American International Journal of Business Management (AIJBM)
ISSN- 2379-106X, www.aijbm.com Volume 07, Issue 03 (March -2024), PP 34-45

Energy Pricing and Economic Growth in Nigeria: An ARDL Investigation.

Umoidem, Ekpedeme James[1*], Nteegah, Alwell[2] and Osokogwu, Uche[3]
[1]*Emerald Energy Institute, University of Port Harcourt, Choba, Rivers State, Nigeria*
[2]*Department of Economics, University of Port Harcourt, Choba, Rivers State, Nigeria*
[3]*Department of Petroleum and Gas Engineering, University of Port Harcourt, Choba, Rivers State, Nigeria*
**Corresponding Author: Umoidem, Ekpedeme James[1]*

ABSTRACT:- This work examined the impact of energy pricing on economic growth in Nigeria. The study obtained data on economic growth (GDP growth rate) and energy prices (hydro energy price, crude oil price, natural gas price, electricity tariffs, and electricity consumption) in Nigeria from the World Bank database and the International Energy Agency. The data was analysed utilising descriptive statistics and the ARDL methodology to achieve the study's objectives. The findings indicated that the cost of hydroelectricity was not conducive to economic progress. The long-term stimuli of crude oil prices on economic progress is minimal, but in the near term, it has a favourable and considerable influence. The short-term economic growth was substantially spurred by the price of natural gas. Electricity rates had a stimulative effect on long-term economic development, while showing little impact on short-term economic growth. Long-term analysis revealed that power consumption was not favourably correlated with economic development in Nigeria. However, in the short term, there was a favourable nexus between electricity consumption and economic growth throughout the research period. As a result of this conclusion, the following suggestions were put forward: promote domestic investment in crude oil production and refining to boost government revenue, improve competitive pricing for electricity in the nation, and fully deregulate the energy and power sectors to enhance efficiency and economic growth in Nigeria.

Keywords*:* Energy Pricing, economic growth, hydro energy price, crude oil price, natural gas price, electricity tariffs and electricity consumption**.**

I. INTRODUCTION

Energy is a crucial catalyst and cornerstone of worldwide economic expansion. The significance of energy in fostering human capital development, reducing poverty and inequality, and generating employment cannot be overstated in both established and developing countries. This is seen in the crucial function that energy plays in the manufacturing process and the revenue generated from exporting energy (Prince, Ogbodob, Callistusc & Samuel, 2021).

Jahangir and Dural (2018) argued that energy plays a crucial role in driving the global contemporary economy. It is an essential component for the production of most products and services and has a substantial influence on people's daily lives. Due to the volatility and irrationality of energy prices, both national production and people's living standards fluctuate. This indicates that energy is crucial in determining the economic success of a nation. The reason for this is because productive activity in all sectors of an economy need energy, without which there can be no substantial economic advancement. Energy is not only crucial for a nation's current economic prosperity, but it also plays a vital part in fueling future development and ensuring security. Additionally, it helps job creation and the elimination of poverty. In addition to promoting economic development and ensuring security, the availability of clean and cost-effective energy also facilitates the provision of healthcare services and contributes to the attainment of climate change objectives (Ramchandra & Boucar, 2011).

In Nigeria, a growing economy, the pursuit of a consistent provision of clean and cost-effective energy has always been a top goal for successive administrations. However, there has been little success in ensuring a reliable energy supply despite Nigeria's abundant energy resources. Energy is essential for people and families in many settings to fulfil their fundamental requirements, including cooking, heating, lighting, cooling, refrigeration, powering appliances and equipment, transportation, communication, and overall comfortable living. Energy is essential for various sectors i.e. commerce, agriculture, healthcare, mining, industry, and education. It plays a crucial role in creating wealth, eradicating poverty, and powering all productive activities in an economy. The per capita consumption of energy can serve as an indicator of a nation's prosperity (Nnaji, Chukwu & Nnaji, 2010; Oyedepo, 2012). Therefore, the ability of Nigeria to produce goods and services and the standard of the output are affected by the interaction between the price, demand, and supply of energy. This interaction also affects the degree of industrial activity in the economy.

As Nigeria is both a substantial exporter and importer of petroleum products, fluctuations in oil and petrol prices have a direct influence on the nation's ability to generate income and its spending patterns. As an example, Nigeria sells crude petroleum products to other countries and buys refined goods for use inside the nation for both household and industrial purposes. Consequently, there exist a nexus between poor production capacity and increasing oil prices. Empirical evidence, i.e. the study conducted by McKillop (2014), confirms that an upsurge in oil prices disrupts market stability, contributes to inflationary pressure, and hinders economic development. Examining how energy costs have affected Nigeria's GDP growth is crucial, considering the nation's abundant energy resources and the recent upsurge in global energy prices caused by crises in the Middle East and parts of Europe. Therefore, the aim of this study is to analyse the influence of energy price on Nigeria's economy in relation to its development. To further our inquiry, we will examine pertinent literature about the subject at hand. This will allow us to draw insights from the work of previous researchers and guide our current research direction.

II. LITERATURE REVIEW

The investigation into the connexion between energy consumption as against economic progress began in the 1970s with the influential research conducted by Kraft and Kraft (1978). They discovered a one-way causal nexus from Gross National Product (GNP) growth to energy consumption in the United States between 1947 and 1974. The nexus between energy use and economic growth has prompted several researchers to dig more into the topic (Yildrim & Aslan 2012). Studies without qualitative differentiation have proposed and presented four hypotheses that might be tested to elucidate the direction of the link amid energy and economic expansion. The energy-growth literature delineates four hypotheses on the causal connexion between energy and economic development. These hypotheses are the Growth Hypothesis, the Conservation Hypothesis, the Feedback Hypothesis, and the Neutrality Hypothesis. Each of these ideas has substantial policy ramifications (Yildirim & Aslan, 2012; Ouedraogo, 2013; Ekeocha, Penzin & Ogbuabor, 2020; Ozturk, 2010).

(a) **Growth Hypothesis:** The Growth Hypothesis posits that energy consumption has a direct impact on economic growth, while accounting for the role of capital and labour. The theory posited a one-way causal nexus from energy use to economic development. Energy policies targeting energy conservation will have a detrimental influence on economic development. (b) **Conservation Hypothesis***:* The Conservation Hypothesis posits that economic growth is the driving force behind the expansion of the energy sector and suggests an economy that relies less on energy. The empirical validity of this theory is confirmed by the one-way causation that exists from economic growth to energy consumption. Energy conservation initiatives, i.e. expenditures in energy efficiency and demand control regulations, do not have any unfavourable effect on production growth. (c) **Feedback Hypothesis:** The Feedback Hypothesis proposes a reciprocal causal nexus between energy consumption and economic development, indicating that there exists a mutual connexion between the two. In this scenario, the implementation of an energy conservation strategy aimed at decreasing energy use may have an adverse impact on economic development, and these effects are reciprocally manifested in energy consumption patterns. (d) **Neutrality Hypothesis:** The Neutrality Hypothesis posits that there exists no causal nexus between energy use and economic development. It asserts that there exists no causal nexus between energy use and economic development. This hypothesis is validated when there exists no causal nexus between energy use and economic growth. In this scenario, implementing energy conservation regulations to decrease energy use will not affect economic development. The energy industry is not a causative factor in economic development, in congruent with the Neutrality Hypothesis. So, the fact that energy consumption and economic growth do not seem to be causally related supports the Neutrality Hypothesis. Ekeocha, Penzin, and Ogbuabor (2020), Yildirim and Aslan (2012), Ouedraogo (2013), and Ozturk (2010) all state that in this specific case, measures that promote higher energy use and access will not impact economic growth.

The majority of experts have performed research on the nexus between energy price and economic development. South Africa's energy prices and economic performance were the subjects of a research by Siyakudumisa, Kin, and Yiseyon-Sunday (2022). From 1994 to 2019, they analysed data utilising the auto-regressive distributed lag (ARDL) technique. In congruent with the research, there exist a consistent nexus between the variables. There exist a strong unfavourable link between electricity costs and economic development in the long and short term, in congruent with the data. On the other hand, crude oil prices show a strong favourable nexus with economic growth in both the long and short term. Granger causality analysis in South Africa did not find that rising energy prices caused the nation's economy to grow. But it only showed one way of looking at things: how productivity in the workplace and new gross fixed capital both contribute to economic growth. There was a consensus that the government should do something to lower the electricity prices so they would not stunt South Africa's economic growth.

Williams, Edem, Francis, Marie-Stella, and Nadjath (2022) conducted a study to examine the impact of electricity prices on the growth and development of SMEs in the Ashanti Region of Ghana. They employed the Vector Error Correction Model (VECM) and the Johansen co-integration method for their analysis. The study's

upshots indicate a detrimental, enduring nexus between power costs and the growth and development of SMEs. Empirical evidence has shown that there exist a unique and unfavourable long-term connexion between power costs and the development of SMEs. Elevated energy tariffs were shown to have an adverse impact on the expansion and advancement of SMEs. The data indicate that a 1 percent rise in ELEC (average power price upsurges) upshots in a 0.68 percent delay in reducing PRO. Moreover, according on the VECM analysis, a 1 percent rise in PPI is followed by a 1.2 percent upsurge in PRO after a certain time period.

Ademola, Ditimi, and Johnson (2022) assessed the nexus between the price of natural gas, crude oil, and the power tariff in Nigeria. The research utilised time series data from 1980 to 2021 to analyse the triple resources. To evaluate the variables' cointegration, nexuss, and causal influences, the study utilised the Bound test approach of ARDL, a paired causality test and a Vector Autoregressive (VAR) model. In congruent with the study's findings, there exist a long-term nexus between the prices of natural gas, electricity tariff and crude oil, all of which are energy resources. But among them, there exist no discernible causal effect. In Nigeria's energy industry, the study discovered a nexus between NGP, EET, and COBP (Crude Oil Price). However, the impacts of these factors are not proportionate. The research proposes government involvement in the energy market to mitigate the effects of rising energy costs on people' welfare outcomes by addressing the underlying issues that contribute to these price upsurges.

Salisu and Moronkeji (2022) investigated the influence of power usage on industrial production in Nigeria between 1980 and 2021, utilising the ARDL methodology. The ARDL bounds testing procedure demonstrated that labour, capital, and power consumption are the only determinants of manufacturing output in Nigeria in the long run. However, inflation and interest rate have a negligible unfavourable impact on manufacturing production in Nigeria. In the near term, the factors that influence manufacturing output in Nigeria include power consumption, labour, gross fixed capital creation, and electricity production. However, it is worth noting that electricity production has a notably adverse impact on manufacturing output. The study's findings suggest that close monitoring of the Government's privatisation strategy in the electrical sub-sector is necessary to ensure sufficient power production and consumption. This, in turn, would promote the widespread employment of both skilled and unskilled people in the economy.

Natural gas consumption, crude oil price, FDI, and per capita GDP were the variables that Nwabueze, Ogbonna, and Nwaozuzu (2021) looked at in Nigeria, as well as their internexuss and causal impacts. They analysed time series data utilising the Vector Error Correction Model (VECM) covering the years 1990–2020. Several statistical tests, including the variance decomposition, Granger causality, and VECM estimates, point to a favourable nexus between Nigeria's economic development (per capita GDP) and natural gas consumption. Even if the price of natural gas has no impact on use, this connexion does exist. Natural gas consumption within Nigeria is projected to rise as a consequence of economic regulations that boost the manufacturing of products and services in the nation. While changes in crude oil price had a much larger sway on natural gas use than FDI did in the end. Owing to these upshots, it seems that variations in crude oil price throughout the world have a more substantial influence on the amount of money flowing into Nigeria than changes in petrol consumption in the nation, all else being equal.

The authors Mamdouh and Mohamed (2021) set out to examine how the ebb and flow of crude oil prices has affected the economic growth of MENA countries. Their goal was to examine the dynamic and imbalanced nexus between oil prices and economic development. The findings indicate that oil-exporting and oil-importing nations experience contrasting effects from changes in oil price and its volatility. Specifically, oil-exporting countries see a favourable impact from changes in oil prices but a unfavourable effect from volatility. Regarding the latter, variations in oil prices have a detrimental impact, while volatility has a beneficial one. Moreover, the influence of fluctuations in oil prices and the level of uncertainty associated with them vary across various quantiles. Moreover, there is empirical data about the asymmetrical impact of fluctuations in oil prices on economic development.

Ighosewe, Akan, and Agbogun (2021) conducted a study to investigate the impact of crude oil price volatility on the Nigerian economy. The research period spans 35 years (1984-2018) and adopts a resource-dependence strategy. The variables utilised are: Kerosene Pump Price Fluctuation (KPPF), Diesel Pump Price Fluctuations (PPPF), Fluctuation in Oil Price per Barrel (FOBP), Petrol Pump Price Fluctuations (DPPF), and Real GDP. The analysis was conducted with the ARDL Model. The findings indicated that only the Fluctuation in Oil Price per Barrel (FOBP) had a substantial favourable impact on the Nigerian economy in the near term. Over time, both the Fluctuation in Oil Price per Barrel (FOBP) and the Kerosene Pump Price Fluctuation (KPPF) have a substantial favourable impact on the Nigerian economy. Therefore, the research determined that for the Nigerian economy to achieve exceptional upshots, it is crucial for both private and governmental entities to refrain from interfering with the central bank's oversight of the surplus crude account. Furthermore, it is imperative for the federal government to prioritise the industrialization of the Nigerian economy.

Udo, Idamoyibo, Inim, Akpan, and Ndubuaku (2021) conducted a study to analyse the co-integration and causal nexus between energy usage and economic expansion in Nigeria's agricultural, manufacturing, and service

sectors. Owing to quarterly data spanning from 2000Q1 to 2018Q4, the analysis revealed a combination of outcomes. Firstly, there exist a co-integrating nexus between economic growth and the creation of value in different sectors. Secondly, there exist a bidirectional causality between liquefied natural gas and energy consumption. Lastly, there exist a unidirectional causality between economic growth and petroleum consumption.

A study conducted by Athanasios, Michael, and Symeoni-Eleni (2020) examined the enduring nexus between energy costs and economic development in the peripheral countries of the European Union. The paper estimated a Vector-Error Correction Model utilising the Engle-Granger method. Researchers also utilised Variance Decomposition Analysis to determine how much of an effect energy price had on GDP growth. When looking at real GDP and household power costs, the study found evidence that supported the conservation theory. When looking at real output and industrial electricity prices, the data showed evidence that supported the growth hypothesis. Since variations in industrial power costs and crude oil prices are demonstrated to be a causative factor for changes in home electricity prices, the residential electricity sector experiences the most impact. The study found evidence supporting the feedback hypothesis on the connexion between home power cost and ultimate energy usage. Finally, internal variables have a far larger effect on the real GDP growth rate over the near term than external forces do.

Dagoumas, Polemis, and Soursou (2020) looked studied data from 1990–2018 on the nexus between energy costs and GDP growth in Europe. For their annual data estimates, they turned to the Engle-Granger method and the VECM (Vector Error Correction Model). The research established a causal nexus between the crude oil price and the prices of industrial and household power. The findings also indicated that a rise in power costs will not have an adverse effect on European economic growth rates.

Charles and Oguntade (2018) conducted a study to analyse the influence of oil prices on the economic development of Nigeria over the time span of 1980 to 2016. Upon utilising the ordinary least squares (OLS) approach, the investigation revealed a persistent connexion among the variables, indicating a favourable and substantial nexus between fluctuations in oil prices and economic development. The writers proposed implementing a comprehensive strategy including stringent budgetary measures, diversification, and industrialization to safeguard the nation's economy.

Apere and Eniekezimene (2016) probed the nexus amid the price of crude oil and the economic development of Nigeria from 1981 to 2013. The use of a vector autoregressive (VAR) model and ordinary least square (OLS) analysis revealed that fluctuations in oil prices had a considerable influence on Nigeria's economic advancement. The OLS approach revealed a favourable nexus between oil prices and GDP. A fall in oil prices has a detrimental effect on GDP, whereas fluctuations in the exchange rate had both favourable and unfavourable impacts on crude oil prices and GDP. The report suggests that diversifying the economy is necessary in order to enhance its resilience and reduce dependence on oil.

Azam, Khan, Abdullah, and Qureshi (2016) conducted a study to examine the impact of CO2 emissions, energy consumption, trade, and human capital on economic growth in China, the USA, India, and Japan. They utilised panel fully modified ordinary least squares (FMOLS) to analyse the nexus between these variables from 1971 to 2013. Statistical study shows that energy consumption and carbon dioxide emissions are unfavourable factors influencing economic development, but commerce and human capital are favourable factors.

Egypt, Gabon, Algeria, Angola, Libya, and Nigeria are some of the African countries that generate natural gas. Nwatu, Nteegah, and Dosunmu (2023) looked at how natural gas use affected the economic growth of these nations. Covering the years 1990–2021, the study employed ARDL panel analysis. In congruent with the upshots, natural gas consumption had a unfavourable and statistically insubstantial impact on economic development, but natural gas price had a favourable and statistically substantial influence. The study's recommendations, owing to the upshots and conclusion, include increasing natural gas consumption via improved infrastructure and ensuring a steady and competitive pricing for natural gas. These steps are seen as crucial for establishing sustained economic development in gas-producing nations in Africa.

The assessment conducted on the nexus between energy price and economic development revealed that much research has been conducted on this topic in Nigeria and other regions worldwide. However, the majority of the research have mostly examined the nexus between fossil fuel use, crude oil price, and economic development. Similarly, several studies have also explored the connexion between natural gas usage, natural gas price, and economic expansion. This research examines the influence of energy pricing, including both renewable and non-renewable energy costs, on economic development. It specifically analyses the influence of hydro energy price, crude oil price, electricity tariff, natural gas price, and electricity usage on the economic development of Nigeria. Our research aims to fill this gap.

III. METHODOLOGY

This research is theoretically grounded on the Paul Romer Endogenous Growth theory and the energy usage and economic growth hypothesis, as established by Kraft and Kraft (1978). Romer (1986) proposed the Endogenous Growth hypothesis, which states that innovation and technologies, i.e. energy, play a crucial role in promoting long-term economic growth. Additionally, Kraft and Kraft (1978) conducted pioneering research in the United States, demonstrating that an upsurge in energy consumption can contribute to economic growth. utilising the data provided above, we can derive the following aggregate production function for the Endogenous Theory:

$Y = f(A, K, L)$ (1)

Where: Y = Aggregate real output, L = Stock of labour, K = Stock of capital, A = Technology (or technological advancement). In terms of the significance of energy in driving economic development, the Endogenous development theory highlights technology (energy) as the endogenous element that is associated with energy and has the potential to stimulate economic growth. This theoretical groundwork is then utilised to construct a model that studies the connexion amongst energy price and economic growth in Nigeria.

$$GDPGR_t = f(\alpha_0, HEP_t^{\alpha_1}, OIP_t^{\alpha_2}, NGP_t^{\alpha_3}, ETR_t^{\alpha_4}, ECP_t^{\alpha_5}, e^{u_t}) \quad (2)$$

To simplify the estimate process, equation 2 is converted into a logarithmic linear form as follows:

$$GDPGR_t = \alpha_0 + \alpha_1 \ln HEP_t + \alpha_2 \ln OIP_t + \alpha_3 \ln NGP_t + \alpha_4 \ln ETR_t + \alpha_5 \ln ECP_t + e_t \quad (3)$$

Where: Ln = Natural Logarithm; $GDPR_t$=Economic growth (growth rate of Gross Domestic Product), HEP_t= Hydro energy price, ETR_t= Electricity tariffs, OIP_t= crude oil price, NGP_t= Natural gas price, ECPt =Electricity Consumption and e_t = Disturbance or error term.

The ARDL estimation technique

In order to verify that the data meet the fundamental requirements of ordinary Least Squares estimation, the stochastic characteristics of the series were examined. This research utilised the Philip-Perron approach, which is one of many techniques available for testing the order of integration. A combination of stationary (I(0)) and non-stationary (I(1)) variables led to the selection of the ARDL model as the optimal econometric method for this study. With an appropriate number of samples, the ARDL method may build both short- and long-term connexions at the same time. It evaluates cross-variable cointegration utilising the OLS method. The variables under consideration have the following ARDL equation:

$$\Delta(GDPGR_t) = \sum_{i=1}^{n} \alpha_0 \Delta(GDPGR_{t-1}) + \sum_{i=1}^{n} \alpha_1 \Delta 1n(HEP_{t-1}) + \sum_{i=1}^{n} \alpha_2 \Delta 1n(OIP_{t-1}) + \sum_{t=1}^{n} \alpha_3 \Delta 1n(NGP_{t-1}) + \sum_{t=1}^{n} \alpha_4 \Delta 1n(ETR_{t-1}) + \sum_{t=1}^{n} \alpha_5 \Delta 1n(ECP_{t-1}) \; \beta_0 \Delta(GDPGR_{t-1}) + \beta_1 \Delta \ln(HEP_{t-1}) + \beta_2 \Delta \ln(OIP_{t-1}) + \beta_3 \Delta \ln(NGP_{t-1}) + \beta_4 \Delta \ln(ETR_{t-1}) + \beta_5 \Delta \ln(ECP_{t-1}) + U_t \quad (4)$$

The variables $\beta_1 - \beta_5$ represent the short-run multipliers, whereas $\alpha_1 - \alpha_5$ are the coefficients of the long-run dynamic of the ARDL model. U_t is a stochastic term that is serially uncorrelated, has a mean of zero, and a constant variance. The operator Δ represents the initial difference. Having established the long-term link between the variables, we proceeded to estimate the long-term equations for the degree of macroeconomic performance.

$GDPGR_t = \alpha_0 + \alpha_1 InHEP$ level thus:

$GDPGR_t = \alpha_0 + \alpha_1 InHEP_{t-1} + \alpha$ level thus:

$$GDPGR_t = \alpha_0 + \alpha_1 InHEP_{t-1} + \; _2InOIP_{t-1} + \alpha_3 InNGP_{t-1} + \alpha_4 InETR_{t-1} + \alpha_5 InECP_{t-1} + \mu_t \quad (5)$$

The lag length of the ARDL model was determined by utilising the Akaike Information Criterion (AIC) and utilising a lag length of one (1) for both the regressors and the regress. The following is the formation of the ARDL error correction equation in estimating the short-run dynamics:

$$\Delta(GDPGR_t) = \sum_{i=1}^{n} \alpha_0 \Delta 1n(GDPGR_{t-1}) + \sum_{i=1}^{n} \alpha_1 \Delta 1n(HEP_{t-1}) + \sum_{i=1}^{n} \alpha_2 \Delta 1n(OIP_{t-1}) + \sum_{t=1}^{n} \alpha_3 \Delta 1n(NGP_{t-1}) + \sum_{t=1}^{n} \alpha_4 \Delta 1n(ETR_{t-1}) + \sum_{t=1}^{n} \alpha_5 \Delta 1n(ECP_{t-1}) + \sum_{t=1}^{n} ECM_{t-1} + U_t \quad (6)$$

The variables α_1 to α_5 represent the short-run parameters. The ECM is the error correction term that is calculated owing to the long-term dynamics. The coefficient adjustment is often unfavourable and often statistically substantial, indicating the presence of a cointegration connexion.

4.1. Results

The descriptive statistics presented in Table 1 indicate a substantial level of volatility in the growth rate of Gross Domestic Product (GDPGR), hydro energy price (HEP), natural gas price (NGP), crude oil price (OIP), electricity tariff (ETR) and electricity consumption (ECP), as evidenced by their mean and standard deviation values. The lowest and maximum values of these variables also indicated the substantial volatility of the variables over the years. The Jarque-Bera, Skewness, and kurtosis statistics indicate that only the hydro energy price and electricity consumption variables follow a normal distribution, as seen by their probability values. The growth rate of GDP, price of natural gas, price of crude oil, and electricity tariff exhibited a non-normal

distribution around their respective mean values. This upshot suggests that the underperformance seen in the macroeconomic indicators might be attributed to the volatility in energy prices throughout the years in Nigeria.

IV. RESULTS

Table 1. Descriptive statistics Result

Statistic	GDPGR (%)	HEP(Kwh)	OIP ($/Barrel	NGP ($/mmbtu	ETR(N/KWh)	ECP(KWh)
Mean	3.04	3.81	42.58	5.45	21.07	107.12
Median	3.65	3.50	29.04	4.05	18.62	100.89
Maximum	15.33	9.11	109.45	16.12	87.26	156.80
Minimum	-13.13	0.92	12.28	2.09	4.26	50.90
Std. Dev.	5.39	2.11	29.15	3.49	15.32	28.16
Skewness	-0.82	0.48	0.99	1.30	2.31	0.12
Kurtosis	4.62	2.58	2.82	3.88	9.77	1.81
Jarque-Bera	9.07	1.88	6.77	12.82	114.58	2.51
Probability	0.01	0.39	0.03	0.00	0.00	0.29
Sum	124.72	156.21	1745.57	223.36	863.90	4391.76
Sum Sq. Dev.	1160.15	177.48	33978.94	487.08	9386.45	31709.72
Observations	41	41	41	41	41	41

Source: Researcher's Computation (E-view 12)

Unit Root Results

The unit roots test findings shown in Tables 2 suggest that the growth rate of GDP (GDPGR) was stagnant either at the level or at order zero. This suggests that the variables achieved stationarity via the process of differencing. Nevertheless, the hydro energy price (HEP), natural gas price (NGP), crude oil price (OIP), electricity tariff (ETR), and electricity consumption (ECP) did not exhibit stationarity at the level, but achieved stationarity at order one i(1). This suggests that the prices of hydro energy, crude oil, natural gas, electricity tariff, and electricity consumption were found to be stable or the hypothesis of the existence of unit roots was rejected after utilising the process of first differencing.

The decision on which estimating approach to utilise in evaluating the influence of energy pricing on macroeconomic performance in Nigeria was owing to the establishment of stability in the variables and the order in which they are cointegrated. The findings in Tables 2 demonstrate that the variables exhibit a combination of different orders of integration. The GDP growth rate (GDPGR) remained constant at a level or i(0), whereas all the independent variables were stationary at order one i(1). Therefore, the Autoregressive and Distributed lag (ARDL) approach was utilised.

To determine whether the dependent and independent variables have a co-integrating (long-run) connexion, an alternate method to traditional econometric research is the ARDL bound testing (Pesaram Shin and Smith, 2001). This method has several benefits over others, i.e. being applicable to both I(1) and I(0) variables, being easy to implement utilising ordinary least squares (OLS), not having endogeneity issues, and being able to estimate both the long-run and short-run coefficients at the same time (Pesaran, Shin & Smith, 2001; Sulaiman & Mohammad, 2010). Owing to the outcomes of our unit roots test, it is essential to use ARDL for the empirical analysis.

Table 2. Unit Root Test Result utilising Philip -Perron method

Variable	PP Statistic	1%	5%	Remark
GDPGR	-4.274	-3.606	-2.937	Stationary@ i(0)
Log (HEP)	-6.850	-3.611	-2.939	Stationary@i(1)
Log (OIP)	-6.150	-3.611	-2.939	Stationary@i(1)
Log (NGP)	-4.555	-3.611	-2.939	Stationary@i(1)
Log (ETR)	-6.454	-3.611	-2.939	Stationary@i(1)
Log (ECP)	-9.567	-3.611	-2.939	Stationary@i(1)

Source: Researcher's Computation (E-view 12)

ARDL Bound Test for Long run nexus.

The ARDL bound test conducted on the economic growth model, as shown in Table 3, indicates the presence of a long-term nexus between the GDP growth rate and energy prices in Nigeria. This is supported by the F-statistic value of 7.535439, which exceeds the theoretical values at significance levels of 10 percent, 5 percent, 2.5 percent, and 1 percent for both the lower and upper bounds. Therefore, the null hypothesis, which

suggests that there exist no link between the dependent and explanatory factors, is rejected. This indicates that there is really a long-term nexus between these variables.

Table 3. ARDL Bound Test for Long run Nexus – GDPGR/Economic growth model

F-Bounds Test			Null Hypothesis:No levels nexus	
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic:n=1000	
F-statistic	7.535439	10%	2.08	3
K	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

Source: Researcher's Computation (E-view 12)

ARDL Results and long run and short run nexus

The ARDL analysis in Table 4 reveals an unfavourable nexus amid the prices of hydro energy, crude oil, and electricity consumption, and economic growth in the long term. These findings indicate that higher prices for hydro energy, crude oil, and electricity led to a decrease in economic growth, whereas a decrease in the price of these energy sources resulted in an upsurge in economic growth in Nigeria throughout the research period. The findings also suggest that the impact of hydro energy prices, crude oil prices, and electricity use on economic development was minimal throughout the period. Conversely, it was shown that the price of natural gas and electricity tariff had a favourable but inconsequential nexus with economic growth. These findings suggest that the rise in natural gas prices and electricity tariffs contributed to economic development, whereas the decline in energy costs hindered economic growth over the research period. The findings indicate that the influence of both natural gas price and electricity tariff on economic development was not substantial throughout the research period.

Table 4. ARDL Result for Long run Nexus – Economic growth model - ARDL(2, 0, 2, 3, 0, 1)

Variable	Coefficient	t-Statistic	Prob.
LOG(HEP)	-6.861991	-1.415615	0.1697
LOG(OIP)	-4.491041	-0.449860	0.6568
LOG(NGP)	16.09733	1.399588	0.1744
LOG(ETR)	9.222759	1.404188	0.1731
LOG(ECP)	-31.19283	-1.701974	0.1017
C	122.4556	1.863317	0.0747

Source: Researcher's Computation (E-view 12)

The Error Correction model/short run ARDL upshot shown in Table 5 demonstrates a statistically substantial favourable connexion between crude oil price and economic growth. Consequently, the research found that the rise in crude oil price had a substantial favourable impact on Nigeria's economic development over the study period. The study revealed that the nexus between natural gas price and economic growth was favourable but not statistically substantial at the current level. However, there was a favourable and statistically substantial nexus between natural gas price and economic growth with a lag of 2 periods, and a unfavourable and statistically substantial nexus with a lag of 1 period. Consequently, the research found that the effect of natural gas price on economic growth was substantial throughout the observed period. The nexus between electricity usage and growth in the economy was favourable but not statistically substantial for the given time period.

The study also indicates a speed of adjustment level of 52 percent, suggesting that Nigeria's economic development responds quickly to changes in energy costs, both in the short and long term. Energy cost fluctuations (including hydro energy price, price of natural gas, price of crude oil, electricity tariff, and electricity use) may explain over 78 percent of the total variation in Nigeria's economic development throughout the study period, in congruent with the goodness of fit value of 0.78.

Table 5. ARDL Result for Short run/ECM – Economic growth model – ARDL (2, 0, 2, 3, 0, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D (GDPGR (-1))	-0.479102	0.103713	-4.619488	0.0001
DLOG(OIP)	3.924188	1.934493	2.028535	0.0537
DLOG (OIP (-1))	7.888763	2.321061	3.398775	0.0024
DLOG(NGP)	1.302783	1.677073	0.776820	0.4449
DLOG (NGP (-1))	-5.851598	2.373142	-2.465759	0.0212
DLOG (NGP (-2))	4.460397	1.829171	2.438480	0.0225
DLOG(ECP)	1.433122	3.701921	0.387129	0.7021
CointEq (-1) *	-0.518492	0.063853	-8.120043	0.0000
R-squared	0.777329	Mean dependent var		0.383421
Adjusted R-squared	0.725372	S.D. dependent var		4.744853
S.E. of regression	2.486537	Akaike info criterion		4.844323
Sum squared resid	185.4860	Schwarz criterion		5.189078
Log likelihood	-84.04213	Hannan-Quinn criter.		4.966984
Durbin-Watson stat	1.762751			

Source: Researcher's Computation (E-view 12)

Table 6 displays the upshots of the diagnostic tests conducted on the economic growth model. With a probability value of 0.106, the Jarque-Bera normalcy test was over the projected significance level of 5 percent. By accepting the normal distribution null hypothesis, we may deduce that the error terms also follow a normal distribution. utilising the Breusch-Godfrey or Lagrange Multiplier (LM) tests, we checked the residuals for serial nexus. By exceeding the 5 percent significance level, the probability value of 0.433 supported the acceptance of the null hypothesis that there exist no serial link. Our model did not show heteroscedasticity, in congruent with the Bresch-Pagan-Godfrey Heteroskedasticity test. This is because we maintained that homoscedasticity is a null hypothesis. This meant that the error terms were homoscedastic and unrelated to the explanatory variables, since the probability value was 0.703. Also, the Ramsey Regression Equation Specification Error Test (RESET) test's probability value of 0.944 was higher than the 10 percent significance level. This led to the confirmation of the null hypothesis, which stated that the model had been properly specified. As an upshot, misstating the model and thereby omitting relevant variables was not an option. This time around, the model's functional form is accurate. In light of these upshots, we conclude that the model is adequate for analysis and that the upshots it produces are trustworthy for forecasting.

Table 6. Model Diagnostic/Post Estimation Test Result for Economic growth model.

Diagnostic test	**F-statistic**	**Probability**
Jarque-Bera test for normality	4.49	0.106
Bresch-Gofrey serial nexus LM test	0.871	0.433
Bresch –Pagan-Godfrey Heteroskedasticity test	0.747	0.703
Ramsey RESET test for specification error	0.005	0.944

Source: Authors' Computation (e-view 12)

Model Stability Test Result for Economic growth (GDPGR) model.

To ensure that the long-run coefficients and the short-run dynamics of the economic growth model are stable, we utilised the Recursive Residual, Cumulative Sum (CUSUM), and CUSUM of Squares graphs. As seen in Figures 1(a), 1(b), and 1(c), the Recursive Residual, CUSUM, and CUSUM of Squares lines maintained a value below the critical 5 percent mark throughout. Never crossing the 5 percent critical lines, the Recursive Residual, CUSUM, and CUSUM of Squares plots demonstrate the stability of the long-run energy price coefficients influencing economic growth in Nigeria. The inclusion of parameter stability in the model demonstrates how energy price affects Nigeria's economic development, as an upshot.

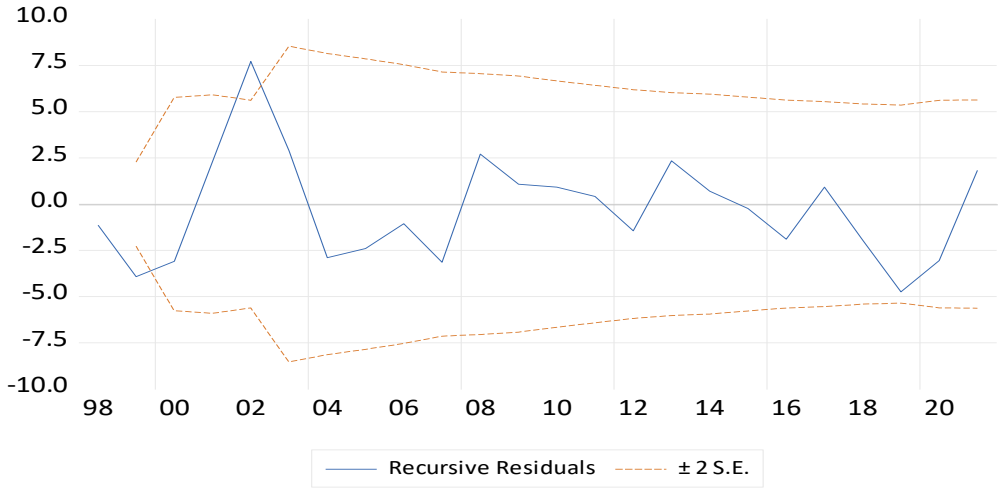

Figure 1 (a). Recursive Residuals Result for Stability of the Economic growth model.

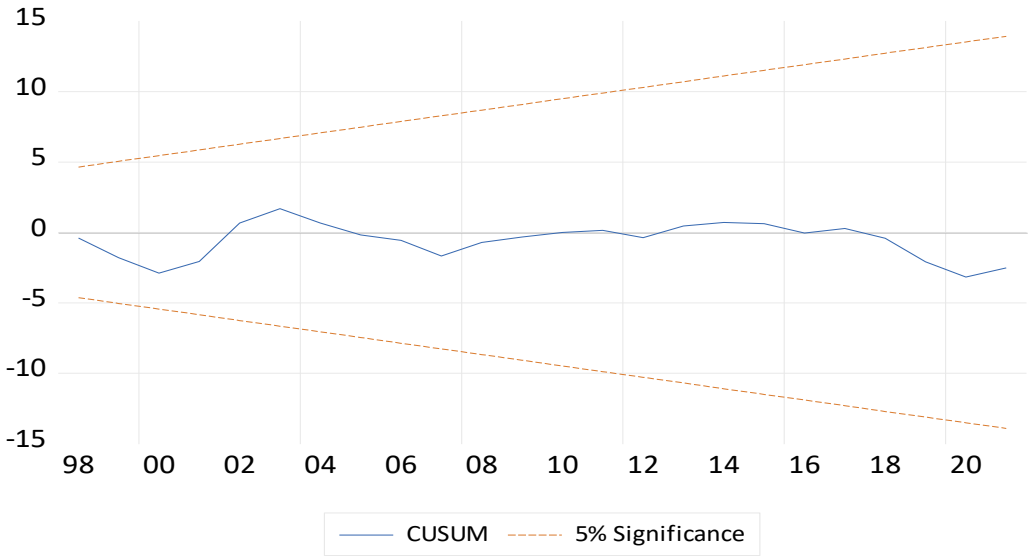

Figure 1(b). CUSUM Result for Stability of the Economic growth model.

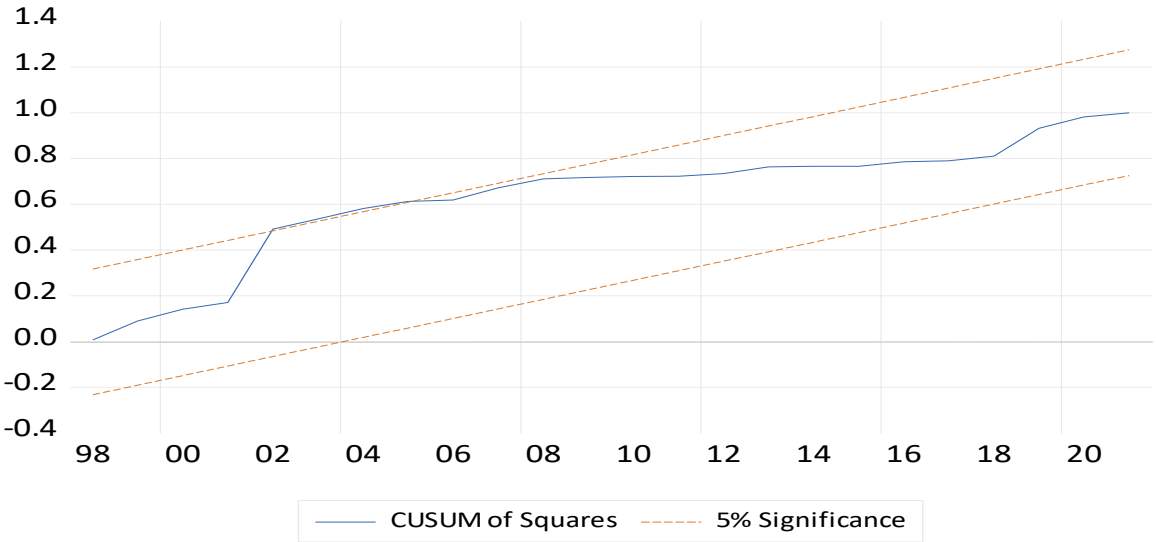

Figure 1. (c) CUSUM of Squares graph for Stability of the Economic growth model
Source: Researcher's Computation (E-view 12)

V. DISCUSSION OF FINDINGS

The ARDL analysis of the economic growth model reveals that the hydro energy price, crude oil price, and electricity consumption have a unfavourable and statistically negligible influence on economic growth in the long term. Rising hydro energy prices may lead to higher production costs and hinder output levels, both at the individual company level and on a national scale. While a rise in crude oil prices would indeed boost government income, it will also upshot in higher energy costs for end users, namely in terms of petroleum product expenses. This might upshot in an upsurge in production costs and a decrease in both the firm's output and the overall output of the national economy. Rising electricity consumption drives national productivity and output. The crude oil price outcome diverged from the initial upshots of research conducted by Ismail and Adegbemi (2013), Salim and Rafiq (2013), and Francois and Mignon (2008), which established a favourable nexus between crude oil price and the economy. In underdeveloped nations i.e. Nigeria, the rise in crude oil prices has served as a substantial catalyst for upsurge income and economic expansion. Nevertheless, the economic development resulting from the windfall in crude oil price has not proven to be enduring. The outcome of power consumption differed with the conclusions given by Adegbemi et al (2013) and Enu and Havi (2014), who established a favourable and substantial nexus between electricity consumption and economic growth. An upsurge in power consumption indicates a corresponding upsurge in economic activity and economic growth, assuming all other factors remain constant. In the long term, there was a favourable but statistically insubstantial nexus between the price of natural gas and electricity tariff, and economic growth. The findings of Solarin & Ozturk (2016) align with the nexus between natural gas price and economic growth, indicating a favourable influence. However, these findings differ with those of Nwatu, Nteegah & Dosunmu (2023). The findings of Siyakudumisa, Kin, and Yiseyon-Sunday (2022) and Williams, Edem, Francis, Marie-Stella, and Nadjath (2022) differ from past studies, since they discovered a unfavourable nexus between electricity price (tariff) and economic development. However, our upshots diverge from their findings. It is important to acknowledge that higher power rates may lead to upsurge manufacturing costs and hinder production and output at both the business and national levels.

Crude oil price had a favourable and substantial bearing on economic development in the immediate term. This upshot corroborated the discoveries made by Ismail and Adegbemi (2013), Salim and Rafiq (2013), and Francois and Mignon (2008), which indicated a favourable nexus between crude oil price and the economy. The rise in crude oil prices has substantially contributed to the upsurge in income and Nigeria's economic development and other emerging nations that produce oil. The varying impacts of natural gas prices on Nigeria's economic development may be closely linked to the inadequate gas infrastructure and underutilization of natural gas in the nation over an extended period of time. Heidari et al (2013) discovered that lowering the price of natural gas might stimulate an upsurge in gas consumption, leading to economic growth and development. The short-term upsurge in electricity consumption has been shown to favourably impact economic development, which is consistent with the findings of Adegbemi et al (2013) and Enu and Havi (2014). The coefficient of determination indicates that energy price accounted for about 73 percent of the overall variability in Nigeria's economic development. Our indicates that the costs of energy have substantial consequences on Nigeria's economic development over the duration of our research.

VI. CONCLUSION AND RECOMMENDATIONS

This study investigated the influence of energy price on the economic development of Nigeria. The inquiry included descriptive analysis and the ARDL approach. Owing to the data and conclusions, the following conclusion was reached: The cost of hydroelectricity was not conducive to economic progress. The long-term effect caused by price of crude oil on the economic growth is minimal, but in the near term, it has a favourable and considerable influence. The short-term economic growth was substantially spurred by the price of natural gas. Electricity tariffs had a stimulative effect on long-term economic growth but did not have any impact on short-term economic development. In the long term, power consumption did not have a favourable nexus with economic development. However, in the short term, electricity consumption was favourably associated with economic growth in Nigeria over the research period. As an upshot of this conclusion, the following suggestions were put forward: promote domestic investment in the production and refining of crude oil to boost government revenue, improve the competitive pricing of electricity in the nation, and fully deregulate the energy and power sectors to enhance efficiency and economic growth in Nigeria.

REFERENCES

[1]. Adegbemi, B. O., Adegbemi, O. O., Olalekan, A. J. S., & Babatunde, O. O. (2013). Energy consumption and Nigerian economic growths: An empirical analysis. *European Scientific Journal, 9*(4), 25-40.

[2]. Ademola, O., Ditimi, A., & Johnson, A. (2022). Evaluating the nexus between crude oil price, natural gas price and electricity tariff: Evidence from Nigeria. *Research Square*, 1-24.

[3]. Apere, T. O., & Eniekezimene, A. F. (2016). Crude oil price fluctuation and the Nigerian economy. *International Journal of Social Science and Economic Research*, *1*(4), 760-770.

[4]. Athanasios, S.D., Michael, L.P., & Symeoni-Eleni, S. (2020). Revisiting the impact of energy prices on economic growth: Lessons learned from the European Union. *Economic Analysis and Policy, 6*(6), 85-95.

[5]. Azam, M., Khan, A. Q., Abdullah, H. B., & Qureshi, M. E. (2016). The impact of CO2 emissions on economic growth: evidence from selected higher CO 2 emissions economies. *Environ Sci Pollut Res, 23*(7), 6376–6389.

[6]. Charles, O., & Oguntade, P.O. (2018) Impact of oil price on Nigerian economy. *International Journal of Economics, Commerce and Management, 6,* 252-264.

[7]. Dagoumas, A. S., Polemis, M. L., & Soursou, S. E. (2020). Revisiting the impact of energy prices on economic growth: Lessons learned from the European Union. *Economic Analysis and Policy, 66*(C), 85–95.

[8]. Ekeocha, P. C., Penzin, D. J., & Ogbuabor, J. E. (2020). Energy consumption and economic growth in Nigeria: A test of alternative specifications. *International Journal of Energy Economics and Policy, 10*(3), 369-379.

[9]. Enu P. and Havi E. D. K. (2014). Influence of electricity consumption on economic growth in Ghana: an econometric approach. *International Journal of Economics, Commerce and Management, 2(9), 1-20.*

[10]. Ighosewe, E. F., Akan, D.C., & Agbogun, O. E. (2021). Crude oil price dwindling and the Nigerian Economy: A resource-dependence approach. *Modern Economy, 12*, 1160-1184.

[11]. Ismail, O. F., & Adegbemi, B.O.O. (2013). Oil price fluctuations and output performance in Nigeria: A VAR Approach. *The Romanian Economic Journal, 49*, 47-72.

[12]. Jahangir, S. M. R., & Dural, B. Y. (2018). Crude oil, natural gas, and economic growth: impact and causality analysis in Caspian Sea region. *International Journal of Management and Economics, 54*(3), 169–184.

[13]. Kraft, J., & Kraft, A. (1978). Relationship between energy and GNP. *Journal of Energy Development, United State,* 3(2), 401-403.

[14]. Mamdouh, A., & Mohamed, A. (2021). Oil price fluctuations and economic growth: the case of MENA countries, *Review of Economics and Political Science, 5*(8), 174-190.

[15]. McKillop, A. (2014), Oil prices, economic growth and world oil demand. *Middle East Economic Survey, 47*(35), 66-80

[16]. Nnaji, C. E., Chukwu, J. O., & Nnaji, M. (2010), Electricity supply, fossil fuel consumption, Co2 emissions and economic growth: Implications and policy options for sustainable development in Nigeria. *International Journal of Energy Economics and Policy,* 3(3), 262-271.

[17]. Nwatu, V.O., Dosunmu, A. & Nteegah, A. (2023) Natural gas consumption and economic growth in top gas-producing African countries. *Asian Journal of Economics, Finance and Management. 5(1) 374 – 387*

[18]. Nwabueze, G., Ogbonna, J., & Nwaozuzu, C., (2021). Analysis Nigerian natural gas consumption (1990 – 2025). A VECM Approach. *International Journal of Engineering Technologies and Management Research, 9*(1), 7–19.

[19]. Ouedraogo, N. S. (2013). Energy consumption and economic growth: Evidence from the Economic Community of West African States (ECOWAS). *Energy Economics, 36*: 637-647.

[20]. Oyedepo, S. O. (2012). Energy and economic development in Nigeria. *Energy, Sustainability and Society,* 1-17.

[21]. Ozturk, I. (2010). A literature survey on energy-growth nexus. *Energy Policy*, 38: 340-349.

[22]. Pesaran, M.H., Shin, Y., Smith, R.J. (2001). Bound testing approach to the analysis of level relationships. *Journal of Research in Business and Management*, 3(7): 1-9.

[23]. Romer, P. M. (1994). The origins of endogenous growth. *Journal of Economic Perspectives*, 8(1), 3-22

[24]. Romer, M.P.(1986). Increasing returns and long-run growth. *Journal of Political Economy 94(5) 1002 - 1037*

[25]. Salim, R., & Rafiq, S. (2013). The impact of crude oil price volatility on selected Asian emerging economies. *Journal of Development Economics*, 51, 1-33.

[26]. Salisu, T. Q., & Moronkeji, O. B. (2022). Impact of electricity consumption on manufacturing output in Nigeria From 1980 – 2021. *Research Square*, 1-20.
[27]. Sharma, M., Mohaparatra, G. & Giri, A.K. (2020). Beyond growth: Does tourism promote human capital development in India? Evidence from time series analysis. *Journal of Asian Finance Economics and Business, 7(12) 693 - 702*
[28]. Siyakudumisa, T., Kin, S., & Yiseyon-Sunday, H. (2022). Energy prices and economic performance in South Africa: an ARDL bounds testing approach. *Cogent Economics & Finance*, 10: 1-23.
[29]. Solarin, S. A. & Ozturk, I. (2016). The relationship between natural gas consumption and economic growth in OPEC members. *Renewable and Sustainable Energy Reviews*, 58, 1348-1356.
[30]. Udo, E. S., Idamoyibo, H. R., Victor, I., Akpan, J. E. & Victor, N. (2021). Energy consumption and sectorial value addition on economic growth in Nigeria. *Universal Journal of Accounting and Finance*, 9(1), 74-85.
[31]. Williams, A., Edem K. A., Francis, S., Marie-Stella, S., & Nadjath, K. Y. (2022). Impact of electricity prices on growth and development of SMEs in Ghana: A case of selected pharmaceutical industries in Ashanti region. *International Journal of Economics, Commerce and Management United Kingdom, 10*(2), 257- 272.
[32]. Yildirim, E. & Aslan, A. (2012). Energy consumption and economic growth nexus for 17 highly developed OECD countries: Further evidence based on bootstrap-corrected causality tests. *Energy Policy*, 51: 985-993.

Corresponding Author: Umoidem, Ekpedeme James[1]
[1]Emerald Energy Institute, University of Port Harcourt, Choba, Rivers State, Nigeria