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TRILATERIAL RELATIONSHIP BETWEEN ENERGY CONSUMPTION TRADE OPENNESS AND ECONOMIC GROWTH IN NIGERIAL USING THE PANEL ARDL MODEL.

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ABSTRACT

The objective of the research was to examined empirically the long and short run relationship among macroeconomic variables; electricity consumption, trade openness measured by export and import on economic growth of Nigeria. The study period spanned from 1971 to 2021. The data has the annual frequency. The time series properties of the data were, first, analyzed using the Augmented Dickey-Fuller (ADF) test and then Auto-Regressive Distributive Lag (ARDL) approach to cointegration was employed to assess the direction of impact and long-run relationships between the variables. Besides these, other diagnostic tests were also conducted and the result revealed that the model was correctly specified. The ARDL bound test analysis depicted the presence of cointegration relationship between economic growth and employed macroeconomic determinants (electricity consumption and trade openness measured by export and import). The ARDL model revealed that electricity consumption and export have a significant positive

relationship on economic growth in the long run and short run while import has a significant negative relationship on economic growth in the long run. Thus, the findings revealed that electricity consumption and export have positive impact on the economic growth of Nigeria. In order to achieve the desired rate of economic growth it is recommended that there should be a continuous investment in electricity sector. It is also recommended that the earnings from the oil revenue should be channeled to the development of non-oil sectors such manufacturing and agriculture. This will help to diversify the export base of the economy thereby enhancing economic growth.

Key words: Electricity consumption, trade openness, economic growth, ARDL.

Introduction

Electricity consumption, trade openness and economic activity have tended to move together across the globe. For instance, the world electricity consumption per capita has registered a robust compound annual growth rate of 1.94% during the decade of 2004– 2014. Besides, the growth in electricity consumption per capita is significantly higher than that of overall energy consumption, which grew at a compound annual rate of 0.95% during this period.Trade openness at the global level, measured as a share of foreign trade in gross domestic product (GDP), has jumped up remarkably from 54.39% in 2004 to 60.7% in 2014. According to Kyophilavong et al. (2015), foreign trade stimulates economic activities which require more energy. In emerging economies, trade openness advances the stages of economic development in which growth in the industrial sector surpassed that of agriculture. This change in composition of GDP also results in more energy demand. On the contrary, trade openness enables the import of advance

technologies which can lead to low-energy intensity of GDP. Besides, energy is an important input for production and transportation of traded goods. So, energy affects trade openness as well. Against this theoretical underpinning, the investigation of the existence and direction of a causal relationship among electricity use, trade openness and economic activity in emerging economies has important implications to devise successful electricity policies. If, for example, economic growth causes electricity consumption (conservative hypothesis) or there is lack of causality between electricity use and economic activity (neutrality hypothesis), then electricity use can be reduced without adversely affecting economic growth. Conversely, if one-way causality runs from electricity use to economic growth (growth hypothesis) or a two-way relationship (feedback hypothesis) is present between electricity use and economic growth, then the expansive electricity production policies will be required. It implies the rising importance of electricity in the end-use energy mix. Indeed, electricity is the most versatile and broadly utilized form of energy. The electricity consumption is a widely used indicator of the socioeconomic development and well-being of a country (Best and Burke, 2018; Faisal et al., 2018). More importantly, the growth in electricity consumption is mainly driven by developing countries. The role of energy sector is crucial for an economy as the energy supply is essential for growth of economy being a crucial input in the production process. The industrial sector of an economy requires a reasonable energy supply to produce commodities on a large scale for domestic as well as external sectors. International trade one of indicators to develop and foster economic growth for the open economy system. This is the reason for the activities of importing and exporting goods and services were one of the focusing policies for each government.

Trade openness is an essential component of economic growth and increase in international trade increases the economic activities and the energy demand (Sadorsky, 2012). The economic condition of the country and the extent of

relationship between economic growth and trade openness determines the impact of trade openness on energy consumption (Cole, 2006). Trade openness enables developing economies to import advanced technologies from developed economies. The adoption of advanced technology lowers energy intensity and produces more output. Similarly, energy affects trade openness via various channels. Firstly, energy is an important input of production because machinery and equipment in the process of production require energy. Secondly, exporting or importing manufactured goods or raw materials requires energy to fuel transportation. Without adequate energy supply, trade openness will be adversely affected. Consequently, energy is an important input in trade expansion and adequate consumption of energy is essential for expanding trade via expanding exports and imports. The relationship between trade openness and energy consumption is important. If energy plays its key role to increase the flow of exports or imports, then any policies aiming at reduction in energy consumption such as energy conservation policies will negatively impact the flow of exports or imports, and hence reduce the benefit of trade openness.

Energy is considered as an essential factor in the production and distribution of goods. Attaining the sustainable development goals (SDGs) like high literacy rates, food security and poverty reduction among others, require a regular energy supply and usage without which these goals would remain a mere paper goal (Akinwale and Ogundari, 2017). Inadequate access to energy in sub-Saharan African in general and Nigeria in specific, despite the abundance of various natural resources, is appalling. Although there have been studies between energy use and economic growth with differing outcomes in the past research studies (Dorgan, 2016; Ozturk and Acaravci, 2013; Lean and Smyth, 2010) but the link between energy use, tradeand economic growth is yet to be widely studied especially in Africa. The framework for developing an efficient energy and environmental policy is

consequent upon comprehending the connection between energy consumption, trade and output in an economy (Sadorsky, 2012).

There are many rationales that give credence to the study of linkage between energy consumption and trade. For instance, if energy use is established to engender trade, then energy conservation policies intended to decrease greenhouse gas emissions will impair trade due to the reduction in energy consumption which lessen the benefits of trade (Akinwale and Muzindutsi, 2019). This creates a conflicting interest between energy reduction policies and trade liberalization policies (Sadorsky, 2012). Suppose no relationship exist between them or a unidirectional Granger causality from trade to energy is stablished, then energy conservation policies will have no effect on any trade liberalization strategies aimed to improve economic growth. The same explanation goes for the association between energy consumption and economic growth. More so, trade liberalization could serve as a stimulant to domestic production causing an improvement to economic development and foreign trade which enables less developed countries to import advance technologies from industrialized countries (Nasreen and Anwar, 2014). Empirical studies have found differing results for different countries without a general consensus of what the direction of causality should be, against this background, an assessment of the presence and direction of a causal relationship between energy consumption, trade openness and economic growth in Nigeria has important implications towards formulating and implementing robust energy policies. Mandella Osei-AssibeyBonsu(2022) used Dynamic seemly unrelated regression(DSUR) to investigate the triangular relationship between energy consumption, trade openness and economic growth in Nigeria. The result of the investigation indicates that there is long- run bi-directional relationship among the variables but didn't address the short-run relationship as well as the causal direction. Our studyintends to cover the gab using the panel ARDL model

since it will take care of both short-run and long-run relation among the variables as well as the causal relationship.

Literature review

Conceptual review

Nigeria generates electricity through the thermal and hydro energy sources. However, the major source of electricity generation in the country comes from fossil fuels especially gas which accounted for about 81% with the remaining percentages of electricity is generated from hydropower and other sources of energy. Nigeria's average electricity power generation is 4,000 Megawatts (MW) though, sometimes the generation hit the 5,000MW mark, with usually an average of 3,000MW being distributed to electricity consumers across the country. Charles (2021) posits that Nigerian government in its effort to increase electricity power generation and supply and also to ensure a clean energy source, agreed to spend about $120 million in 2016 for the continued construction and completion of Kashimbila Hydropower Dam located in Taraba State of the North Eastern part of the country which is expected to generate around 400 Megawatts of electricity and at the same time to provide portable water supply to communities within the area.

International trade theories which are relevant to this study are classical theory and neo-classical theory, also called the modern theory, with its main variant dubbed the Heckscher-Ohlin theory. The proponents of these two theories argued that international trade plays important role in promoting economic growth of the nations. The theories also recognized that export trade is important for generating foreign exchanges that are needed for importation of goods that

cannot be domestically produced. Both theories being based on the principle of comparative advantage, extol the virtue of specialization, division of labour and free trade. In fact, for those two theories, the advantage of external trade is maximized when it is entirely free from natural and man-made encumbrances. Both theories emphasise the gains from external trade.

Ricardo (1817), in his famed theory of comparative advantage, showed that countries benefit by specializing in the production of those goods with the lowest opportunity cost and trading the surplus of production over domestic demand, taking as given appropriate exchange-rate regimes. Under this model, a country will quickly specialise in sectors in which it has a comparative advantage. The classical theory is easily couched in terms of comparative cost specifically; the theory states that a country will tend to export the commodity whose comparative cost is higher in pre-trade isolation. Given the assumption of constant cost, a country will specialize completely in the production of commodity in which it has comparative advantage.

Theoretical Review

The purchasing and selling of products and services between nations is referred to as international trade. Countries can make money by selling domestically produced goods to other nations through international trade. As a result, engaging in commerce with other nations or joining a trade agreement has a favourable effect

on economic growth (Abdullahi et al., 2013). The three historical periods of international commerce theory are classical, neoclassical, and modern. According to conventional wisdom, free trade will benefit all nations' economies. The absolute advantage theory created by Adam Smith and the comparative advantage theory created by David Ricardo are the two most well-known classic theories. According to neoclassical views, nations can benefit from free trade by manufacturing items in which they are experts while using resources wisely. The Hecksher-Ohlin Trade Theory is the most popular Neo-classical theory (Usman, 2011).

By recognizing economies of scale as a significant driver of economic growth, contemporary theories bolster the comparative advantage argument (Usman, 2011). A mercantilism thesis that was created in the sixteenth century existed before Adam Smith. This idea contends that encouraging exports while limiting imports determines a nation's wealth. Because countries could not simultaneously gain from trade, this argument opposed free trade and claimed that global wealth was fixed (Berkum&Beijl, 1998).

Empirical review

The relationship between electricity supply and industrial/economic growth in Nigeria using data from 1971 to 2009 was studied in [14]. A casual test indicated the absence of a causal link between industrial/economic growth and electricity supply in Nigeria. This implies that electricity supply has not impacted

significantly on economic growth in Nigeria owing to the electricity crises that has paralyzed economic activities over the years (1971 – 2009). Ayodele [4] 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 an improved electricity supply and consumption will have a diverse impact in a range of socio economic and industrial activities and also on the living standards of Hünkar, Özkan and Selçuk (2022) examines the impact of the COVID-19 pandemic on the electricity consumption and economic growth nexus in 30 European countries' using quarterly data between 2015Q1 and 2021Q3. The study employed the panel unit root, panel causality, and dynamic panel estimation tests and the result show that there is bi-directional causality between electricity consumption and economic growth during the study period. Meaning that, an increase in electricity consumption during the COVID-19 pandemic decreases economic growth. While, Hlongwane and David (2021) analyzed the nexus between electricity generation and economic growth in South Africa. The study employs time series data spanning from 1985 to 2020. By employing an Autoregressive Distributed Lag Model (ARDL), Error Correction Model and Granger causality test, the results revealed that there was a positive relationship between electricity generation and economic growth both in the short and long run period. In addition, Zahid, et al (2020) studied the impact of electricity consumption on economic growth, during the period between 1961 to 2015. The

study used Vector Error Correction Model of estimation and the VECM methodology revealed the short-run as well as a long-run nexus among the variables. Pairwise Granger Causality method discovered one-way causal relationship running from electricity consumption to economic growth.

Olusola and Taiwo (2019) examined the impact of energy generation on economic growth in Nigeria. The study covered the period of 1980–2017. Error correction model as a technique of estimation was employed by the researchers. The results indicated the existence of cointegration among gas energy, physical capital and interest rates and are crucial to the development of economic growth in the long run. While hydropower contributed to the development of the economy in the short run. Ojonugwa et al. (2020) investigate the role of democracy, ecological footprint, economic growth, and globalization in enhancing sustainable electricity power in an ecological reserve-based country of Brazil over the period 1971 to 2014. The model was estimated using the fully modified ordinary least squares (FMOLS) and dynamic ordinary least squares (DOLS) estimation procedures. The empirical results suggest that all the variables had positive and significance effect on electricity power. This implies that increasing the level of these variables would stimulate electricity power consumption in the study area.

In addition, Njindan (2019) examined the link between electricity power consumption and economic growth in Nigeria by employing VECM and using data for the period of 1971 to 2012. The results show that there is a distinct causal flow

from electricity power consumption to economic growth both in the short run and long run. Kouton (2020) investigate the impact of renewable energy consumption on inclusive growth in 44 African countries. Generalized Method of Moments (GMM) was employed to estimates the dynamic panel data for a period covering 1991 to 2015. The main finding of the study revealed that renewable energy consumption has a significant positive impact on inclusive growth in Africa, particularly in African countries experiencing low levels of inclusive growth. Nigerians.

Data and methodology

The yearly data on Nigeria economic growth, electricity consumption, trade openness (import and export) was obtained from World Development Indicators (WDI) for the period 1971 to 2021 comprising of 50 observations. The choice of this period was informed by the availability of data due to empirical nature of the study and also to conform with the central limit of 30 minimum observations as justified by the studies of Squalli (2007), Ghosh and Moon (2010) and Musa and Maijama'a (2019) who suggested that 25 to 80 years observations is enough for the application of Autoregressive Distributed Lag (ARDL).

This study will adopt the autoregressive distributed lag (ARDL) model by Pesaran et al. (2001) to test the relationship between electricity consumption, trade openness and economic growth. This model is selected because it can accommodate a mixture of variables that are stationary at level, I(0) and those

that are stationary at first difference, I(1). The ARDL model can therefore be used when variables are I(0), I(1), or a mixture of I(0) and I(1), but it cannot be used when variables are stationary at the second difference, I(2) (Pesaran and Shin, 1998). Before conducting formal tests, descriptive statistics and correlation analysis will be use to conduct a preliminary analysis of trend and variability of the variables. In addition to the ARDL, Granger's (1969) causality test will be employed to establish the causal relationships between electricity consumption, trade openness and economic growth. The ARDL model will be used to test for the short and long run relationships between the variables and expressed as follows:

$$\Delta LGDPt = \alpha 0 + \sum \beta jnj=0\ \Delta LGDPt-j + \sum \gamma jnj=0\ \Delta LELEt-j + \sum \delta jnj=0\ \Delta LTOPNt-j + \varphi 1 LGDPt-1 + \varphi 2 LELEt-1 + \varphi 3 LTOPNt-1 + ut \quad *** \quad (1)$$

Where: $\Delta LGDPt$ represents the change in the natural log value of GDP at time t;

$\Delta LELEt$ is the change in the natural log value of electricity consumption at time t and $\Delta LTOPNt$ is the change in the natural log value of trade openness. $\alpha 0$ is the intercept, n is number of lags and ut is the error term. Coefficients βj, γj and δjrepresent the short-run dynamics of the model; while $\varphi 1$, $\varphi 2$, and $\varphi 3$ are used to test for the long-run relationship known as bound cointegration test. Based on Equation 1, the following hypothesis was therefore set to test for co-integration: Null hypothesis (H0) for no co-integration: $\varphi 1 = \varphi 2 = 0$ Alternative hypothesis (H1) for co-integration $\varphi 1 \neq 0$, $\varphi 2 \neq 0$

To test this joint hypothesis, bound cointegration tests will be use where the estimated F-statistic will be compared to the critical values from the Pesaran et al. (2001) table with unrestricted intercept and no trend. This table has lower and upper critical values and if the estimated F-value is greater than the upper critical

value, the H0 is rejected in favor of H1. This would imply that there is a cointegrating relationship between the variables. However, if the lower critical value is greater than the estimated F-value, the H0 cannot be rejected and this implies that there is no cointegration between the variables. Lastly, unless there is additional information, the result will remained inconclusive if the calculated F-statistics lay between the upper and lower critical values. The existence of cointegration provides evidence for a long-run relationship between the variables and it means that an error correction model (ECM) has to be estimated to capture the adjustment to the equilibrium (Muzindutsi and Sekhampu, 2013). The ECM equation derived from the ARDL model in Equation (1) is as follows:

$$\Delta LGDPt = \alpha 0 + \sum \beta jnj=0\ \Delta LGDPt-j + \sum \gamma jnj=0\ \Delta LELt-j + \sum \delta jnj=0\ \Delta LTOPNt-j + \lambda ut-1 + et^{***} \quad (2)$$

Where ut-1 is the error correction term (ECT) and λ is the ECT coefficient which measures the speed of adjustment to the equilibrium. The ARDL will be estimated using EViews 9 and the best ARDL model will be selected based on the comparison of Akaike Information Criterion (AIC) and the Schwarz's Bayesian information criterion (SBIC). Various diagnostic tests such as serial correlation, heteroscedasticity, structural breaks and normality tests will be conducted to check if the selected ADL model meet the required econometric assumptions.

Empirical review

We use the Augmented Dickey-Fuller (ADF) tests to conduct unit root tests on the four variables, which are displayed in Tables 1-4 below. The p-values for economic growth, electricity consumption, export, and import(trade openness), respectively, all exceeded the 0.05 level of significance which is an indication that

the variables are stationary at level form. More evidence of non-stationarity can be found in Figures 1-4.

All four variables reached stationary states following the first difference. This is clear from their p-values, which are all below the 5% level of significance in each case. Tables 1-4 display the findings.

Table 1: ADF Test Result of Economic Growth After First Difference

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.83948	0.0000
Test critical values:	1% level	-3.571310	
	5% level	-2.922449	
	10% level	-2.599224	

*MacKinnon (1996) one-sided p-values.

Table 2: ADF Test Result of Electricity Consumption After First Difference

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.558017	0.0000
Test critical values:	1% level	-3.571310	
	5% level	-2.922449	
	10% level	-2.599224	

*MacKinnon (1996) one-sided p-values.

Table 3: ADF Test Result of Export After First Difference

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.984458	0.0000
Test critical values:	1% level	-3.571310	
	5% level	-2.922449	
	10% level	-2.599224	

*MacKinnon (1996) one-sided p-values.

Table 4: ADF Test Result of Import After First Difference

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.523815	0.0000
Test critical values:	1% level	-3.571310	
	5% level	-2.922449	
	10% level	-2.599224	

*MacKinnon (1996) one-sided p-values.

The Optimal ARDL Model

The ARDLmodel was estimated from a recursive search of the optimal number of lags through the Akaike Information Criterion (AIC) and from the diagnostic statistics. Figure 5 presents the first 20 ARDL models and their selection criteria while Table 11 presents the ARDLestimates. From Figure 5 it is observed that ARDL (4, 4, 0, 2) was the best model with minimum Akaike information criteria.

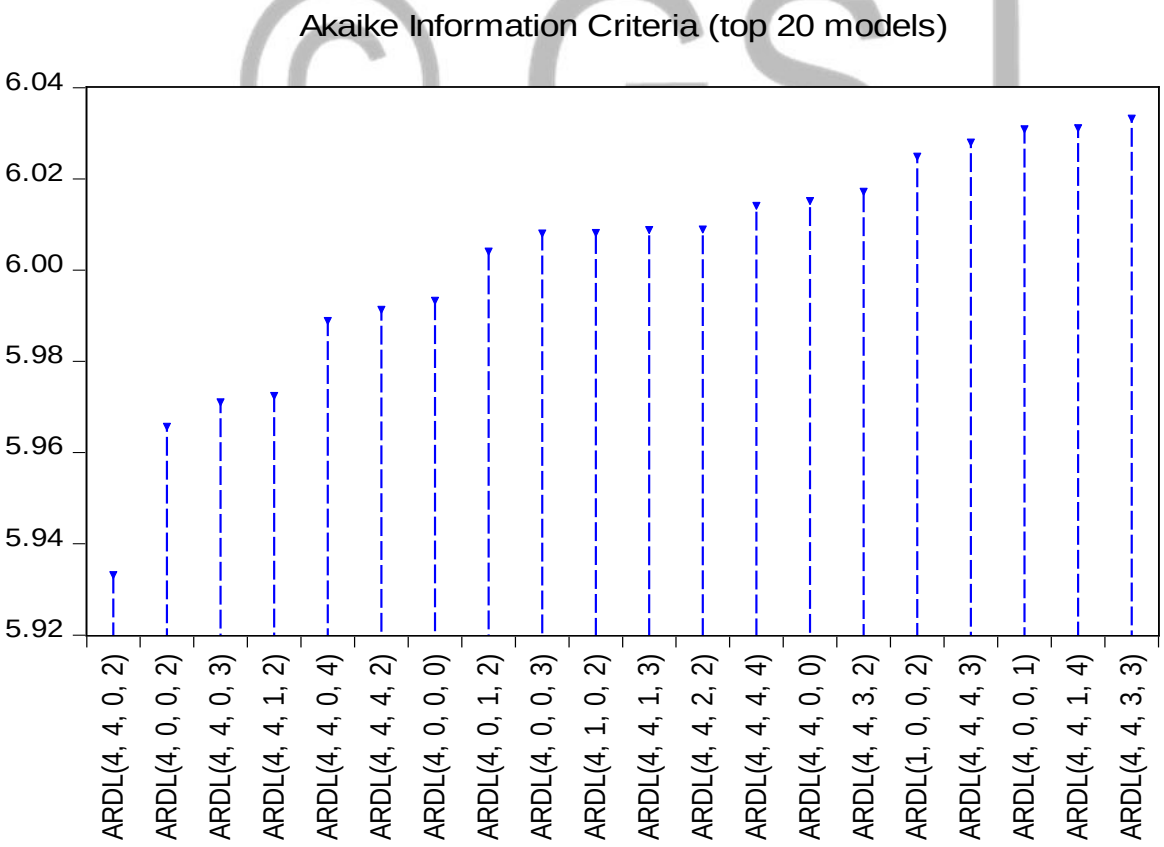

Figure 1: Model Selection Based on Alkake Information Criteria

Bound Test

In order to achieve the objective of the study; to examine empirically the long and short run relationship among selected macroeconomic variables on the economic growth of Nigeria, the co-integration relationship between Economic growth and selected macroeconomic variables are tested using ARDL model. This study employed ARDL modelling for the formulation of long-run equilibrium between economic growth and selected variables (electricity consumption, export and import). The bound test (F-statistics) has been applied to explain the existence of the co-integration relationship among variables in the model. The result of the ARDL bound test approach to

cointegration is shown in Table 5. The optimal lag order of the ARDL model is set to one (1) which is based on the Akaike information criterion.

The empirical results in Table 5infered to a long run relationship between economic growth and the independent variables of the model because F-statistic for the Bounds Test is 6.220645, it clearly exceeds the 1% (4.66), 2.5% (4.08), 5% (3.67) and 10% (3.2) critical values for the upper bound. So, this study rejects the hypothesis of "No Long-Run Relationship", and accepts the alternative hypothesis that there is a Long-Run co-integration Relationship

Table 5: ARDL Bound Test for Cointegration

F-Bounds Test			Null Hypothesis: No levels relationship	
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	6.220645	10%	2.37	3.2
K	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66
			Finite Sample: n=50	
Actual Sample Size	50			
		10%	2.538	3.398
		5%	3.048	4.002
		1%	4.188	5.328

Long Run Coefficient Test Results

After establishing a co-integration relationship between the series, Autoregressive Distribution Lag (ARDL) model can be established to determine long run and short run relationships. The estimated long run coefficients are shown in Table 6. The empirical results in Table 6 inferred that electricity consumption is positive and statistically significant at 5% level. Since the coefficient of electricity consumption is positive, it means that it has a direct relationship with economic growth in the long run.

Table 6: Estimated Long Run Coefficient Using the ARDL Approach

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ELECTRICITY_CONSUMPTION	0.041910	0.015561	2.693305	0.0110
EXPORT	0.294715	0.082860	3.556760	0.0012
IMPORT	-0.031543	0.130762	-3.241226	0.0109
C	-6.913023	2.305865	-2.998017	0.0051

Short-run Dynamics Results of ADRL Process

Table7 shows that there is a short run association between economic growth and selected macro variables. The negative and statistically significant coefficient of the one period lagged error correction term (ECMt-1) provides further support to the existence of co-integration of the dependent variable economic growth with its regressors included in the estimates. The size of (ECM_{t-1}) is -0.461728which suggests that about 46 percent of the disequilibrium caused by previous period's shocks in the system converges back to the long run equilibrium. That is the short run deviation is corrected by 46% each period and it takes about two periods to return back to the long run equilibrium (0.46+0.46 = 0.92, about 100% deviation corrected). The positive and statistically significant short run coefficients related to electricity consumption, export, and import indicate their respective importance in affecting the economic growth in the short run. This suggests that the short run dynamic effect of the selected regressors on the economic growth is positive.

Table 7: ECM Representation for the Selected ARDL Model

Variables	Coefficients	Std. Error	t-St
Electricity Consumption	0.044670	0.069090	0.
Export	0.373528	0.111245	3.
Import	0.174105	0.176868	0.
ECT(-1)	-8.761728	3.635212	- 2.

Stability Test Results

Stability of the long-run coefficients together with the short-run dynamics, the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUM) are applied. The stability of the estimated coefficients of the error correction model and a graphical representation of CUSUM and CUSUMQ statistics are shown in Figures 2 and 3. According to Bahmani-Oskooee, (2004) the null hypothesis cannot be rejected if the plot of these statistics remains within the critical bound on the 5% significance level.

As it is clear from Figure 2 and 3, the plots of both the CUSUM and the CUSUMQ are within the boundaries and hence providing evidence that these statistics confirm the stability of model i.e., the model do not suffer from any structural instability over the period of the study.

The pinpoint of above Diagnostic Test is that this model does not suffer from any problems of incorrect functional form, serial correlation, heteroscedasticity, nonnormal distribution and instability of the model. Since ordinary least square and time series models are based on the assumptions of Stationarity, Normality, Linearity, No serial correlation, Homoscedasticity, No multicollinearity. Therefore, the obtained results are robust due to satisfying the above assumptions and thus this model is BLUE.

In conclusion, the ARDL result shows that the alternative hypothesis of the existence of a significant relationship between selected macroeconomic variables (physical capital, human capital, government expenditure, foreign aid and openness to foreign trade) and economic growth has been accepted. This means rejection of the null hypothesis of no significant relationship between selected macroeconomic variables and economic growth

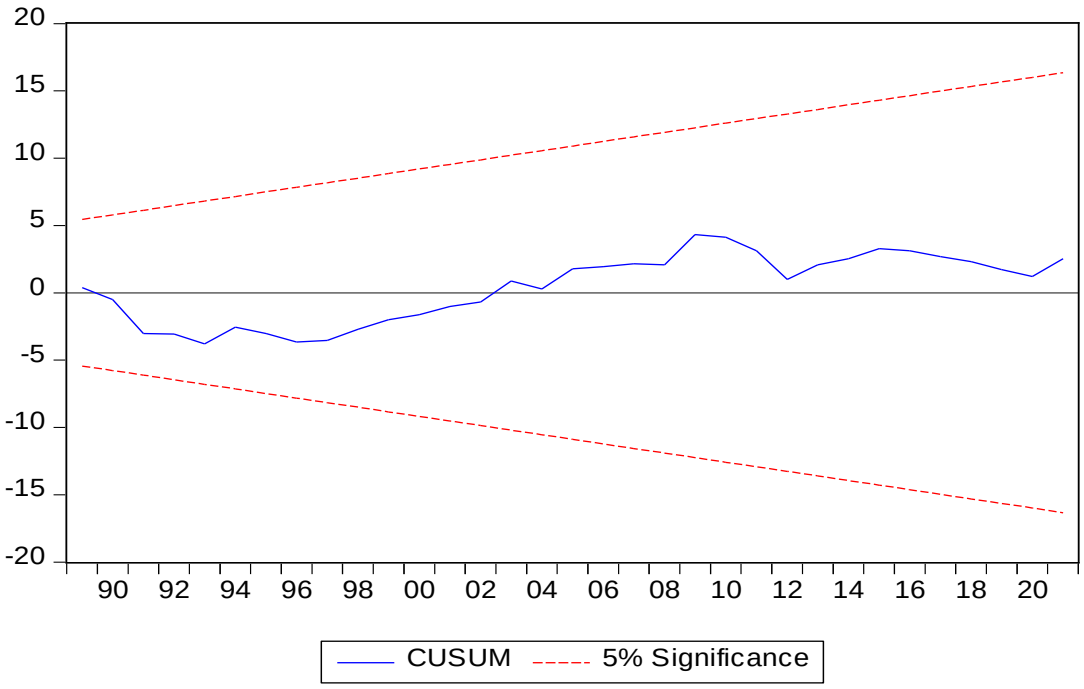

Figure 2: Plot of Cumulative Sum of Recursive Residuals

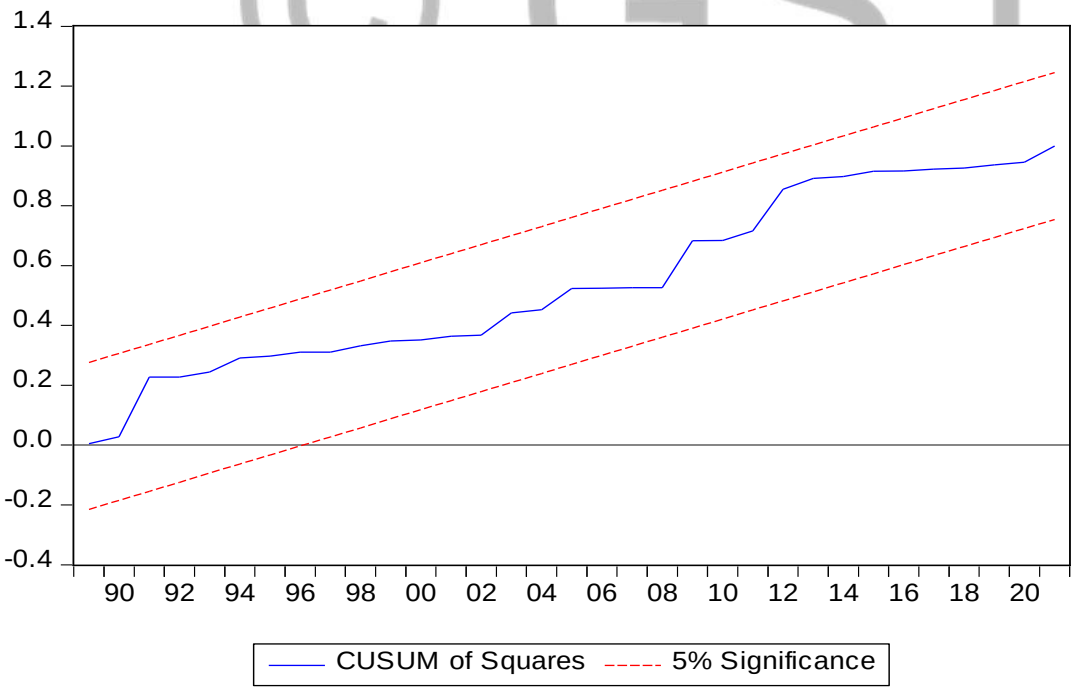

Figure 3: Plot of Cumulative Sum of Square of Recursive Residuals

5.1 Summary

In this work we considered data on economic growth, electricity consumption, trade openness (export and import) from 1971 to 2021 comprising of 50 observations. ARDL (4, 4, 0, 2) was modelled to determine the long-run relationship between the dependent variable (economic growth) and the independent variables (electricity consumption and trade openness). The result of the bound test established a significant positive long-run relationship between electricity consumption and economic development, significant positive long-run relationship between export and economic growth while the long-run relationship between import and economic growth was negative and significance. The ECM representation of the ARDL (4, 4, 0, 2) model revealed a positive and significant short-run relationship between electricity consumption and economic growth, trade openness and economic growth. The diagnosis of ARDL (4, 4, 0, 2) model revealed that the model is stable and has no issues with serial correlation, heteroscedasticity, non-normal distribution, or erroneous functional form. since the assumptions of stationarity, normality, linearity, lack of serial correlation, homoscedasticity, and lack of multicollinearity, ordinary least square and time series models are founded on these concepts. As a result of the assumptions being met, the results are reliable, and this model is hence BLUE.

Conclusion

Since achieving higher economic growth rate is important to the economy, therefore, the knowledge of the relationship of economic growth with the macroeconomic variables present in its economic environment, no obvious relationship between these variables and the economic growth can be discerned without performing the time series analysis, the way that the macroeconomic variables interact with economic growth will remain ambiguous and it will be difficult to predict how recent development in Nigeria's macroeconomic variables will affect economic growth. There is a potential for harnessing positive growth in the economy but the main issue is in understanding the factors driving growth which cannot be done effectively before establishing their impact. There is a need to establish how macroeconomic factors like electricity consumption, export and import can help drive the economic growth of Nigeria where real GDP is taken as a proxy for the economic growth.

In view of the foregoing, the study employed ARDL model to investigate the relationship between electricity consumption, export, import on the dependent variable (economic growth).

The results of ARDL approach to cointegration showed that electricity consumption has positive and significant relationship with economic growth both in the long run and short run, export has a significant positive relationship with economic growth in the long run and their relationship is positive and insignificant

in the short run, import has a negative and significant relationship with the economic growth in long run while their relationship is found to be positive and statistically significant in short run. In general, the empirical results revealed that there exists a positive long-run relationship between electricity consumption, export, and economic growth and a negative long-run relationship between import and economic growth. This confirms the interdependence between economic growth and selected macroeconomic variables

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