The Impact of Energy Consumption on Financial Development in Nigeria

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Abstract

This study is aimed at examining the impact of energy consumption on financial development in Nigeria. The study covers the period of 36 years (1980 – 2016). Model was formulated and data were analyzed using Augmented Dickey Fuller unit root test, co-integration and error correction model. The dependent variable for the study was financial development (FD), while the explanatory variables were crude oil consumption (COC), coal consumption (CC) and electricity consumption (EC). The empirical findings of the study reveals that crude oil consumption has positive and significant impact on financial development. It was also established that coal consumption has positive and significant impact on financial development while electricity consumption has negative and significant impact on financial development. The study concluded that energy consumption has impact on financial development in Nigeria at long run. The study recommends among others that Government and other stakeholders need to evolve policies that will enhance and engender the transmission of the developments in the Nigerian financial sector into level of consumption of energy in the economy.

1.0 Introduction

The relationship between energy consumption and financial development is gaining momentum among academicians, researchers, and policy makers. This issue is considered important in that energy drives the wheels of financial development in many parts of the world been key factor of production, along with capital, and labour (Salah, Muhammad, Shahbaz & Rashid, 2015). Consumption of energy is among the factors that determine economic performances because it affects both the volume and efficiency of productivity in global economy (Hamisu, Zulkornain & Law, 2015). It is thus obvious that the importance of energy consumption in economic dealings can never be ignored considering its diverse functions for both the households and firms. The growing of the emerging economies is faster than projected and coupled with increase in human population has necessitated more demand for energy thus resulting to an upsurge in its consumption (Islam, Shahbaz, Ahmed, & Alam, 2013). Despite the 2009 global recession due to 2007/2008 global financial crisis, the consumption of energy remains unaffected. For example highest energy consumers in Asia (China and India) spending heavily on energy which represents substantial portion of their various economic dealings (Tan & Tan, 2014). Various empirical evidences indicated that development of the financial market can lead to a reduction in energy consumption by improving energy efficiency (Hamisu, Zulkornain & Law, 2015). Much research work in this area aimed at exploring the long run relationship and the direction of causality between economic growth and energy use has included several other variables, for example, population, urbanization, financial development, and so on in order to better understand the underlying dynamics of the relationship. Lee, Chang and Chen (2008) included capital stock and labour to explain energy use for some Asian nations. Their study found that the positive link between economic growth and energy demand gets stronger as relevant variables are included. Ang (2007) explored the dynamic causal relationships between GDP and energy consumption in France. Its study found that economic growth influences energy consumption (and pollution) in the long run, but the relation reverses in the short run in case of France. Apergis and Payne (2009) and Wolde-Rufael (2009) argued in favor of a rise in energy demand in African countries including Nigeria where it was established to be closely linked to income.

On the other hand population growth created by pressure on rural resources forces people to move to urban areas, and thus increases energy demand. For sustained economic growth, the increased energy demand over a long period must be met from new sources, or by

developing cost-effective alternative energy. Using both bi- and multivariate models, Bartleet and Gounder (2010) found causality running from real GDP to energy use. They also found that real GDP and employment exert significant impact on capital formation, where capital stock plays an important role in determining the direction of the causality.

In Nigeria, there are studies that examined the relationship between financial development and economic growth, but only few studies investigated the relationship between energy consumption and financial development. Literatures reviewed reveals that for the past three decades the empirical studies have concentrated more on the link between energy consumption and economic growth. Less attention have been given to the impact of energy consumption on financial development. Also, there exist a number of studies that examine the linkage among energy consumption, financial development and economic growth with divergent and inconclusive findings for example, Sardosky (2010) and Chtoui (2012). This study is thus motivated by the present energy situation of Nigeria coupled with the nature of it's under developed financial market. The motivation for the study includes among others that Nigeria is blessed with abundant natural and human resources thereby making the country the highest producer and consumer of energy in Africa. This is more so that energy is seen as one of the engines of economic growth; be it in a developed or developing economies (Salami, Odubunmi & Atoyebi, 2016).

This study is therefore aimed at examining the impact of energy consumption (electricity, crude oil and coal consumption) on financial development in Nigeria from 1980 to 2016. The work is divided into five sections. The second part of the study will deal with literature review while the third section discusses methodology of the study and sources of data. In the fourth section findings from empirical data analysis are reported and discussed and policy implications, recommendations and conclusion are presented in section five.

2.0 Literature Review

Various empirical studies documented the links between consumption of energy and financial development. Al-Mulali and Sab (2012) studied the effect of energy consumption, CO2 emissions on economic growth and financial market advancement across 30 sub-Saharan African economies for the time frame of 1980-2008. The finding exhibited that energy consumption significantly enhance economic growth and financial development albeit higher rate of environmental pollution. In the same vain the authors also conducted study in 2012, on the impact of energy uses on economic growth and financial development across a sample of 19 countries for the period of 1980-2008. The findings pointed that energy uses significantly influences development of financial market as well as the overall performance of the economy. It however affected environmental quality negatively because it increases the rate of CO2 emissions on the environment.

The causal relationship of energy consumption and economic growth was investigated by Abid and Sebri (2011) for the time frame of 1980-2007 using VECM approach in Tunisia. The empirical finding shows that in overall economic perspective energy consumption lead to higher economic performance, while in sectorial level energy uses negatively affect economic growth. Using VECM technique Islam, Shahbaz, Ahmed, & Alam (2013) examine the impact of financial market growth, population and economic performance on energy consumption in Malaysia. The finding reveals that energy consumption affect financial development and economic growth in the short and long-run as well, while its nexus with the growth of population exist only in the short-run.

Sardosky (2010) examines the impact of financial development on energy consumption in 22 emerging economies using the generalized method of moments (GMM) estimation techniques to control for endogeneity, and finds that increase in financial development (measured using stock market variables) increased the demand for energy. These stock market variables include stock market value traded to GDP, stock market capitalization to GDP, and the stock market turnover. However, other financial development variables like net FDI and deposit money bank assets as a percentage of GDP were found not to have statistically significant effect on energy consumption. Coban and Topcu (2013) in a study on EU countries also reported strong evidence of the impact of

financial development (emanating from neither the stock market nor the banking sector) on energy consumption for the old member countries while an inverted U-shaped relationship was found between financial development and energy consumption for the new member countries.

Kakar, Khilji and Khan (2011) found a significant relationship between financial development and energy consumption in the long-run for Pakistan while the relationship in the short-run was insignificant for the period of 1980-2009 using the co-integration and error techniques as well as the Granger causality test. The Granger causality indicates that financial development does affect energy consumption. Similarly, unidirectional causality was found between money supply and energy consumption while bi-directional causality was found between domestic credit and energy consumption. With the aid of ARDL bound co-integration test and the Vector Error Correction Model (VECM), Islam *et al.* (2013) find that energy consumption is influenced by financial development and economic growth both in the short and long run in Malaysia. A bi-directional causality was also found between energy consumption and financial development in the long run while it runs from financial development to energy consumption in the short run. Also, population exerts a significant positive influence on energy consumption in the long run with its influence found to be insignificant in the short run.

A notable study that examined the nexus between financial development and energy consumption in Nigeria was by Ali, Yusop & Hook (2015). They reported that both economic growth and financial development have negative impact on energy consumption (proxy by fossil fuel consumption) in the short-run and long-run periods. This submission is clearly not in tune with theoretical exposition and is in contrast to findings from empirical studies for many economies, including developing countries. This could have emanated from specification problem as the authors expressed variables that are originally in percentages in logarithmic form. Therefore, this study re-examines the nexus between financial development and energy consumption in Nigeria.

Furthermore, Shahbaz and Lean (2012) reveal that financial development, industrialization, urbanization and economic growth, increased energy consumption in Tunisia, especially in the long-run, while they observe the existence of co-integration among these variables. It was also revealed that long-run bidirectional causal relationship existed between financial development and energy consumption. Siddique and Majeed (2015) find long-run relationship exist among economic growth, energy consumption, trade and financial development in South Asian countries of India, Nepal, Pakistan, Sri Lanka and Bangladesh. They also established non-existence of link between energy consumption and financial development in the short-run. In the same vein, CO2 emissions, energy consumption, financial development and economic growth have long-run relationship in the presence of structural breaks in Greece. Financial development is positively related with energy demand while economic growth reduces with energy demand in the economy (Dritsaki & Dritsaki, 2014), Pernille Holtedahl and Frederick L. Joutz (2003) examined the residential demand electricity as a function of price elasticity, income, population growth, and degree of urbanization through error correction model, for Taiwan. It was concluded the urbanization measured for the cities with population of 100,000 or more has positive long-run and short-run effects on electricity consumption. Lariviere and Lafrance (1999) used statistical modeling to establish relationship between electricity consumption per capita and urban density, demography, meteorological factors for cities in Canada. Their result suggested that greater urban density was factor in reducing energy consumption.

Esso (2010) investigates the long-run and the causality relationship between energy consumption and economic growth for seven Sub-Saharan African countries during the period 1970–2007. Using the Gregory and Hansen testing approach to threshold co-integration, the study indicate that energy consumption is co-integrated with economic growth in Cameroon, Cote d'Ivoire, Ghana, Nigeria and South Africa. The test suggests that economic growth has a significant positive long-run impact on energy consumption in these countries before 1988; and this effect becomes negative after 1988 in Ghana and South Africa. Furthermore, causality tests suggest bi-directional causality between energy

consumption and real GDP in Cote d'Ivoire and unidirectional causality running from real GDP to energy usage in the case of Congo and Ghana.

The investigation of the relationship between the consumption of crude oil, electricity and coal in the Nigerian economy (1970 to 2005) was conducted by Odularu and Okonkwo (2009). Their result obtained after applying the co-integration technique, showed that there exists a positive relationship between energy consumption and economic growth. However, with the exception of coal, the lagged values of these energy components were negatively related to economic growth. Using a vector error correction based Granger causality test, the examination of the relationship between energy consumption and economic growth in Nigeria (1970 - 2005), Orhewere and Machame (2011) reports a unidirectional causality from electricity consumption to GDP both in the short-run and long-run. Unidirectional causality from gas consumption to GDP in the short-run and bi-directional causality between the variable in the long-run was also reported. A unidirectional causality from oil consumption to GDP is found in the long-run. However, in the short run, no causality was found in either direction between oil consumption and GDP.

Gbadebo, Olusegun and Chinedu (2009) citied from Sama and Tah (2016) investigated the relationship between energy consumption and economic growth in the Nigerian economy from the period of 1970 to 2005. They examined three different sources of energy which are crude oil, electricity and coal. By applying the co-integration technique, the results derived inferred that, there exists a long run positive relationship between current period energy consumption and real GDP. The study revealed a negative relationship for lagged values of crude oil, electricity consumption and real GDP. The study observes that, energy consumption is a strong determinant of economic growth having an implicit effect in lagged periods and both an implicit and explicit effect on the present economy of Nigeria. The study recommended that this sector should be given more relevance even by the opportunities laden in the sector to increase economic growth.

Ayodele (2004) citied from Sama and Tah (2016) carried out a research on improving and sustaining power (electricity) supply for socio economic development in Nigeria. His results obtained shows that electricity consumption is positively related to economic growth. He concluded that electricity consumption has diverse impact in a range of socio economic activities and also on the living standards of Nigerians.

Ongono (2009) citied from Sama and Tah (2016) carried a study on Energy consumption and economic performance in Cameroon. The results of this study show that there is no Granger causality between electricity consumption and economic performance (GDP) at the national level and primary sector. The result also revealed that in the secondary sector, production Granger causes electricity consumption. Furthermore, in the tertiary sector, the causality runs from electricity consumption to production. He recommended that any policy aimed at strengthening growth and reduce poverty must pay special attention on energy production.

Sama and Tah (2016) carried out a study to determine the Effect of Energy Consumption on Economic Growth in Cameroon from the period of 1980 to 2014. The energy sources used to test for this relationship were Petroleum and electricity. The study made used of secondary time-series data. Using the Generalized Method of Moments technique, the results obtained shows that Gross Domestic Product (GDP), population growth rate and petroleum prices, have a positive relationship with petroleum consumption. Also, there was an established positive relationship between Gross Domestic Product (GDP), population growth rate, electricity prices and electricity consumption. Again, the study found a positive and significant relationship between petroleum consumption, electricity consumption, Gross domestic investment (GDI) and population growth rate and economic growth. Furthermore, the empirical result revealed that the rate of inflation and economic growth are positively related. Based on the findings of this study, it is recommended that the government should expand current sources and exploit the other sources of energy such as solar energy, wind energy, thermal energy so as to increase the production and consumption of energy which increases economic growth.

Gbadebo and Okonkwo (2009) investigated the relationship between energy consumption and

the Nigerian economy from the period of 1970 to 2005. The energy sources used to test for this relationship were crude oil, electricity and coal. By applying the co-integration technique, the results derived infer that there exists a positive relationship between current period energy consumption and economic growth. With the exception of coal which was positive, a negative relationship was noted for lagged values of energy consumption and economic growth. The implication of the study is that increased energy consumption is a strong determinant of economic growth having an implicit effect in lagged periods and both an implicit and explicit effect on the present period in Nigeria. Thus, it is pertinent that this sector should be given more relevance even by exploiting the opportunities laden in the sector to increase economic growth.

Choji (2014) investigated the causal relationship among electricity consumption, fuel price and economic growth in Nigeria, using time series techniques covering the period of 1970-2012. The results of their estimation show that real gross domestic product, electricity consumption and fuel price are co-integrated. Showing a positive relationship of electricity consumption and real GDP and shows a negative relation between fuel price and real GDP. It also finds the presence of unidirectional causality from real gross domestic product to electricity consumption without any feedback effect. This shows that an improvement in economic growth in Nigeria will improve electricity consumption. And shows that fuel price granger cause consumption, which shows the impact of fuel price on electricity consumption. To cope with the increasing electricity demand and to overcome the shortage of electricity, it is imminent that investments be encourage in the electricity supply sectors to ensure an efficiency in distribution and transmission of electricity on a large scale to bridge the gap between supply and demand of electricity in Nigeria.

Akomolafe and Danladi (2014) examined the electricity consumption on development in Nigeria. The authors introduced capital formation as well as labour stock in a multivariate system for the period covering 1990-2011. Augmented Dickey Fuller test and Philip Perron unit roots test; Johansen test for co integration, vector error correction and Granger causality test are employed. The result of the study shows unidirectional causality from electricity consumption to real gross domestic product. The long run estimates however, supports the Granger causality tests by revealing that electricity consumption is positively related with financial development in the long run. Investigation further indicates that there is unidirectional causality from capital formation to real gross domestic product. This implies that Nigeria- being a country highly dependent on energy- will have capital formation's contribution to the economy relatively determined by adequate electricity.

Muhammad and Hooi (2011) assess the link among energy consumption, financial development, economic growth, industrialization in Tunisia. The study covers the period of 37 years (1971 – 2008). The autoregressive distributed lag bound testing approach to co-integration and granger casualty test was employed for the analysis. The result of their findings confirms the existence of long run relationship among energy consumption, economic growth, financial development, industrialization and urban development in Tunisia. It was recommended that sound and develop financial system that can attract investors, boost the stock market and improve the efficiency of the economic activities should be encourage in the country.

Aminu and Aminu (2015) examined the causal relationship between energy consumption and financial development using Nigeria's data from 1980 to 2011 in a multivariate framework by including labour and capital in the causality analysis. Applying Granger causality test, impulse response and variance decomposition analysis; the results of the causality test reported absence of causality and that of variance decomposition found that capital and labour are more important in affecting output growth compared to energy consumption.

Ogundipe, Akinyemi, and Ogundipe (2016) examined the relationship between electricity consumption and economic development using an extended neoclassical model for the period 1970-2013. The study incorporates the uniqueness of the Nigerian economy by controlling for the role of institutions, technology, emissions, and economic structure in the electricity consumption-development argument. The study adopted a co-integration analysis based on the Johansen and Juselius

(1981) maximum Likelihood approach and a vector error correction model. In order to ensure robustness, the study adopted the wald block endogeneity causality test to ascertain the direction of causal relationship between electricity consumption and economic development. The study found an existence of long-run co-integration equation with electricity consumption inversely related to economic development. Likewise, the vector error correction model failed to reject the null hypothesis of non-convergence in the long-run. The study found evidence supporting unidirectional causal relationship running from economic development to electricity consumption.

3.0 Methodology and Sources of Data

Empirical Model

The model for this study was specified in line with the study of Molem & Ndifor (2016). Recall that the main objective of the study is to examine and establish the impact of Energy consumption on financial development in Nigeria. Specifically, the study examines the impact of Electricity, coal and crude oil consumption on financial development. The functional form of the model is stated as follows:

FD= f (EC, CC, COC)

Where,

FD = Financial Development
EC = Electricity Consumption
CC = Coal Consumption
COC = Crude Oil Consumption

The econometric model that express the cause-effect relationship between the variables under investigation can then be stated as:

$FD_t = \beta_0 + \beta_1 EC_t + \beta_2 CC_t + \beta_3 COC_t + \mu_t$

Where

β_0= Constant of the equation
β_1= Coefficient of Electricity Consumption
β_2= Coefficient of Coal Consumption
β_3= Coefficient of Crude Oil Consumption
μ= Error term
FD = Financial Development
EC = Electricity consumption
CC = Coal Consumption
COC = Crude Oil Consumption

Method of Estimation

The study will employ the error correction model (ECM) in its investigation. The error correction model had emerged as one of the effective contemporary tools for ascertaining the dynamic paths of variables and ability to return to long-run equilibrium (converge) after a shock. The preference for ECM followed Phillips (1991) and Gonzalo (1994) who ascribed better properties to ECM than several other estimating frameworks for long-run relationships. The ECM is preferred for data sets where co-integration is detected. An ECM investigates the long-run and the short-run dynamic co-movements among economic variables.

A typical ECM model is specified as follows:

$$\Delta lnFD_t = \beta_0 + \beta_1 \Delta lnEC_t + \beta_2 \Delta lnCC_t + \beta_3 \Delta lnCOC_t + \theta ECT_{t-1} + u_t$$

Where

*l*nFD refers to the log of financial development, *l*nEC is the log of electricity consumption, *ln*CC is the log of coal consumption, lnCOC, is the log of crude oil consumption and Δ, is the difference operator. θ, is the coefficient of the error correction term.

Model Evaluation

The study applied Wald test of F-test with the aim of testing joint significance of the coefficient of lagged variables to see if there exist long-run relationship between energy consumption and financial development in Nigeria. The null hypothesis is H0: $\beta_1 = \beta_2 = \beta_3 = 0$ which stated that there is no long-run relationship between the variables.

Johansen Juselius Co-integration Test

The study will test for the existence of co-integration among the variables in the model; this will be based on the representation of the approach specified by Johansen Juselius (1990). The Johansen test for co-integration provides an analytical statistical framework for ascertaining the long-run relationship between the economic variable (Agbola, 2004). The test will compare unrestricted co-integration rank test available from the trace and maximum eigenvalue test with the corresponding critical values due to Mackinnon-Haug-Michelis (1999). The Johansen's estimation model is given as follows:

$$\Delta X_t = \mu + \sum_{i=1}^{r} r_i \Delta X_{t-1} + \alpha\beta' X_{t-1} + \varepsilon_t$$

Where:

X_t = (nx1) vector of all the non-stationery indices in the study
r = is (n x n) matrix of coefficients

α = (n x r) matrix of error correction coefficients where r is the number of co-integrating relationships in the variables, so that 0<r<n. This measures the speed at which the variables adjust to their equilibrium (Adjustment parameter).
β = (n x r) matrix of r co-integrating relationship between the variables
In determining the lag length for the Johansen Joselius procedure, the researcher will choose between using Akaike Information Criterion (AIC) and the Schwarz's Bayesian Information Criterion (SBIC) process. The SBIC is usually more consistent but inefficient while AIC is not as consistent but is usually more efficient (Brooks, 2008).
The Johansen (1990) defines two different test statistics for co-integration under his method: The Trace Test and the Maximum eigenvalue Test. The trace test is the joint test that test the null hypothesis of no co-integration (H_0: r = 0) against the alternative hypothesis of co-integration (H_1: r > 0). The maximum eigenvalue test conduct test on each Eigen value separately. It tests the null hypothesis that the number of co-integrating vectors is equal to r against the alternative of r+1 co-integration vectors (Brooks, 2008).

$\lambda_{trace}(r) = -T\sum_{i=r+1}^{g}\ln(1-\hat{\lambda}_i)$
$\lambda_{max}(r, r+1) = -T ln(1-\hat{\lambda}_{r+1})$
r = number of co-integrating vectors under the null
$\hat{\lambda}_i$ = Estimated i^{th} ordered Eigen value from the $\alpha\beta'$ matrices.
A significantly non-zero eigenvalue indicates a significant co-integrating vector.

The data collected for the study was secondary data which was collected from various sources such as: international agency energy statistics, index mundi and United States energy information administration. The study covers the period of 36 years from 1980 to 2016.

Data Analysis and Interpretation
Descriptive Statistics
The results of descriptive statistics are reported in Table-1. The Jarque-Bera test statistics reveal that the series of energy consumption that is crude oil consumption, coal consumption, electricity consumption and financial development have normal distributions while mean is zero with constant variance. The normal distribution of the series enables the study to proceed for further analysis.

Table: 4.1
Descriptive Statistic Result

	FD	COC	CC	EC
Mean	15.005	263.000	60.143	102.272
Median	13.400	263.000	47.000	91.430
Maximum	38.400	428.000	201.000	156.730
Minimum	8.700	170.000	3.3000	50.870
Standard Deviation	6.023	45.791	53.457	27.855
Skewness	2.506	1.016	1.212	0.383
Kurtosis	9.5945	6.078	3.554	2.025
Jaegue Bera	105.781	20.969	9.531	2.369
Prob	0.000	0.000	0.009	0.306

Source: Author's Computation using E-views 9

Unit Root Test (ADF and PP)
The section examines the unit root property of the variables of the study using augmented dickey fuller (ADF) and Philip Perron (PP) test with the inclusion of trend and intercepts components in the test equations at both levels and first difference. All the variables appear to be stationary at first difference at 5% significance level.

TABLE: 4.2

Unit root test using Augmented Dickey Fuller (ADF) and Phillips Perron (PP)

Variables	ADF Test Statistics				PP Test Statistics			
	Constant		Constant & Trend		Constant		Constant & Trend	
	Level	First Different	Level	First Different	Level	First Different	Level	First Different
FD	-2.8001 (0.068)	-5.393** (0.0001)	-3.423 (0.065)	-5.305** (0.0006)	-2.570 (0.1083)	-9.885** (0.0000)	-2.499 (.3269)	-9.678** (0.000)
CC	-3.416** (0.017)	-6.174** (0.000)	-1.455 (0.825)	-6.136 (0.0001)	-3.369** (0.019)	-3.078** (0.038)	-3.122 (0.117)	-1.048 (0.924)
COC	-0.402 (0.898)	-4.496** (0.0010)	-1.703 (0.729)	-4.507** (0.005)	-0.368 (0.904)	-4.351** (0.002)	-1.988 (0.588)	-4.358** (0.008)
EC	-1.300 (0.6189)	-8.163** (0.000)	-2.809 (0.204)	-8.042** (0.000)	-1.060 (0.721)	-8.157** (0.000)	2.889 (0.1777)	-8.033** (0.000)

***, **, * Denote 1%, 5% and 10% significance level respectively.

Co-integration test results

The study proceeds to test for the existence of co-integration among the variables in the model; this is based on the representation of the approach specified by Johansen and Juselius (1990). The Johansen test for co-integration provides an analytical statistical framework for ascertaining the long-run relationship between the economic variable (Agbola, 2004). The table 3 compare unrestricted co-integration rank test available from the trace and maximum eigen value test with the corresponding critical values due to Mackinnon-Haug-Michelis (1999).The result indicates that the trace statistic show an evidence of a unique co-integration equation, which implies an existence of long run equilibrium relationship among the observed variables.

Table: 4.3 Co-integration test using Johansen Juselius test.

Null Hypothesis	**Tests statistic**		**Critical value (5%)**	
	Trace	Max-Eigen	Trace	Max-Eigen
None*	47.93219	30.99963	47.85613	27.58434
At most 1	16.93255	12.39078	29.79707	21.13162
At most 2	4.541771	4.369856	15.49471	14.26460
AT most 3	0.171915	0.171915	3.841466	3.841466

Trace and Max-Eigen test indicates 4 co-integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Lag Selection

Table 4 indicates that LR, FPE, AIC, SC and HQ select lag 1 as the optimal lag. Hence, lag 1 was selected for the estimation procedure of the study.

Table: 4.4 *Optimal Lag Length Selection Based on Schwarz Information Criterion (SIC) for Co-integration Test.*

Lag	Logl	LR	FPE	AIC	SC	HQ
0	0	-631.853	NA	7.08e+10	36.334	36.512
1	1	-562.812	118.3570*	3.44e+09*	33.304*	34.192*
2	2	-550.125	18.849	4.33e+09	33.493	35.093

Note. LR = sequential modified LR test statistic; FPE = final prediction error; AIC = Akaike information criterion; SC = Schwarz information criterion;
LogL = log likelihood; LR = likelihood ratio.
∗ Indicates the lag suggested by each criterion. HQ = Hannan-Quinn information criterion.

Long Run Relationship

Table 5 reveals that the impact of crude oil consumption on financial development is positive and significant. By implication, 10 percent increase in crude oil consumption increased financial development by 29.7 percent. It could be inferred that crude oil consumption promotes financial development. This conform with findings from Sardosky (2010), Gbadebo, Olusegun and Chinedu (2009), Coban and Topcu (2013), Kakar, Khilji and Khan (2011) and Odularu and Okonkwo (2009). However, the findings from this study contradict the finding of Odularu and Okonkwo (2009).

Also, the effect of coal consumption on financial deveolpment is positive and significant at 5 percent. The coefficient of the coal consumption indicates that 1 percent increase in coal; consumption results into 18.2 percent increase in financial development (as a percentage of GDP) in the long-run. This finding supoort the findings of Siddique and Majeed (2015), Odularu and Okonkwo (2009) and Gbadebo, Olusegun and Chinedu (2009).

The impact of electricity consumption on finanacial development is negative and significant at 10 percent. The coefficient of the electricity consumption indicates that 1 percent increase in electricity consumption decreases financial development (as a percentage of GDP) by 26.7 percent at long run. This findins is in line with the findings of Ali, Yusop & Hook (2015). However, the findings contradict the finding of Odularu and Okonkwo (2009).

Table: 4.5 *Estimated Long-Run Coefficients' results.*
Dependent variable, FD

Regressors	Coefficients	T-statistic (p-value)
COC	0.297*	5.691(0.052)
CC	0.182**	5.903(0.030)
EC	-0.267*	-4.952(0.054)
Constant	-75.472	

***,**, and ∗ Denote 1%, 5% and 10% significance level, respectively. Figures in parenthesis are the p-values.

Error Correction Model

From table 4.6, it can be seen that the error correction term (ECT) is significant. This indicates that there is a long-run causality from financial development to energy consumption, but the reverse does not. This reveals the fact that any changes in energy consumption that disturb long-run equilibrium are corrected by counter-balancing changes in the financial sector. Short-run causality is not reflected from the result due to statistical insignificance of the coefficients of ΔlnCC and ΔlnEC terms. The statistical insignificance of the estimated coefficients on lagged values of change in electricity consumption along with the ECT, means that there is no strong Granger-causality running from electricity consumption to financial development. Also the statistical insignificance of the estimated coefficients on lagged values of change in coal consumption

along with the ECT, means that there is no strong Granger-causality running from coal consumption to financial development. Results of the significance of the estimated coefficients on lagged values of change in financial development, along with the ECT and in crude oil consumption equation are consistent with the presence of strong Granger-causality running from financial development to crude oil consumption. These indicate that whenever a shock occurs in the system, changes in COC would make short-run adjustments to restore long-run equilibrium.

The adjusted R-squared value of 0.205 indicates that 20.5% of the variation in the dependent variable (financial development) has been explained by the independent variables (electricity consumption, crude oil consumption and coal consumption).

Table: 4.6 *The Error Correction Model*

$$\Delta lnFD_t = 1.017 - 0.046\Delta lnEC_t - 0.004\Delta lnCC_t - 0.602\Delta lnCOC_t - 0.443ECT_{t-1} + u_t$$

(1.217) (-0.722) (-0.179) (-1.893) (3.118)

Adjusted R^2 = 0.205	DW Stat = 1.604	Heteroskedasticity: 117.130(0.116)
F-Stat = 3.253 (0.024)	Normality = 18.320(0.001)	Breusch-Pagan- Godfrey = 1.2271(0.3236)
N = 37		LM Stat = 20.649 (0.192)

Note: In parenthesis are the p-values

5.0 Results and Discussions

The study examines the impact of energy consumption on financial development in Nigeria for a period of 36 years. Specifically, the study covers the impact of crude oil consumption, coal consumption and electricity consumption on financial development.

Results from the study indicated that:

i. Crude oil consumption has positive and significant long run impact on financial development.
ii. Coal consumption has positive and significant impact on financial development at the long run.
iii. Lastly, electricity consumption has negative and significant impact on financial development.

A significant long-run relationship was therefore confirmed between energy consumption and financial development in Nigeria. It was also deduced that the development of the energy sector exerted positively and significantly on financial development in the Nigerian economy, in the long-run. This vividly implies that the development of the energy sector drives the Nigerias financial development to a significant extent.

The following recommendations were made on the bases of the findings of the study:

i. Government and other stakeholders need to evolve policies that will enhance and engender the transmission of the developments of the Nigerian financial sector into a certain level of energy consumption in the economy.
ii. The results necessitate the need for the development and implementation of appropriate financial policy tools to encounter the rising demand for energy by enhancing the process of capitalization of the energy sector.

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