Energy consumption and economic growth in Nigeria: A revisit of the energy-growth debate

Emeka Nkoro*, Nenubari Ikue-Johnb and God'sgrace I. Joshuaa

aroa,b,c Department of Economics, Faculty of Social Sciences, University of Port Harcourt, Nigeria

ARTICLE INFO

Article history:
Received 27 July 19
Received in revised form 22 Aug 19
Accepted 12 October 19

Keywords:
Renewable-Energy
Non-renewable energy
Non-renewable-Energy
Economic-Growth
Factor-Productivity

JEL Classification:
L72, L94, Q42, Q43

ABSTRACT

This paper investigated this disparity in the literature using Nigeria data from 1980 to 2016. In doing this, energy consumption was disaggregated, and their impacts on economic growth investigated using a modified Ordinary Least Square technique which allows for time gaps in the model. It was observed that only renewable energy impacted on economic growth in the long-run whereas non-renewable energy component impacted on economic growth in the short-run. Therefore, the study sees the impact of energy consumption on economic growth to be indistinct in Nigeria within the period under review. This further buttresses the need for improvement in electricity production and distribution in Nigeria. Given the importance of energy consumption on productivity, the study, therefore, suggests policies/measures that will bring about increasing the supply or improvement of energy production in the country.

Introduction

Energy plays a crucial role in socio-economic development, industrial breakthrough, health, education, employment and overall welfare of a country citizen. Sufficient amount of energy supply as well as its efficient utilization of the energy is needed for an economy to completely experience growth and development. Though the presence of energy is not by itself an answer to the social and economic problems facing developing economies like Nigeria, the very lack of access to affordable and reliable energy services is recognized as a major problem to the development of the country. In order to achieving the Economic Recovery and Growth Plan for 2017-2020, energy poverty (being the lack of access to modern energy services) eradication is important because energy services have significant contributions to productivity, education and communication services (UNIDO, 2011). The poverty of energy in Nigeria is such that all manufacturing firms depend on self-created electricity to power their operations and to maintain power back-up in the event of power failure, (Nkoro, Ikue-John, Okeke, Amabuike, & Ajaba, 2019). This situation is an irony, in a country where energy resources are in high abundance and serving as the prime income earner together with the fluctuating economy places the country in dire need of explanations as to the role of energy in economic life of Nigeria (Babatunde, 2016). Hence, it is pertinent to examine the role of energy in the face of fluctuating economic growth, if appropriate energy policies are to be devised.
Empirical literatures have shown conflicting evidence on the relationship between energy consumption and economic growth that has left us uncertain about the cause-and-effect nature of this nexus. An attempt by Dantama et al (2012), Adegbesi et al (2013), Jacques (2010), Mesbah (2016) and Adam et al (201) to examine the relationship between energy consumption and economic growth revealed conflicting results. The studies reported unidirectional, bidirectional, feedback and neutrality causality between energy consumption and economic growth. These conflicting results could be as a result of the choice of methodology, selectivity bias and, data quality and specification issues. It was equally observed that most of these studies treated the relationship between energy consumptions and economic growth in a feedback models. The case of Nigeria maybe little different since over the years economic growth have been increasing even in the present of higher level energy poverty as such we can argued that economic growth have not contributed to energy consumption in Nigeria, rather we suspected that it is energy consumption that will contribute to economic growth in Nigeria, (Medee, Ikue-John, & Amabuike, 2018). However, the question still remains. Does energy consumption stimulation economic growth or vice versa? This question can only be resolved by appealing to empirical evidence. Hence, the aim of the paper is to assess in a linear framework the impact of energy consumption on the economic output in Nigeria from 1980 to 2016 using the instruments of factor productivity as a check variable. To achieve this objective, the study developed a linear framework against the feedback framework to investigate the impact of disaggregated energy consumption components on economic growth in Nigeria. The study is guided by the following hypothesis, H0: Energy consumption has no significant impact on economic growth in Nigeria.

The remaining section of this paper is divided such that section two discusses theoretical issues and review empirical literature. Section three highlights the theoretical model. Section four gives the empirical results and the discussion of findings while the last sections proffers policy recommendations and also conclude the study.

2. Literature Review

Theoretical Literature

An investigation on the link between energy consumption and economic growth is not a thing of recent studies. It dates back to the 1970s with the pioneer work of Kraft & Kraft (1978), where a unidirectional causality from GNP growth to energy consumption were observed in the united states for the period of 1947-1974. Since then numerous scholars have carried out further test to determine the relationship between energy consumption and economic growth. Renewable energy sources have begun replacing traditional energy sources in these past years due to the challenges of energy security, the risk of extinction of traditional energy sources environmental problems as well as greenhouse gas emission. It is important to understand the relationship between renewable energy consumption and economic growth in revealing its dependency on energy (Yildrim & Aslan, 2012).

Studies without qualitative distinction have provided four testable hypotheses to explain the direction of the relationship between energy consumption and economic growth (Ozturk, 2010; Wesseh & Zoumara, 2012; Tugcu et al 2012; Shahbaz et al, 2015; Kocak & Sarkgunesi 2017). They are the Growth Hypothesis, the Conservative Hypothesis, the Feedback Hypothesis and the Neutrality Hypothesis.

The Growth Hypothesis sees energy consumption as a direct influence on economic growth in presents of the control for capital and labor. The hypothesis argued unidirectional causality from energy consumption to economic growth. Here, energy policies aimed at reducing energy consumption for conservative purposes will affect economic growth negatively. The Conservative Hypothesis posits that economic growth pulls energy consumption. The hypothesis argued for unidirectional causality from economic growth to energy consumption. Here energy conservation policies on energy consumption would not have a negative effect on the economy. The Feedback Hypothesis posits bidirectional causality between energy consumption and economic growth meaning that a mutual relation exists between energy consumption and economic growth. In this situation, energy conservation policy seeks to reduce energy consumption may negatively affect economic growth and these changes are likewise reflected back to energy consumption. The Neutrality Hypothesis states that energy consumption has no effect on economic growth. It posits that there is no causality between energy consumption and economic growth. This hypothesis is supported when there is absence of causality between energy consumption and economic growth. In this case, energy conservation policies for the reduction of energy consumption will have no impact on economic growth.

Empirical Literature

Results regarding energy consumption and economic growth are different for countries and no inference has been drawn in literature (Bhattacharya, 2016). Most of these studies differ in the time periods, econometric methods, countries selected, energy types, and results (Ozturk, 2010). Bhattacharya et al (2016) in examining 38 countries saw that despite the various literatures on energy consumption and economic growth in the past ten years, literature on the impact of renewable energy on economic growth is not enough. To this end, Table 1 summarized some empirical evidences on the relationship between energy consumption and economic growth.
Table 1: Past Studies on the Relationship between Energy Consumption and Economic Growth

| Authors | Subject | Periods | Sample variables | Method | Major findings |
|---------|---------|---------|------------------|--------|---------------|
| Medee, Ikue-John & Amanuibe, (2018) | Granger causality of Energy Consumption and Economic Growth in the Organization of Petroleum Exporting Countries: Evidence from the Toda–Yamamoto approach | 1970-2014 | Economic Growth, renew and non-renew energy consumption | Augmented Granger Causality model (AGCM) by Toda-Yamamoto | Dominants of feedback hypotheses among the major oil exporting countries. |
| Mesbah (2016) | Energy consumption and economic growth in Egypt | 1980 - 2012 | Oil, electricity, coal, natural gas and economic growth | Toda Yamamoto causality test | Neutrality hypothesis |
| Adam et al., (2016) | Energy consumption, political regime and Economic growth in Sub-Saharan Africa | 1971-2013 | Energy consumption, energy price, GDP, and degree of openness | Panel Vector Autoregressive Model (PVAM) | Feedback Hypothesis |
| Fuinhas&Margues (2012) | Nexus between primary energy consumption and economic growth in five European countries | 1965-2009 | Oil, electricity, natural gas and GDP | Autoregressive Distributed Lag (ARDL) approach | Feedback Hypothesis |
| Menegaki (2011) | Causal relationship between renewable energy consumption and economic growth in selected 27 European countries | 1980-2007 | Renewable energy resources and economic growth | Multivariate panel analysis | Neutrality Hypothesis |
| Yildirim et al., (2014) | Causality between energy consumption and economic growth in selected 11 countries | 1980-2011 | Oil, electricity, and GDP | Trivariate model and bootstrapped auto-regressive metric causality approach | Neutrality Hypothesis |
| Apergis& Payne (2012) | Examine the link between renewable, non-renewable energy consumption in selected 80 countries | 1990-2007 | Renewable, non-renewable resources and GDP | Panel Error Correction Model (PECM) | Feedback Hypothesis |
| Mohammadi&P arvaresh (2014) | Short and long dynamics between energy consumption and economic output in 14 selected oil exporting economies | 1980-2007 | Oil, natural gas and GDP | Panel estimation techniques, dynamic fixed effect, pooled, and mean-group estimators | Feedback Hypothesis |
| Shahbaz et al., (2012) | the link between renewable, non-renewable energy usage and economic growth in Pakistan | 1972-2012 | Renewable, non-renewable resources and GDP | Autoregressive Distributed Lag (ARDL) bound test approach | Feedback Hypothesis |
| Bloch et al., (2015) | Relationship between GDP Oil, Coal and Renewable energy resources in China | 1977-2013 | GDP, Oil Coal and Renewable Energy resources | ARDL techniques and Vector Error Correction Model | Feedback Hypothesis |
| Omri&Mabrouk (2014) | The effect economic growth on energy consumption in 65 selected countries | 1990-2011 | GDP, oil Natural gas and electricity | GMM estimator techniques | Conservative Hypothesis |
| Odhiambo (2010) | Examines the link between Energy-Growth Nexus in Kenya, Congo and South Africa | 2006-2011 | Energy consumption, price and GDP | Panel Error Correction Model | Growth Hypothesis in Kenya and South Africa, Conservative Hypothesis in Congo |
| Menyakh&Wolde-Rufael (2010) | The relationship between energy consumption and economic growth in South Africa | 1965-2006 | Energy consumption, pollutant emission, GDP | Autoregressive Distributed Lag (ARDL) | Growth Hypothesis |
| Jacques (2010) | Examines the link between energy consumption and economic performance in seven Africa Countries | 1970-2007 | Energy consumption and economic growth (GDP) | Bound approach test | Conservative Hypothesis |
| Karanfil& Li (2015) | Energy-Growth Nexus In 160 Countries | 1980-2010 | Electricity consumption and level of economic performance | Exploring Panel-Specific Difference | Conservative, Feedback and Neutrality Hypotheses |
| Khalid (2015) | Dynamic linkages among energy consumption, environment, health and wealth in BRICS Countries | 1975-2013 | Energy consumption, health, | Panel integration co- | Growth Hypothesis |
### Research and Methodology

#### Analytical Framework

This paper follows the works of Fang (2011) and Ogundipe and Apata (2013) in an attempt to evaluate the impact of energy consumption on economic growth in China and Nigeria respectively. They used the Cobb-Douglas functional form to show the relationship between inputs and outputs in production. In its general form the production function appears as;

$$Q = AL^\alpha K^\beta$$

Where;

- $Q$ = production in monetary value
- $L$ = labor input
- $K$ = capital input
- $A$ = total factor productivity
- $\alpha$ & $\beta$ = Elasticity of labor and capital respectively.

In this paper, labor and capital are captured easily as number of the employed persons in the country and gross fixed capital formation respectively, technological changes are not so easily quantifiable and data for it in Nigeria is scarce hence its omission here. The model for this paper is premised on Fang (2011) and Ogundipe and Apata (2013) but with little modification in terms of variable and method of analysis. The paper uses total consumption of renewable energy (TCR) in kiloton of oil equivalent as proxy for renewable energy consumption obtained by the sum of solar, hydro, biofuel, biomass, wind and geothermal and CO2 emission to account the present of non-renewable energy which is treated as strictly exogenous in the model whereas Fang (2011) and Ogundipe and Apata (2013) used renewable energy consumption and electricity consumption respectively. Analytically, this paper adopts the modified ordinary least square as in Ogundipe and Apata (2013) but contrary to Fang (2011) who adopted the multivariate OLS. Also, Ogundipe and Apata (2013) examined the relationship between energy consumption and economic growth from 1980-2008 while this paper extended to 2016 as a result of policy changes that have taken place in the country.

#### Data Analysis

Analytically, this paper adopts the modified ordinary least square. The estimation starts with examining the time series characteristics of the variables included in the model, then proceed to estimating the Engel & Granger co-integration analysis in order to test for the existence of a co-integrating relationship among the variables. Next is the examination of the relationship between energy consumption and economic growth is conducted using Parsimonious Error Correction Model and finally, the diagnostic tests of the model.

All the data employed in this study are obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin, International Energy Agency, and World Development Indicators Annual Reports.
Model

The functional relationship between economic growth and energy consumption in the present of control for some selected macroeconomic fundamentals can be express as follows:

\[ \text{GDP} = f (\text{TCR}, \text{CO}, \text{EMP}, \text{GFCE}) \]

Where;
- GDP = Gross domestic product proxy for economic growth
- CO = Carbon Dioxide Emissions (CO₂ Emission Per Capita) proxy for non-renewable Energy Consumption
- RENER = Total Consumption of Renewable proxy for Renewable Energy Consumption
- EMP = Employment proxy for labor force
- GFCE = Gross Fixed Capital Formation proxy for physical capital

The general specification of a linear static model is cast as follows;

\[ Y_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 Y_{t-i} + \sum_{i=0}^{m} \alpha_2 Y_{t-i} + \epsilon_t \]

Whereas, the general expression of linear dynamic model with Error Correction is cast as follows:

\[ \Delta Y_t = \beta_0 + \sum \beta_1 Y_{t-1} + \sum \beta_2 Y_{t-1-j} + \psi ECM_{t-1} + \epsilon_t \]

In equation 2 the speed of adjustment parameter (\(\psi\)) in the dynamic model must be negative and statistically significant. The Error Correction Term specifies that any divergence from the long-run equilibrium between variables is corrected in each period and how much time it will take to restore the long-run equilibrium position.

Where:
- ECM\(_{t-1}\) = Residuals acquired from cointegration model

The model is estimated with the modified Ordinary Least Square (OLS) technique. The interpretation of the model follows econometrics, statistics and economic criteria. The Econometric criteria includes the examination of second other test (that is, diagnostic and robustness check in the spirits of conducting linearity test, homoscedasticity test, serial correlation, residual normality test and cumulative sum (CUSUM) and cumulative sum squared (CUSUM square) among others). The statistical test includes the test for the explanatory power of the models, the statistical significance of the overall model and the significance of the individual parameters. Whereas the economic criteria includes the interpretations of the theoretical relationship (signs of the parameters), elasticity’s of the parameters (size or magnitude of the parameters) and finally, the economic implication of the sign and magnitudes of the parameter estimated.

Hypothesis

\(H_0\) = Energy consumption has no significant impact on economic growth in Nigeria.

Result and Discussion

Unit Root Test

The unit root result is conducted by using Dickey & Fuller (1979) technique is summarized in Table 2. It reveals that the variables are not stationary at level but are at first difference. Hence, all the variables in the model are integrated at order one (I(1)). Since the variables are not integrated at I(0), there is need to test for possible long-run relationship among them.

| Variables      | Calculated Values | Test Methods: Augmented Dickey-fuller (1979) | Order of Integration |
|----------------|-------------------|---------------------------------------------|----------------------|
|                | Level             | 1st diff.                                   | Critical values      | Order (l(d)) |
| logGDP\(_t\)   | -2.4987           | -144.44***                                 | -3.5443              | I(1)         |
| LogCO\(_t\)    | -2.1218           | -5.6742***                                 | -3.5403              | I(1)         |
| LogRENER\(_t\) | -2.7224           | -5.3602***                                 | -3.5403              | I(1)         |
| LogGFCF\(_t\)  | -1.8838           | -5.0414***                                 | -3.5403              | I(1)         |
| LogUMP\(_t\)   | -2.6419           | -4.4641***                                 | -3.5403              | I(1)         |

Source: Authors Computations from E-Views 9.0 Results

Cointegration Test

The result in Table 3 shows that the study fails to accept the null hypotheses of cointegration since the unit root results of the error term is stationary at level of order I(0). Since the error term extracted from the static model is integrated at I(0) or stationary at
levels. Then the combinations of the non-stationary variables in the model are cointegrated. The significance of the tau-statistics and z-statistics show that the critical values are greater than the calculated values in real terms.

Table 3: Cointegration Result/Engel-Granger Two Step

| Specification: LOG(GDP) LOG(CO) LOG(RENER) LOG(GFCF) LOG(UMP) C |
|---------------------------------------------------------------|
| Null hypothesis: Series are not cointegrated                 |
| Value             | Prob.*          |
| Engle-Granger tau-statistic       | -8.7458***    | 0.0000  |
| Engle-Granger z-statistic         | -38.925***    | 0.0012  |

*MacKinnon (1996) p-values

Source: Authors Computations from E-Views 9.0 Results

Since the variables in the model are non-stationary but cointegrated by Engel-Granger technique, the study therefore estimated both the static and dynamic model. The dynamic model shows similar behavior as the static model both models are reported below.

Table 4: Results from the Static Model

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|----------|-------------|------------|-------------|-------|
| C        | -56.587**   | 26.168     | -2.1625     | 0.0382|
| LOG(CO)  | 0.5548      | 0.5573     | 0.9954      | 0.3270|
| LOG(RENER)| 10.973**     | 4.4846    | 2.4665     | 0.0192|
| LOG(GFCF)| 0.2921       | 0.1827     | 1.5989     | 0.1197|
| LOG(UMP) | -1.9061***   | 0.4746     | -4.0167    | 0.0003|
| R-squared| 0.6420       | Adjusted R-squared | 0.5973 |
| F-statistic| 14.34 (0.0000) | Durbin-Watson stat | 1.5421m2 |

Source: Authors Computations from E-Views 9.0 Results

The static model reported on table 4 is estimated with the Ordinary Least Square estimator. The model is not spurious since the R2 is less than the Durbin-Watson statistics (0.6420<1.5421). The model is free from first order Markov because the Durbin-Watson value is approximately 2. The model is strong as about 64.20 percent of the explanatory variables predicted the outcome of energy consumption on economic growth within the study periods whereas the remaining 35.80 percent were explained by other variables which are not included in the model but are accounted for by the error term. The analysis of the entire model (Analysis of the Variance) shows that the model is statistically significant at the 5 percent shown by the value Analysis or the Variance of F-statistics.

The Dynamic Model Result Presentation

Table 5: Dynamic Model

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|----------|-------------|------------|-------------|-------|
| C        | 0.0319**    | 0.0112     | 2.8477      | 0.0116|
| DLOG(GDP(-1)) | 0.2746      | 0.2000    | 1.3731      | 0.1886|
| DLOG(GDP(-2)) | -0.0409***  | 0.1789    | -2.2286     | 0.0221|
| DLOG(GDP(-3)) | 0.0052**    | 0.0058    | 5.9077      | 0.0000|
| DLOG(CO)  | 0.0305      | 0.0304    | 1.0032      | 0.3307|
| DLOG(CO(-1)) | 0.0339      | 0.0308    | 1.1003      | 0.2875|
| DLOG(CO(-2)) | 0.0749***   | 0.0242    | 3.1022      | 0.0068|
| DLOG(RENER)| 0.5058      | 0.2915    | 1.7352      | 0.1019|
| DLOG(RENER(-1)) | 0.1803      | 0.2660    | 0.6778      | 0.5076|
| DLOG(RENER(-2)) | -0.0905     | 0.2468    | -0.3666     | 0.7187|
| DLOG(GFCF)| 0.0559      | 0.0196    | 2.8530      | 0.0115|
| DLOG(GFCF(-1)) | -0.0142     | 0.0226    | -0.6276     | 0.5391|
| DLOG(GFCF(-2)) | 0.0239      | 0.0226    | 1.0615      | 0.3042|
| DLOG(UMP) | -0.0716***  | 0.0236    | -3.0321     | 0.0079|
| DLOG(UMP(-1)) | -0.0555     | 0.0358    | -1.5513     | 0.1404|
| DLOG(UMP(-2)) | -0.0364     | 0.0341    | -1.0692     | 0.3008|
| ECM(-1)  | -0.4621***  | 0.0204    | -2.9877     | 0.0028|
| R-squared| 0.8103      | Adjusted R-squared | 0.8007 |
| F-statistic| 4.2727 (0.0030) | Durbin-Watson stat | 2.274132 |

Source: Authors Computations from E-Views 9.0 Results

The result in Table 5 shows that the non-renewable component of energy consumption impacted significant on economic growth in Nigeria while the relationship between renewable energy consumption and economic growth is insignificant. This is contrary with
the static model which reveals that only renewable component of energy consumption significantly impacted on economic growth. With respect to the dynamic model, the significant impact of non-renewable energy on growth is only observed in the second period lag. The result indicates that economic growth will respond effectively to energy consumption after two years of consumption non-renewable energy. Therefore, the study reveals that renewable energy component significantly impacted on economic growth in the long-run and exhibited insignificant impact on growth in the short-run within the study period.

The finding agrees with the works of Apergis et al. (2010) and Ouedraogo (2013). The three studies show a positive relationship between economic growth and energy consumption among various developing nations of Africa. The results show that the third period lags of GDP in the model show a 5% significant cluster effects reflecting the strength of the effect. This means that economic growth can internally stimulate itself to ensure more growth in the future periods; also the first period lag of GDP shows an insignificant positive effect implying that it perpetuates itself relatively in the early period. The Error Correction Mechanism is negative and statistically significant. This shows that the adjustment procedure from the disequilibrium in short-run towards the long-run equilibrium is 46.21%. The rate of adjustment procedure in the model is slow indicating that shocks on the model tend to be permanent. Thus, policy option on the relationship between energy consumption and economic growth in Nigeria should be viewed from the short-run perspective.

Diagnostic Test

| Hypothesis                | Test-statistic      | Empirical Statistic | Decision |
|---------------------------|---------------------|--------------------|----------|
| Residual Normality        | Jacque-Bera (JB)    | 1.7349 (0.4200)    | Accept   |
| Serial correlation        | Breusch-Godfrey (BG)| 0.7778 (0.4783)   | Accept   |
| Homoscedasticity          | Breusch-Pagan-Godfrey| 0.7513 (0.7130)  | Accept   |
| Model specification       | Ramsey RESET        | 0.2088 (0.8374)   | Accept   |

Source: Researcher's computation. All tests were carried out at 0.05 level of significance, figures in parenthesis are the p-values and the hypothesis are stated in the null form.

The result in Table 6 shows the acceptance of the null hypothesis of the four assumptions diagnosed. That is the residuals from the model are normally distributed with a constant mean and variance and are not autocorrelated since the probability values of the test statistics are not significant at the 5 percent level. Also, it was revealed that the model was correctly specified which indicates that there is no specification bias. Figure 1 and 2 are aimed at examining whether any of the estimated coefficients falls outside the cycles. If any of the coefficients falls outside the circle then, the coefficient estimated is not stable. The results from figure 1 and 2 show that none of the coefficient falls outside the CUSUM and CUSUM square circle at 5% level, hence the parameters estimated are stable.

![Figure 1: Coefficient Stability Test](image1.png)

![Figure 2: Coefficient Stability Test](image2.png)
Conclusions

This study examines the relationship between energy consumption and economic growth in Nigeria. The findings from the study reveal that economic growth is only affected by renewable energy in the long-run whereas non-renewable energy component affected economic growth in the short-run (i.e after two years of consumption activity). Therefore the study sees the impact of energy consumption on economic growth to be indistinct in Nigeria within the period under review. Based on the findings, the following suggestions where made:

i) There is need to advocate for policies/measure that will bring about increase the supply or improve on renewable energy production in the country; as this could improve productivity and economic growth in the long run.

ii) There is need for short term measures in the area of improving on the non-renewable energy supply as this could serve as an intervention measure when there is a disturbance in the supply of renewable energy in the country.

References

Adams, S., Klobodu, E. K. M., & Opoku, E. E. O. (2016). Energy consumption, political regime and economic growth in sub-Saharan Africa. Energy Policy, 96, 36-44.

Adegbesi O. O., A. J. Olalekan, O. O. Babatunde (2013). The Causal Nexus Between Energy Consumption and Nigeria’s Economy Growth. European Scientific Journal. 9(1).

Apergis, N., & Payne, J. E. (2012). Renewable and Non-Renewable Energy Consumption-Growth Nexus: Evidence from a Panel Error Correction Model. Energy Economics, 34(3), 733-738.

Babatunde, M. A. (2016). Energy Consumption and Economic Growth in Nigeria A Time–varying Framework Analysis, in the quest for development, Essays in Honour of Prof. Akin Iwayemi, edited by Adeninkiju, A, Jerome, A and Ogunkola, O.

Bhattacharya, M., Paramati, S. R., Ozturk, L. & Bhattacharya, S. (2016). The Effect Of Renewable Energy Consumption On Economic Growth: Evidence From Top 38 Countries. Applied Energy. 733–741.

Bloch, H., Rafiq, S., & Salim, R. (2015). Economic Growth with Coal, Oil and Renewable Energy Consumption In China: Prospects For Fuel Substitution. Economic Modeling. 44; 104-115.

Dantama, Y. U., Y. Umar, Y. Z. Abdullahi, I. Nasiru (2012). Energy Consumption And Economic Growth Nexus In Nigeria: An Empirical Assessment Based on ARDL Bound Test Approach. European Scientific Journal. 8(12); 141-157

Dickey , A. & W.A. Fuller (1979). Distribution of the Estimators for Autoregressive Time Series with a Unit Root. Journal of the American Statistical Association, 74; 427–431.

Engle, R. E., & Granger, C. W. (1987). Cointegration and Error-Correction: Representation, Estimation nda Testing. Econometrica, 55: 251-276.

Fang, Y. (2011). Economic Welfare Impacts from Renewable Energy Consumption: The China Evidence. Renewable Sustainable Energy Review. 15(5); 120-128.

Fuinhas, J. A., & Marques, A. C. (2012). Energy Consumption and Economic Growth Nexus In Portugal, Italy, Greece, Spain and Turkey: An ARDL bounds test approach (1965–2009). Energy Economics. 34(2); 511-517.

International Energy Outlook (2016). Energy Information Administration.

Jacques L. E., (2010). The Energy Consumption-Growth Nexus in Seven Sub-Saharan African Countries. Econ. Bull.30(2); 1191–1209.

Karanfil, F. & Li, Y. (2015). Electricity Consumption and Economic Growth: Exploring Panel Specific Differences. Energy Policy. 82,264–277.

Kraft, J., & Kraft, A. (1978). Relationship Between Energy and GNP. J. Energy Development United State. 3(2).

Medee, P. N., Ikue-John, N., & Amabuik, I. L. (2018). Granger Causality of Energy Consumption and Economic Growth in the Organization of Petroleum Exporting Countries: Evidence from the Toda–Yamamoto approach. Millennium Development Goals (MDGs). 11(1); 95-102.

Menegaki, A. N. (2011). Growth and Renewable Energy in Europe: A Random Effect Model with Evidence for Neutrality Hypothesis. Energy Economics, 33(2); 257-263.

Menyah, K., Wolde-Rufael, Y.,(2010). Energy Consumption, Pollutant Emissions and Economic Growth in South Africa, Energy Econ. 32(6); 1374–1382.

Mesbah F. S. (2016). Energy Consumption and Economic Growth In Egypt: A Disaggregated Causality Analysis With Structural Breaks: Topics In Middle Eastern And African Economies.18 (2).

Mohammadi, H., & Parvaresh, S. (2014). Energy Consumption and Output: Evidence from A Panel of 14 Oil-Exporting Countries. Energy Economics, 41, 41-46.

Nkoro, E., Ikue-John, N., Okeke, W., Amabuik, I. L., & Ajaba, J. A. (2019). Power Supply And The Performances of Small And Medium Scale Enterprises (SMSEs) In River State: A Qualitative Response Model Approach. International Journal of Business Ecosystem and Strategy, 1(1) 54-61.
Omri A. & Mabrouk K. (2014). Modeling the Causal Linkages Between Nuclear Energy, Renewable Energy and Economic Growth in Developed and Developing Countries. *Renewable Sustainable Energy Review*, 4(2):1012–22.

Ouedraogo, N. S. (2013). Energy Consumption and Economic Growth: Evidence From The Economic Community Of West Africa (ECOWAS). *Energy Economics*, 637-647.

Ozturk, I. (2010). A Literature Survey On Energy-Growth Nexus. *Energy Policy*, 38:340-9.

Shahbaz, M., Zeshan, M., & Afza, T. (2012). Is Energy Consumption Effective To Spur Economic Growth In Pakistan? New Evidence from Bounds Test to Level Relationships and Granger Causality Tests. *Economic Modeling*, 29(6): 2310-2319.

Streimikiene, D., Kasperowicz, R., (2016), Review Of Economic Growth and Energy Consumption: A Panel Cointegration Analysis for EU Countries, *Renewable and Sustainable Energy Reviews*, 59, 1545–1549.

Tugcu, C., I., O., & Aslan, A. (2012). Renewable and Non-renewable Energy Consumption and Economic Growth Relationship Revisited: Evidence from G7 countries. *Energy Econ*, 34(6):1942-50.

UNIDO. (2011). Energy for all. Vienna energy forum.

Yildirim, E., Sukruoglu, D., & Aslan, A. (2014). Energy Consumption and Economic Growth in the Next 11 Countries: The Bootstrapped Autoregressive Metric Causality Approach. *Energy Economics*, 44, 14-21.