of 62.811 that is greater than the tabulated value of 3.47.

Table 4.1.1. Dummy Variable Regression Results

Dependent Variable: INDQ
Included observations: 34

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3198038.	3239067.	0.987333	0.3322
DUMY	10.36046.	13.73739.	0.754180	0.4573
OIL	11040.94	13034.49	0.847056	0.4044
GAS	-15104.63	5173.288	-2.919734	0.0070
ELEC	594026.1	145485.2	4.083068	0.0004
COAL	-12799.75	9134.514	-1.401251	0.1725
DUMYOILGASELECCOAL	0.097980	0.027434	3.571528	0.0014
R-squared	0.933147	Mean dependent var		3893847.
Adjusted R-squared	0.918291	S.D. dependent var		5072794.
S.E. of regression	1450051.	Akaike info criterion		31.39334
Sum squared resid	5.68E+13	Schwarz criterion		31.70759
Log likelihood	-526.6867	Hannan-Quinn criter.		31.50050
F-statistic	62.81173	Durbin-Watson stat		1.741044
Prob(F-statistic)	0.000000			

Source: Author's Computation using E-Views 7.0

The significance of energy policy on industrial output as shown in dummy variable technique result in table 4.1.1 was supported by the result of Paired t-test in table 4.1.2.

Table 4.1.2 Paired t-test

Paired T for indq - indq2

	N	Mean	StDev	SE Mean
INDQ	10	2416383	1214832	384164
INDQ2	10	10683012	4513951	1427437
Difference	10	-8266629	3462320	1094882

95% CI for mean difference: (-10743424, -5789834)
T-Test of mean difference = 0 (vs ≠ 0): T-Value = -7.55 P-Value = 0.000

The paired t-test result revealed that industrial sector output is more significant in the policy period than the none-policy period.

Conclusion

This study examined the structural effect of energy policy on industrial output in Nigeria between 1980 and 2013. Dummy variable regression technique was used to analyse data on energy consumption (Oil, Gas, Electricity and Coal) and Industrial output in Nigeria. A dummy variable was introduced to capture the period before energy policy in 2003 and the period of energy policy. The result revealed that energy policy has significant influence on industrial output in Nigeria. Strong evidence of structural instability on industrial sector output in Nigeria was observed. Further evidence showed that the structural instability was attributed to the energy consumption variable in the model. The study finally supported the Nigerian Energy Policy of 2003. The government of Nigeria should pursue the effective implementation of the energy policy towards making energy available and affordable to industrial sector. To enhance research and proper policy formulation and implementation, there is need for government agencies responsible for collating data to make current data available for research.

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