Financial Sector Development, Energy Consumption and Economic Growth in Nigeria

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DOI: https://dx.doi.org/10.47772/IJRISS.2025.90300249

Received: 01 March 2025; Accepted: 07 March 2025; Published: 12 April 2025

ABSTRACT

This study examines the relationship between financial sector development, energy consumption, and economic growth in Nigeria. Despite extensive research on these interdependencies, gaps remain in analyzing financial development using a comprehensive financial development index while simultaneously disaggregating energy consumption into renewable and non-renewable sources. This study addresses this gap by employing the Autoregressive Distributed Lag (ARDL) technique to analyze annual data from 1990 to 2023. The findings reveal that financial development significantly contributes to economic growth in both the short and long run. Non-renewable energy consumption positively impacts economic growth, underscoring Nigeria's continued reliance on fossil fuels. However, renewable energy consumption exhibits a negative impact on economic growth, suggesting inefficiencies or high transition costs associated with clean energy investments. Inflation negatively affects economic growth, reinforcing the need for macroeconomic stability. The study also finds that gross fixed capital formation and population growth do not significantly influence economic growth in the long run, although short-term effects vary. Based on these findings, the study recommends that financial sector policies be strengthened to enhance economic growth, given the strong positive relationship between financial development and GDP. While transitioning to renewable energy is essential for sustainability, a gradual shift with improved efficiency, technological advancements, and policy incentives is necessary to mitigate its negative economic impact. Additionally, strict monetary and fiscal measures should be implemented to control inflation and sustain long-term economic growth.

Keywords: Autoregressive Distributed Lag (ARDL), Economic Growth, Energy Consumption, Financial Development, Renewable Energy.

INTRODUCTION

Energy plays an important role in economic growth and development of every economy. It is the driving force of every economy as it is used as input in the production, distribution, and consumption of goods and services (Asghar, 2008). Given the increasing rate of population growth and urbanization, increase in energy consumption becomes necessary to sustain the standard of living of people (Dash, 2015). As economic activities continue to expand, more energy is required to sustain growth.

According to the International Energy Agency (IEA), global energy consumption in 2025 is expected to see a significant rise in electricity demand, with a growth rate of around 4%, driven by factors like rapid industrialization, population growth, increasing adoption of electric vehicles, and expanding data centers, particularly in emerging economies like Africa and China. This growth rate is considered one of the fastest in recent decades(IEA, 2025). Energy consumption can be divided into renewable and nonrenewable categories. The former represents energy from sources that are replenished over time, whereas the latter's sources are not readily replenished.

Over the years, the Nigerian energy sector has been dominated by the fossil fuels (non-renewable), with petroleum and natural gas serving as the cornerstone of the country’s energy supply. However, after decades of

dependence on these finite resources, the country is gradually transitioning towards renewable energy sources. Renewable energy sources like wind, solar, and biomass are becoming popular, providing a more sustainable and eco-friendly solution to meet Nigeria's increasing energy demands and marking a significant shift away from the country's long-standing reliance on fossil fuels. In 2020, fossil fuels comprised about 85% of Nigeria's energy use. Renewables, including wind, solar, and biomass, accounted for roughly 12%, with the remaining 3% coming from other sources like hydroelectric power. However, transitions to cleaner energy sources are determined by economy and technological advancements (Adeshina et al., 2024).

Financial markets can impact the economy positively by increasing the efficiency of the country's economy and its financial system by diversifying financial funds from unproductive to productive uses. Financial development has been argued to significantly increase energy consumption through the consumer effect, the business effect, and the wealth effect (Sadorsky, 2010). Firstly, a developed financial system can help increase energy demand, by easing borrowing for households which increases confidence and wealth and encourages consumers to purchase durable consumer goods such as machinery, and automobiles which consume a lot of energy (Chang, 2015). This link is known as the consumer or direct effect. Here, development in the financial sector pumps funds into the economy leading to economic growth which increases energy consumption.

Secondly, a developed financial system can promote businesses by reducing the cost of accessing financial capital for the business sector and making it easier to expand existing business activities which can influence the demand for energy via the use of plants, machinery, and labor activities known as the business effect (Oyinlola,2020). Thirdly, increased stock market activity can create a wealth effect by boosting the confidence of businesses and firms which enables them to acquire an additional source of funding from the stock market. This in turn increases economic activity which translates to more energy consumption. On the other hand, financial development may lead to a reduction in energy consumption by providing an opportunity for technological innovations for projects that are friendly to the environment of local firms (Shahbaz et al, 2017). It could also lead to better opportunities for renewable energy sectors.

The Nigerian financial sector has witnessed significant growth, emerging as the prime financial market in Africa. The sector contributed 44.2 trillion to Nigeria's GDP between 2017 and 2020. The sector's contribution to GDP in 2023 increased to N3.8 trillion, representing a 26.5 percent increase from N3.01 trillion reported in 2022(NBS, 2024). However, financial sector concerns such as regulatory inconsistencies and supervisory weakness, financial inclusion issues, insufficient intermediation, and high lending rates, among others, continue to hinder accessibility to funds for smaller businesses.

Given that the financial sector has a potent role to play towards making clean energy affordable thus increasing its accessibility and contribution to economic growth, this study therefore examines the relationship between financial sector development, energy consumption and economic growth in Nigeria. Energy consumption is disaggregated into renewable and non-renewable energy sources. This study also deviates from previous studies by employing financial development index as a measure of financial development in Nigeria. The index summarizes financial institutions and financial markets in terms of their depth, access, and efficiency. These indices are aggregated into an overall index of financial development (IMF, 2024). The index is extensively broader than traditional indicators used in the majority of previous studies. The rest of the paper is divided into four sections study, section two presents the review of relevant literature, section three presents the methodology, section four discusses the results and section five concludes the study.

LITERATURE REVIEW

Although there is a wide range of literature on the relationship between financial sector development and economic growth as well as energy consumption and economic growth, however literature shows conflicting evidence. While some studies have reported a positive relationship, others have reported otherwise. The first strand of literature examines the effect of financial sector development on economic growth. In this regard, Iliyasu, Saliu and Sule (2024) investigated the effect of financial sector development on economic growth in Nigeria from 1990 to 2021 using the ordinary least square (OLS) regression model. Findings revealed that Domestic Credit to Private Sector had significantly positive effect on real GDP, while money supply exerts insignificant positive effect on real GDP.

Mikebanyi and Kigabo (2022) examined the effect of financial sector development on economic growth in Rwanda using a constructed financial development measure (FD index) that combines many dimensions of financial system development; access, depth and efficiency of both financial intermediaries and financial markets. The study employed the augmented Granger non-causality test suggested by Toda and Yamamoto for the years 1980 to 2018. The results suggest that, for Rwanda, the the financial markets and traditional indicators have a bi-directional relationship with economic growth.

A study by Akintola, Oji-Okoro and Itodo (2020) investigated the impact of the financial sector development on economic growth in Nigeria, using quarterly data between 2000Q1 and 2019Q4. The results indicated that while financial deepening, banking system liquidity and all share index had positive and significant impact on the growth of real output in the long-run, the behaviour of exchange rate spread was consistent with falling levels of real output growth.

Ayeni et al. (2024) examined the impact of financial development on economic growth in Nigeria from 1986 to 2022. The Autoregressive Distributed Lag model was employed and the long run result reveals that interest rate, lagged value of broad money supply and domestic credit to private sector have positive impacts on real GDP. On the contrary, broad money supply has a negative impact on GDP.

Adekunle and Tonia (2024) employed the Autoregressive Distributed Lag technique (ARDL) to investigate the impact of financial sector development on economic growth in Nigeria. Findings showed that credit to the core private sector, market capitalization, total savings, and monetary policy rate are identified as drivers of economic growth,

Tadese and Abebow-Degu (2023) also investigated the effect of financial sector development on the economic growth of 25 sub-Saharan Africa countries for the period 2010–2017. Employing three dynamic panel data models that examined the effect of financial sector depth, access, and efficiency on economic growth, the two-step system GMM estimation results revealed that financial sector depth, access, and efficiency have a positive and statistically significant effect on these countries' economic growth.

The debate on the nexus between energy consumption and economic growth remains unabated with divergent views. In view of this, the second strand of literature examines the effect of energy consumption (renewable and non-renewable) on economic growth. Using the auto-regressive distributed lag method, Okoye et al. (2021) examined the effect of energy consumption on economic growth in Nigeria between 1981 and 2017. The results showed that energy consumption and gross fixed capital formation significantly determine growth of economic activities in Nigeria.

Ekeocha et al. (2020) analyzed the relationship between energy consumption and economic growth in Nigeria over the period 1999Q1 2016Q4 using alternative model specifications. Specifically, the study used a nonlinear (or asymmetric) ARDL model and an ARDL-ECM specification which presumes a linear relationship rather than a nonlinear one. Results showed that the role of energy consumption as a driver of growth remained negligible. The Granger causality tests also revealed a unidirectional causality running from energy consumption to economic growth,

Okeoma et al. (2023) evaluated the impact of energy consumption on economic growth in Nigeria covering the period of 1981 to 2018. The study adopted the Ordinary Least Square (OLS) regression technique and Johansen co-integration test. Gross fixed capital formation, electricity consumption, and crude oil consumption have a positive and significant impact on economic growth in Nigeria while coal consumption has a positive but insignificant impact on economic growth in Nigeria.

Bank-Ola et al. (2024) examined the effect of renewable energy consumption on economic growth from 1990 to 2022. The study employed Johansen co-integration test and Vector Error Correction Model (VECM) to examine the effect of renewable energy consumption on economic growth. Empirical evidence revealed long-term relationship between renewable energy consumption and economic growth. Evidence also shows that there is no causality between renewable energy and economic growth in Nigeria.

Umar et al. (2024) examined the relationship between renewable energy consumption and economic growth

in Nigeria from 1996 to 2021. Using the ARDL technique of analysis, the long run results showed that renewable energy has a negative and significant effect, thus validating the conservative hypothesis.

Nkoro et al. (2019) investigated the effect of energy consumption on economic growth in Nigeria from 1980 to 2016. While disaggregating energy consumption into renewable and non-renewable, the study employed the fully modified Ordinary Least Square technique which allows for time gaps in the model. It was observed that only renewable energy has an impact on economic growth in the long-run whereas non-renewable energy component impacted on economic growth in the short-run.

DATA AND METHODOLOGY

This study is hinged upon upon the Neoclassical Growth theory as introduced by Robert Solow in 1956. The theory is a framework that explains the dynamics of economic growth, focusing on the indispensable role of capital accumulation and technological advancement. This theoretical framework therefore, forms the basis for exploring the relationship among financial development, energy consumption, and economic growth.

The neoclassical perspective emphasizes the significance of credit availability and financial intermediation in facilitating capital accumulation. Integrating energy consumption into the neoclassical growth model recognizes energy as a critical production input (Atoyebi et al., 2024)

The study employs annual data from 1990 to 2023, given the availability of data for renewable energy. Data was obtained from World Bank Development Indicators (WDI, 2024) as well as the International Monetary Fund (IMF) Data Portal. The study aligns with the model specified by previous studies with some modifications (Nagmi, 2020; Fasheyitan et al., 2022; Atoyebi et al., 2024)

The model is formulated functionally as follows:

$GDP_t = f(EN_t, FNDEV_t, GFCF_t, INF_t, POP_t)$ .....(3.1)

The econometric specification of the model is specified as:

$lnGDP_t = \beta_0 + \beta_1 lnEN_t + \beta_2 lnFNDEV_t + \beta_3 lnGFCF_t + \beta_4 lnINF_t + \beta_5 lnPOP_t + \mu_t$---------- (3.2)

where: GDP represents economic growth; EN is a vector that represents renewable and non-renewable energy consumption, FNDEV represents financial development measured by the financial development index; GFCF is gross fixed capital formation, INF is inflation rate and POP is population growth rate. Also, β_0 is the constant, and β_1 - β_5 are the coefficient estimates, while μ_t is the error term.

The Bounds Test for co-integration is used in the context of an Autoregressive Distributed Lag (ARDL) model to determine whether there is a long-run relationship between variables in a time series model. The Autoregressive Distributed Lag (ARDL) estimation technique is used to analyze the dynamic relationship between variables in the context of time series data. It is particularly useful for examining the short-run and long-run relationships between variables that may be integrated at different orders, i.e., a mix of I(0) and I(1) variables.

The ARDL model is given as:

$$lnGDP_t = \beta_0 + \sum_{i=1}^{n} \beta_1 \Delta lnEN_{t-1} + \sum_{i=1}^{n} \beta_2 \Delta lnFNDEV_t + \sum_{i=1}^{n} \beta_3 \Delta lnGFCF_t + \sum_{i=1}^{n} \beta_4 \Delta lnINF_t + \sum_{i=1}^{n} \beta_5 \Delta lnPOP_t + \emptyset_1 lnEN_t + \emptyset_2 lnFNDEV_t + \emptyset_3 lnGFCF_t + \emptyset_4 lnINF_t + \emptyset_5 lnPOP_t + \emptyset_6 ECM_t + \mu_t \text{.....(3.3)}$$

Where β_1 to β_5 are the short run coefficients and $\emptyset_1$ to $\emptyset_5$ are the long run coefficients of the variables.

RESULTS AND DISCUSSION

Empirical analysis involves the summary statistics, correlation matrix, unit root test, co-integration test, ARDL

results

Descriptive Statistics

This is done to summarize the basic features of the data. The results of the descriptive statistics are presented in Table 1. below.

Table1. Summary Statistics

	GDP	NRE	RE	LGFCF	INF	POP	FNDEV
Mean	4.288	19.502	84.760	3.288	18.085	2.597	0.193
Median	4.230	19.342	84.630	3.317	12.876	2.575	0.189
Maximum	15.329	22.845	88.681	3.974	72.835	2.764	0.273
Minimum	-2.035	15.854	80.642	2.702	5.388	2.380	0.123
Std. Dev.	3.958	1.590	2.394	0.390	16.108	0.107	0.035
Skewnes	0.465	0.1338	-0.092	-0.105	2.199	-0.169	-0.147
Kurtosis	3.389	2.602	1.777	1.806	6.826	1.981	2.659
Jarque-Bera	1.397	0.316	2.102	2.019	46.728	1.586	0.279
Probability	0.497	0.853	0.349	0.364	0.000	0.452	0.869

Source: Author's computation (2025)

The summary statistics shows that GDP growth rate averages around 4.29%, which suggests moderate economic expansion. A negative minimum value of -2.04% indicates that at some points, the economy contracted, possibly due to external shocks like global recessions or internal factors like poor policy decisions. The high standard deviation of 3.96% signals volatility in economic performance, reflecting inconsistent growth patterns. The GDP growth rate averages around 4.29%, which suggests moderate economic expansion. Non-renewable energy consumption is relatively stable, with a low standard deviation of 1.59%. The narrow range (15.85% - 22.84%) suggests that energy consumption does not fluctuate drastically. The positive skewness (0.13) is almost negligible, indicating a symmetric distribution.

The mean renewable energy consumption is high (84.76%), suggesting strong reliance on renewables. The standard deviation is low (2.39%), indicating that renewable energy consumption is fairly stable over time. The negative skewness (-0.09) suggests slightly more observations at higher values. The low kurtosis (1.78) indicates fewer extreme values, meaning consumption patterns are steady. For gross fixed capital formation, a low mean value of 3.29% suggests limited capital investment growth, which could constrain long-term economic expansion. The low standard deviation (0.39%) implies stable investment trends.

The inflation rate is relatively high at an average of 18.08%, indicating persistent inflationary pressure. The high standard deviation (16.11%) suggests significant inflation volatility. The positive skewness (2.20) shows that there have been extreme spikes in inflation. The mean population growth rate (2.60%) is relatively stable. The low standard deviation (0.11%) suggests minimal fluctuations in population growth. On-renewable energy consumption is relatively stable, with a low standard deviation of 1.59%. The narrow range (15.85% - 22.84%) suggests that energy consumption does not fluctuate drastically.

Correlation Analysis

The correlation analysis of the variables are presented in Table 2.

Table 2. Correlation Matrix

	GDP	NRE	RE	LGFCF	INF	POP	FNDEV
GDP	1						
NRE	-0.052	1					
RE	0.076	-0.406	1				

LGFCF	0.116	0.172	0.519	1			
INF	-0.420	0.117	0.313	0.408	1		
POP	0.617	-0.169	0.341	-0.348	-0.208	1	
FNDEV	0.077	-0.341	-0.474	-0.723	-0.478	0.019	1

Source: Author's computation (2025).

The correlation matrix explains the relationships among Gross Domestic Product (GDP), Non-Renewable Energy (NRE), Renewable Energy (RE), Gross Fixed Capital Formation (LGFCF), Inflation (INF), Financial Development (FNDEV) and Population (POP). For population growth and GDP, a strong positive correlation of 0.6173 shows that a growing population appears to be associated with increased GDP, possibly due to a larger workforce and greater economic activity.

Inflation has a negative correlation with GDP **a**nd this means that higher inflation tends to be associated with lower GDP growth, reflecting the adverse effects of price instability on economic performance. Renewable Energy shows a weak positive correlation (0.0763) with GDP. This **s**uggests that renewable energy use has a minor impact on GDP growth. On the other hand, non-Renewable Energy is negatively correlated with GDP and this suggests that dependency on fossil fuels might not be significantly contributing to GDP growth. Similarly, Gross Fixed Capital Formation has a weak negative correlation (-0.1166) with GDP. Financial Development has a weak positive correlation with economic growth.

Unit Root Test

The Augmented Dickey Fuller (ADF) and Philip Perron test for unit root were employed to test whether the variables are stationary and also determine the order of integration of the variables.

Table 3: Unit Root Test Results

Variables	Augmented Dickey Fuller (ADF)		Phillip-Perron (PP)		I(d)
	Levels	**1stDifference**	**Levels**	**1stDifference**	
GDP	-2.152	-4.301	-2.432	-4.582	I (1)
NRE	-2.634	-5.462	-2.521	-5.555	I (1)
RE	-1.771	-5.793	-1.791	-5.825	I (1)
GFCF	-2.603	-4.022	-2.401	-4.024	I (1)
INF	-3.594**	--------	-3.592**	-------	I (0)
POP	-2.881	-6.761**	-2.761	-6.562**	I (1)
FNDEV	-2.062	-5.522	-2.073	-5.611	I (1)
Critical Value:1% **5%** **10%**	-3.69 -2.97 -2.63	-3.69 -2.96 -2.62	-3.65 -2.96 -2.62	-3.66 -2.96 -2.62	

Source: Author's computation (2025)

The unit root test shows a mixed order of integration for the variables. While GDP, renewable energy consumption, non-renewable energy consumption, gross fixed capital formation, financial development and population growth are integrated of order one, inflation is integrated of order zero.

Table 4: Bound Test for Co-integration

Test Statistic	Value	K
F-statistics (GDP|FNDEV, NRE, LGFCF, POP, INF)	7.391***	5

F-statistics (GDP|FNDEV, RE, LGFCF, POP, INF)	8.697***	
Critical Value Bounds		
Significance	**I0 Bound**	**I1 Bound**
1%	3.06	4.15
5%	2.39	3.38
10%	2.08	3.00

Source: Author's computation (2025).

F-Statistics is used to compare against the critical value bounds. Higher values indicate stronger evidence against the null hypothesis. Since 7.391 and 8.697 are greater than the upper bound (I1 Bound**)** at all significance levels, we reject the null hypothesis, indicating there is a long-run relationship between economic growth and the other variables.

ARDL RESULTS

Table 5. ARDL result on the nexus **among Financial Sector Development, Non-Renewable Energy and Economic Growth in Nigeria.**

ARDL Error Correction Regression **Dependent Variable: GDP** **Selected Model: ARDL (3, 2, 1, 0, 2, 3)**				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
SHORT RUN				
D (GDP (-1))	0.432	0.163	2.655	0.019
D(GDP (-2))	0.396	0.111	3.570	0.003
D(FNDEV)	14.693	22.099	0.665	0.518
D(FNDEV (-1))	70.099	19.265	3.639	0.003
D(NRE)	0.382	0.261	1.463	0.167
D(LGFCF)	-24.364	4.322	-5.638	0.000
D (LGFCF (-1))	-23.447	4.943	-4.743	0.000
D(POP)	-43.424	13.049	-3.327	0.005
D (POP (-1))	12.730	17.736	0.718	0.486
D (POP (-2))	76.195	15.847	4.808	0.000
CointEq (-1) *	-0.315	0.019	-15.842	0.000
LONG RUN				
FNDEV	56.237	18.749	2.999	0.010
NRE	1.229	0.232	5.30	0.000
INF	-0.074	0.025	-2.991	0.010
LGFCF	1.761	2.382	0.739	0.472
POP	1.007	11.279	0.089	0.930
C	-37.973	37.367	-1.016	0.328
R-squared	0.87			
Adjusted R-squared	0.81			
S.E. of regression	1.51			
Durbin-Watson stat	2.54			
Breusch-Godfrey Serial Correlation LM Test	0.571			
Heteroskedasticity Test: Breusch-Pagan-Godfrey	0.822			

Source: Author's computation (2025).

The ARDL short run estimates reveal that GDP in the previous and two lagged period have significant positive

impact on current GDP. A percentage increase in GDP in these periods will increase the current period GDP by 0.43 0.39 percent respectively. This implies persistence in economic growth. Financial development in the current period does not significantly impact GDP. However, financial development from the previous period significantly increases GDP. This means that a percentage increase in the previous value of financial development will increase GDP by 70.1 percent.

The short-run effect of non-renewable energy consumption on GDP is insignificant, meaning that the Nigerian economy may be transitioning away from heavy reliance on fossil fuels. Gross fixed capital formation in both the previous and current periods exhibit negative and significant influence on GDP as a percentage increase in gross fixed capital formation reduces GDP by 24.36 and 23.45 percent respectively.

In the current period, population growth reduces GDP significantly. A percentage increase in population is seen to reduce economic growth by 43.42 percent. This implies that rapid population growth could strain resources and reduce productivity. The error correction term is negative and significant, indicating a quick adjustment to equilibrium after short-term shocks, with about 31.5% of deviations corrected each period.

The long run ARDL estimates reveal that financial development has a positive and significant relationship with GDP, indicating that financial sector growth contributes strongly to long-term economic growth. A percentage increase in financial development will increase economic growth by 56 percent. In the same vein, non-renewable energy has a strong positive and highly significant relationship with economic growth. A percentage increase in non-renewable energy will increase economic growth by 1.2 percent. Inflation has a negative and significant effect on economic growth, confirming that rising inflation hampers long-term economic growth. A percentage increase in inflation is seen to reduce economic growth by 0.07 percent. However, gross fixed capital formation and population growth do not significantly affect economic growth in the long run.

For the Post-Estimation Diagnostic test, a high p-value (typically above 0.05) suggests that we fail to reject the null hypothesis, meaning there is no evidence of serial correlation in the residuals. Since the probability value (0.57) is greater than (0.05), we conclude that there is no evidence of serial correlation. Similarly, the Breusch-Pagan-Godfrey test is used to detect the presence of heteroskedasticity in a regression model. The probability value of 0.82 is much greater than 0.05, indicating that we fail to reject the null hypothesis of homoskedasticity. CUSUM and CUSUM of Squares Tests are used to establish the stability of the estimated ARDL model. The model appears to be stable, with no significant structural breaks detected.

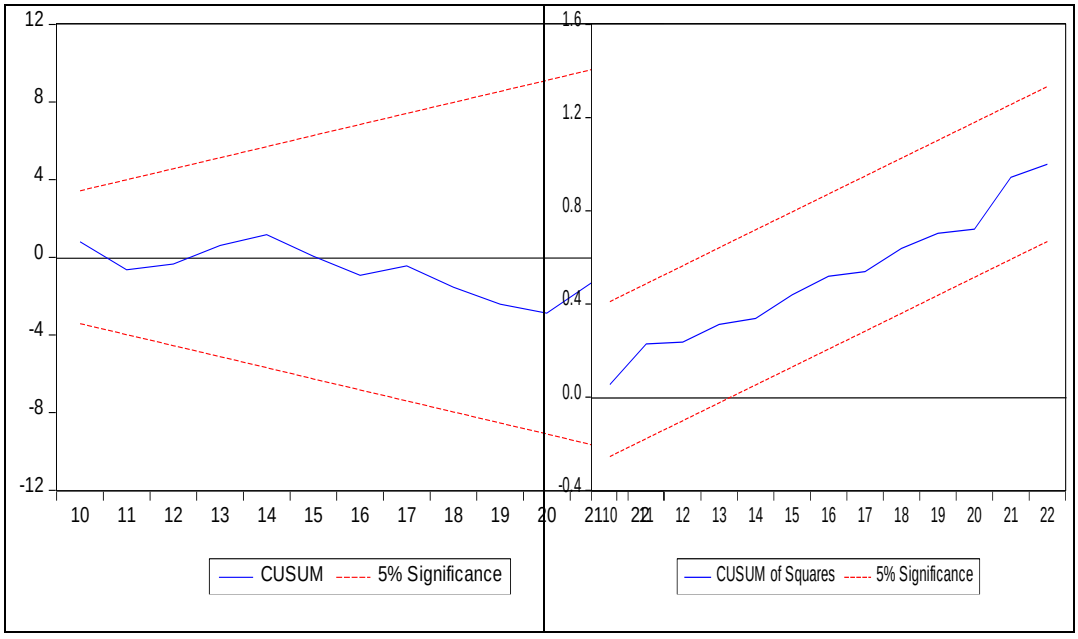

Figure 1. CUSUM and CUSUM of Squares Test Result

Source: Author's Illustration (2025).

Table ARDL result on the nexus **among Financial Sector Development, Renewable Energy and Economic Growth in Nigeria**

ARDL Error Correction Regression **Dependent Variable: GDP** **Selected Model: ARDL(1, 3, 1, 1, 3, 3)**				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
SHORT RUN				
D(FNDEV)	47.705	19.543	2.441	0.031
D (FNDEV (-1))	51.501	18.550	2.776	0.017
D(FNDEV (-2))	47.439	18.081	2.624	0.022
D(RE)	-0.813	0.239	-3.399	0.005
D(INF)	-0.128	0.028	-4.628	0.000
D(LGFCF)	-14.966	2.876	-5.204	0.000
D (LGFCF (-1))	-16.489	4.352	-3.788	0.003
D (LGFCF (-2))	-8.614	3.194	-2.697	0.019
D(POP)	-9.422	12.169	-0.774	0.453
D (POP (-1))	35.418	15.7012	2.256	0.043
D (POP (-2))	54.178	15.067	3.596	0.004
CointEq (-1) *	-1.306	0.137	-9.556	0.000
LONG RUN				
FNDEV	47.736	28.329	1.685	0.117
RE	-1.289	0.266	-4.847	0.000
INF	-0.047	0.029	-1.613	0.133
LGFCF	5.404	3.120	1.732	0.109
POP	10.112	8.424	1.200	0.253
C	60.495	32.527	1.859	0.088
R-squared	0.90			
Adjusted R squared	0.84			
S.E. of regression	1.39			
Durbin-Watson	2.63			
Breusch-Godfrey Serial Correlation LM Test	0.08			
Heteroskedasticity Test: Breusch-Pagan-Godfrey	0.33			

The ARDL short-run estimates show that financial development has a positive and significant relationship with GDP in both the current and lagged period. This suggest that financial development contributes to GDP growth in the short run. A percentage increase in financial development in the present, one and two lagged periods will increase GDP by 47, 51 and 47 percent respectively. However, renewable energy has a negative and significant impact with GDP, implying that, in the short run, renewable energy investment may be reducing GDP growth, possibly due to high initial costs or inefficiencies in adoption. A percentage increase in renewable energy consumption, reduces GDP by 81 percent. Similarly, inflation exhibits a significantly negative effect on GDP, suggesting that rising inflation reduces economic growth, likely due to reduced purchasing power and increased business costs. A percentage increase in inflation is seen to reduce GDP by 12 percent in the short run.

Gross fixed capital formation also has a significant and negative relationship with GDP, suggesting that capital investment in the short run is not translating into immediate GDP growth, possibly due to delayed returns on investment. A percentage increase in gross fixed capital formation in the current, one and two lagged period increases GDP by 14, 16 and 8 percent respectively. This deviates from theoretical expectation as investment is a major instrument of economic growth. Population growth in the first lag has a positive impact, while the second lag has a much stronger positive effect, indicating a delayed positive influence of population growth on GDP. A percentage increase in population growth in the first and second lag increases GDP by 35 and 54 percent respectively. The error correction term is negative and highly significant confirming that the model

adjusts towards long-run equilibrium. The adjustment speed of 130.6% suggests a rapid correction of disequilibrium.

The long-run analysis suggests that only renewable energy has a significant relationship with economic growth. Although the relationship is negative, it implies that renewable energy investment reduces GDP in the long run, possibly due to inefficiencies, high costs, or inadequate infrastructure. The renewable energy sector in Nigeria is still in its infancy, providing only a fraction of the country's total energy needs. Nigeria lacks the advanced technology and infrastructure needed to maximize the efficiency of renewable energy. Poor transmission and distribution networks hinder the effective utilization of renewable energy sources, limiting their contribution to economic growth.

Similarly, weak policy implementation, lack of incentives, and regulatory bottlenecks slow down the adoption and scalability of renewable energy. Inconsistent government policies and inadequate private-sector involvement hinder the sector's potential contribution to economic growth. However, financial development, inflation, gross fixed capital formation and population growth do not significantly affect economic growth in the long run.

For the Post-Estimation Diagnostic test, a probability value (0.57) is greater than (0.05), we conclude that there is no evidence of serial correlation. Similarly, the Breusch-Pagan-Godfrey test is used to detect the presence of heteroskedasticity in a regression model. The probability value of 0.82 is much greater than 0.05, indicating that we fail to reject the null hypothesis of homoskedasticity. CUSUM and CUSUM of Squares Tests are used to establish the stability of the estimated ARDL model. The model appears to be stable, with no significant structural breaks detected.

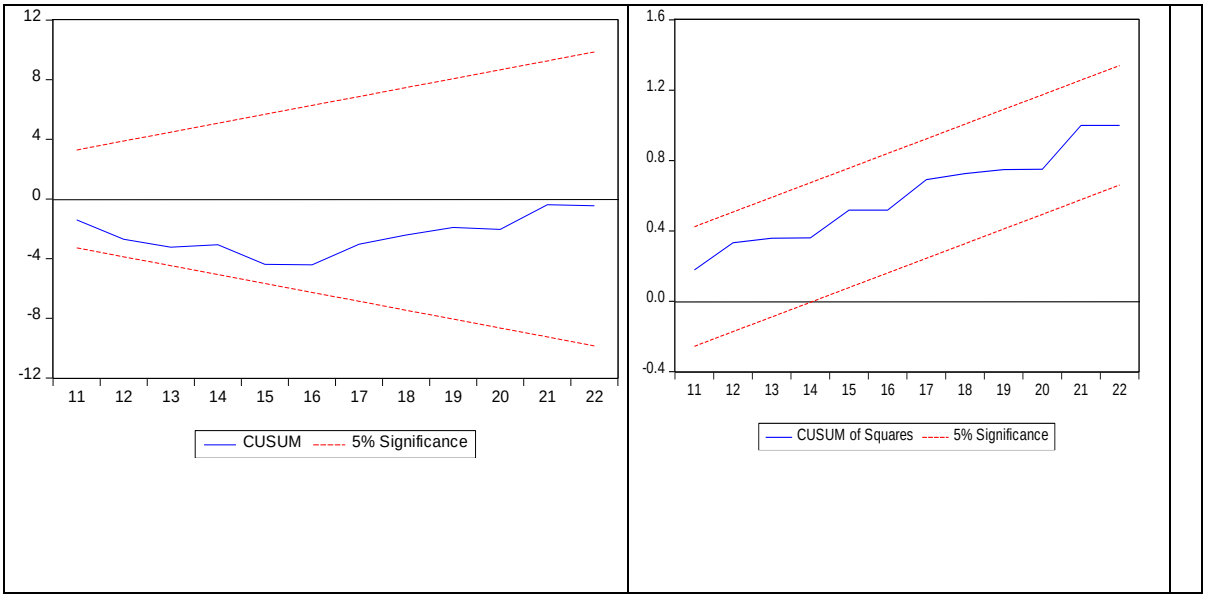

Figure 1. CUSUM and CUSUM of Squares Test Result

Source: Author's Illustration (2025).

CONCLUSION AND RECOMMENDATIONS

The study examines the relationship among financial development, energy consumption and economic growth in Nigeria, while dis-aggregating energy consumption into renewable and non-renewable energy. Results have shown that in the short and long run, financial development has a positive and significant relationship with GDP, indicating that financial sector growth contributes strongly to economic growth. Similarly, non-renewable energy has a strong positive and highly significant relationship with economic growth. However, renewable energy has a negative effect on economic growth in Nigeria. The study recommends that financial sector policies should be strengthened to further enhance GDP growth, as financial development is a key driver of economic performance. Given that n**o**n-renewable energy remains a critical driver of economic growth, the

transition to renewables should be gradual to avoid economic disruptions. Similarly, renewable energy investments need better efficiency to reduce their short-run negative impact on economic growth, possibly through subsidies or technological improvements. Inflation control measures are also crucial to sustaining economic growth, policymakers should ensure stable inflation rates through strict monetary and fiscal policies.

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