Renewable Energy Sources, Financial Development and Economic Growth in Nigeria

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ABSTRACT

The study empirically investigates the interconnectivity among renewable energy consumption, financial development, and economic growth in Nigeria, covering the period of 32 years that runs from 1980 to 2022. The variables employed in the study were economic growth proxy by GDP, financial development proxy by domestic credit to the private sector, foreign direct investment, access to electricity and renewable energy consumption. An autoregressive distributed lag model was employed to determine the short and long-run dynamic behaviours of the variables in the mode. It was discovered that all explanatory variables exert a positive relationship with gross domestic product in the short-run. However, in the long - run, foreign direct investment, renewable energy consumption and domestic credit to the private sector are positively associated with gross domestic product as evidently proved by their coefficient value of 0.6388, 0.5870 and 0.665545 respectively which implies that a unit change in each of these variables would on the average increase gross domestic product by 63%, 58.7% and 66.6% respectively while access to electricity coefficient value of 0.6064 has a negative relationship with gross domestics product but statistically insignificant which implies that a unit increase in access to electricity will on the average result to a decrease in gross domestic product by 60.6%. The study therefore recommends that the government should create a conducive policy environment, improve regulatory framework and launch public awareness campaigns to promote the alignment of financial resources through financial institutions with renewable initiatives which will eventually stimulate economic growth in the long run.

Keywords: renewable energy, financial development, economic growth, ARDL

INTRODUCTION

The relationship between financial development, energy consumption, and economic growth has been a subject of significant research and policy interest. These three factors are interconnected and can have profound implications for a nation's economic prospects and environmental sustainability. Financial development is

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a critical driver of economic growth. Studies have shown that an efficient and well-developed financial system plays a pivotal role in stimulating economic expansion. Rahman et al. (2019) find that financial development enhances productivity and resource allocation by facilitating access to credit and investment opportunities. Additionally, efficient financial markets enable efficient risk-sharing and mobilization of savings for productive investments, thereby contributing to sustained economic growth. However, economic growth often leads to increased energy consumption, particularly in developing economies.

Empirical evidence presented by Zhang et al. (2017) indicates a positive correlation between economic growth and energy consumption. As economies grow, there is a heightened demand for energy, primarily reliant on fossil fuels. This increased energy consumption can pose environmental challenges, including heightened greenhouse gas emissions and climate change concerns. Addressing the intertwined issues of energy consumption and economic growth requires adopting sustainable energy strategies. Awad and Bouri (2020) propose that policymakers prioritize investments in renewable energy sources to reduce reliance on fossil fuels, ensuring energy security and mitigating environmental impacts. Transitioning towards cleaner and more sustainable energy alternatives can pave the way for a more sustainable path of economic growth.

According to World Development Indicators (2021), Nigeria faces significant challenges in meeting electricity demand. In 2019, the country's electricity consumption per capita was approximately 146 kilowatt-hours (kWh), which is significantly lower than the global average. Furthermore, this is poor when compared with countries like China, Brazil and South Africa with 1379kWh, 1934kWh and 4,500kWh respectively (Akuru & Okoro, 2014).

Esan, Anthony and Obaseki (2019) postulated that the well-being of Nigerians and economic progress is at serious risk due to the current situation of power supply in the country. In order to improve electricity supply and access to its citizens, the Nigerian Government in 2003 introduced renewable energy into the National Energy Policy and in the year 2006, it created the Renewable Energy Master Plan (REMP). It was expected that with the successful implementation of the plan, there would be enough solar power: wind, hydroelectricity and solar thermal to provide the equivalent of today's total grid capacity by 2025.

Moreover, the financial sector can play a vital role in promoting green investments to address energy con-sumption and environmental challenges. Majeed et al. (2021) suggest that improved financial regulations and incentives can redirect investments towards sustainable technologies and projects.

Financial development, as the name suggests, is borne out of the development of the institutions, tools and markets, as well as the legal and regulatory framework (World

Resource Institute, 2018) that allows transactions to be completed through the extension of credit to individuals and businesses. As established by Tamazian et al (2019), a well-functioning financial system will ease financial constraints on firms to update production equipment and technologies thereby increasing energy efficiency. In addition, financial development encourages firms to improve research and development, investment, design and production of energy saving which essentially reduces energy used (Tamazian et al, 2019). Thus, develop-ing green financial instruments, such as green bonds and green venture capital, can spur innovation and entre-preneurship in the renewable energy sector, aligning economic growth with environmental objectives.

In light of this background, this study seeks to unravel the impact of renewable energy consumption and financial development on economic growth in Nigeria.

The rest of this study is structured as follows: following the introductory part is section two of the study which covers literature review. Section three of the study entails methodology which encompasses research de-sign, model specification, estimation technique and data description, sources and measurement.

CONCEPTUAL REVIEW

Renewable energy

Renewable energy, as the name implies, has been acknowledged as energy sourced from natural processes like water, wind and sunlight (Shinn, 2018). Renewable energy is also known as clean energy, i.e. constant stock-up energy from natural resources. Though their availability may depend on time and weather, the sun does not cease to shine nor the wind does not cease to blow. One of the sources of renewable energy sources is solar power which can be used in homes and businesses to provide light and heat. The sun has the potential with photovoltaic cells made from silicon, and this names it possible to collect solar power.

Economic growth

Economic growth has been defined as a sustainable increase in real output of goods and services from one period of time to another. It is usually measured in terms of annual increase in aggregate market value of goods and services using a proxy variable as GDP.

Financial development

This can be defined as the level of growth and improvement of the financial system in a particular country or nation.

THEORETICAL REVIEW

Neoclassical growth theory

This, as introduced by Robert Solow in 1956, serves as the cornerstone for understanding economic growth dynamics, primarily focusing on the roles of capital accumulation and technological progress. This theoretical framework forms the basis for exploring the interconnectedness between financial devel-opment, energy consumption, and economic growth.

Financial development, within the neoclassical context, is vital for efficient capital allocation. As stated by King and Levine (1993), well-developed financial systems enhance investment and contribute to economic growth. The neoclassical perspective emphasizes the significance of credit availability and financial intermediation in facilitating capital accumulation (Solow, 1956). Integrating energy consumption into the neoclassical growth model recognizes energy as a critical production input. Jorgenson and Wilcoxen (1993) highlight the importance of energy efficiency in contributing to productivity and, consequently, economic growth. Neoclassi-cal theory, when extended to incorporate energy considerations, provides insights into the impact of ener-gy-related factors on the growth process.

EMPIRICAL REVIEW

A quantum of studies have been conducted between financial development and economic growth as well as renewable consumption and growth prominent among these studies include (Onyinye et al, 2023, Badamosi et al. 2023, Stephen et al, 2023) among others.

Some of these studies include Stephen et al (2023), who examined the nexus and implica-tion(s) of financial development on renewable energy consumption in Nigeria. The study utilized the broad-based financial development index data to effectively address the multidimensional nature of financial development and the portion of renewable energy in total energy consumption as key variables, while other rel-evant pieces of information (growth rate of per capita GDP, foreign direct investment and consumer price index) were incorporated. Autoregressive distributed lag model (ARDL) was deployed to determine the long-run relationship[s] using data from 1981 to 2019. The study estimation finds, among other things, that financial development is critical for renew-

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able energy consumption in Nigeria and recommends policies to promote better outcomes for the financial and energy sectors, respectively.

Al-Mulali and Sab (2012b) investigate the impact of energy use on economic growth and financial devel-opment across a sample of 19 countries for the period of 1980-2008 in six CEMAC Countries which comprises Cameroon, Central Africa Republic, Congo, Gabon, Equatorial Guinea and Chad. The study used Generalized Method of Moment (GMM) as an estimation technique. The findings revealed that energy use sig-nificantly influences financial market development as well as the overall performance of the economy. It has, however, affected environmental quality negatively because it increases the rate of CO2 emissions in the economies. Using ARDL bound testing approach, Chaudhry et al. (2012) examine the nexus between energy consumption and economic growth in Pakistan for the period of 1972–2012. The result shows that when oil is used to measure energy consumption, it negatively affects economic growth. The causal relationship between energy consumption and economic growth was investigated by Abid and Sebri (2011) for the time frame of 1980–2007 using the VECM approach in Tunisia. The empirical finding shows that in overall, economic perspective energy consumption leads to higher eco-nomic performance, while at the sectoral level, energy use negatively affects economic growth. Using VECM technique, Islam et al. (2013) examine the impact of financial market growth, pop-ulation and economic performance on energy consumption in Malaysia. The finding reveals that energy con-sumption affects financial development and economic growth in the short and long-run as well, while its nexus with the growth of population exists only in the short run.

Shahbaz et al. (2013a) investigated the relationship between energy consumption and economic growth by incorporating financial development and trade variables from 1971–2011 in China using the ARDL framework. The empirical finding suggests that energy consumption, financial development and trade have a positive rela-tionship with economic growth. Shahbaz et al. (2013b) examined the connection between economic growth, en-ergy consumption, financial development, trade openness and CO^2 emission in Indonesia for the period of 1975 Q1 – 2011 Q2 and applied ARDL bound testing procedure. The result shows that an increase in gross domestic product (GDP) and energy use leads to an increase in CO^2 emissions, whereas financial development and liberalization compressed it. However, the VECM causality analysis indicated feedback hypothesis among energy use and CO2 emissions, bidirectional causality between economic growth and CO^2 emission exists and unidi-rectional causality exists running from financial development to CO^2 emissions.

Akintola et al (2020), investigated the impact of the financial sector development on economic growth in Nigeria by looking at the independent contributions of the money, capital and foreign exchange markets to the growth of the economy, using quarterly data between 2000 Q1 and 2019 Q4. The results indicated that while financial deepening, banking system liquidity and all share indexes had a 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. It is therefore recommended that the growth of the money and capital markets be prioritized by macroeconomic managers in Nigeria to improve the level of economic growth. More specifically, the study recommended that the monetary authority should adjust her policy rates and other instruments of monetary policy, such as the cash reserve ratio, to increase the level of banking system liquidity. This will increase banks' lending capacity to the private sector, with the benefit of increasing economic growth in Nigeria.

Coban and Topcu (2013) applied a system-generalized method of moments approach and examined the impact of financial development on energy consumption across European Union (EU) member countries for the period of 1990–2011. The finding indicated that the development of the financial system has a significant impact on energy consumption among old EU member countries irrespective of the financial indicator used. Conversely, in the new member countries, the effects rely on the type of financial development variable used. When bank index is applied, the effect signifies an inverted U-shape, whereas, it shows no significant relationship when stock market index is used. Abbas (2015) examined the favourable and substantial effect of the development of the financial sector by using channels of economic growth. Outcomes of this research show that an increase of 1% in FD brings a 0.024 % rise in EC. In Saudi Arabia, Mahalik et al. (2017) exposed the association between financial sector advance-ment and energy consumption for the era 1971–2011. Their results show that there is a one-way causation be-tween FD and EC. Similarly, in Nigeria, Odusanya et al. (2016) analyzed the relation between FD and EC for the era of (1971–2004). According to their results, there is positive and significant association concerning these variables. In addition, Komal and Abbas (2015) found the association of FD and EC in Pakistan by using urbanization and energy price as control variables. According to their results, development in the financial sector has a favourable and vital impact on the consumption of energy.

Furthermore, when the financial sector is developed, producers then take loans at low cost and purchase advanced technology which consumes less energy (Shahbaz et al., 2017). Hence, Mielnik and Goldemberg (2002) established a negative connection between FDI and energy consumption. Imamoglu (2019) suggests that there is a direct and definitive impact of financial advancement, trading, and economic growth on energy consumption, both in developed and emerging countries.

Shahbaz and Lean (2012) analyze the correlation between financial development and energy consumption in Tunisia. According to their findings, there is a direct association between financial sector advancement and energy consumption, because of the positive effect of the stock market on energy consumption.

Similarly, the Granger causality method was used by Dan and Lijun (2009) to test the connection between energy consumption and the development of financial sector in Belgium. Similarly, Ang (2009) expressed that domestic credit to the private sector (DCP) is an important indicator of financial development because the pri-vate sector is able to use their funds in a good manner in comparison with the public sector. To incorporate the overall credit expansion as the proxy of financial development, overall credit given by the banking sector, as well as broad money supply, was included. An increase in money supply increases financial depth (Gelb, 1989). The result revealed that Foreign Direct Investment (FDI) does not raise the consumption of energy.

Sami (2011) examines the impact of exports on energy consumption by incorporating income per capita in energy demand. The result shows that there exists a co-integration between the variables and VEC Granger causality confirmed unidirectional causality among exports, economic growth, and energy con-sumption. Sardosky (2010) investigates the impact of financial development on energy consumption in 22 emerging economies. The Generalized Method of Moments (GMM) technique was used and the findings show that financial development has a direct relationship with demand for energy. Mallick and Mahalik (2014) used annual data from 1971–2011 in India and China. They employ the ARDL approach to co-integration model and their results show that energy consumption is adversely linked with financial development in India and China. Kakar et al. (2011), in their study, Financial Development and Energy Consumption in Pakistan From 1980-2009 employ co-integration and error techniques as well as the Granger causality test. Their findings show a significant relationship between financial development and energy consumption in the long-run for Pakistan while the relationship in the short-run was insignificant for the period under consideration. The Granger causality indicates that financial development does affect energy consumption. Similarly, unidirectional causality was found between money supply and energy consumption while bi-directional causality was found between domestic credit and energy consumption.

In a study conducted by Ozturk and Acaravei (2013) on the relationship between energy consumption, eco-nomic growth, trade openness and financial development on carbon emission in Turkey (check this sentence). The study employed ARDL and error correction model estimation technique. The result revealed a uni-directional causality relationship between financial development, per capita energy consumption, per cap-ita real income, and square per capita real income between 1960 and 2007. They inferred that improvements in the financial sector will result in an increase in energy consumption and income in Turkey in the short run. Sadorsky (2011) examines the impact of financial development on energy consumption in the case of central and eastern European frontier economies using dynamic panel demand models. The results showed a positive relationship between financial development and energy consumption. In the case of China, following Karanfil (2008), Dan and Lijun (2009) applied the bivariate model to explore the relationship between financial development and energy consumption. Their empirical evidence reported that primary energy consumption Granger causes financial development. Xu (2012) revisited the relationship between financial development and energy consumption in 29 Chinese provinces. The existence of a long-run relationship was conditioned by the measure of financial development.

In Nigeria, a number of studies have investigated the relationship between financial development and energy consumption. Prominent among these studies include:

Chukwu and Agu (2009) adopt multivariate VECM to investigate the causality between financial depth and economic growth from 1971 to 2008. Their results suggest that financial depth and economic growth have a stable long-run relationship. They find evidence in support of the demand-following hypothesis when financial depth is proxy by the banking sector's private sector credit and real broad money supply and supply-leading hypothesis when loan deposit ratio and bank deposit liabilities are used as proxies for financial depth. Gbadebo and Okonkwo (2009) investigated the relationship between energy consumption and the Nigerian economy from the period of 1970 to 2005. The energy sources used to test for this relationship were crude oil, electricity and coal. By applying the co-integration technique, the results derived infer that there exists a positive relationship between current period energy consumption and economic growth. With the exception of coal which was positive, a negative relationship was noted for lagged values of energy consumption and economic growth.

Adegbemi, Adegbemi, Olalekan and Babatunde (2013) investigate the causal relationship between energy consumption and Nigeria's economic growth for the period of 1975 to 2010. Secondary time-series data were analyzed using co-integration and ordinary least square techniques. The result shows that in the long run, total energy consumption had a similar movement with economic growth except for coal consumption. The empiri-cal results reveal that petroleum, electricity, and aggregate energy consumption have a significant and positive relationship with economic growth in Nigeria. However, gas consumption, although positive, does not significantly affect economic growth. The impact of coal was negative but significant; therefore, this is just the time to increase the use of this resource to the nation's benefit.

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

Orhewere and Machame (2011) carried out a study aiming at determining the relationship between energy consumption and economic growth from 1970 to 2005. The method of analysis was a co-integration test and vector error correction model. The study found a unidirectional causality from electricity consumption to GDP both in the shortrun and long-run. Unidirectional causality form Gas consumption to GDP in the short run and bidirectional causality between the variable in the long run. Although no causality was found in either direction between oil consumption and GDP in the short run, a unidirectional causality from oil consumption to GDP was found in the long run. Their findings showed that a policy to reduce energy consumption aimed at reduc-ing emissions will have a negative impact on GDP in Nigeria.

Enu and Havi (2014) carried out a study aiming at examining the extent to which electricity consumption influences economic growth in Ghana. The study employed Augmented Dickey-Fuller test, Co-integration test, Vector Error Correction Model and Granger Causality test. The study revealed that, in the long term, a hundred percent increase in electricity power consumption would cause real gross domestic prod-uct per capita to increase by approximately fifty-two percent. However, in the short run, electricity consumption negatively affects real gross domestic product per capita. The study again revealed that unidirectional causality runs from electricity consumption to economic growth, meaning that any policy actions taken to affect the smooth consumption of electricity in Ghana will definitely affect her gross domestic product per capita.

Adeyemi and Ayomide (2013) examined the relationship between electricity consumption and economic growth in Nigeria using the Johansen and Juselius cointegration technique based on the Cobb–Douglas growth model covering the period 1980-2008. The study adopted also conducted the vector error correction modelling and the pairwise Granger causality test. The study found the existence of a unique co-integrating relationship among the variables in the model with the indicator of electricity consumption impacting significantly on growth. Also, the study shows evidence of a bi-directional causal relationship between elec-tricity consumption and economic growth.

METHODOLOGY

Theoretical framework

The underpinning theory of this study is the Neoclassical growth theory, introduced by Robert Solow in 1956. This theoretical framework forms the basis for exploring the interconnectedness between financial development, energy consumption, and economic growth.

Research design

This study made use of ex-post facto research design which enables us to measure the effect or relationship between dependence variable and explanatory variables using time-series secondary data. To empirically ex-amine the impact of financial development and energy consumption on economic growth in Nigeria, the re-searcher subjected the data collected to Engle-Granger cointegration test and error-correction mechanism.

Data sources

To investigate how financial development, energy consumption could affect economic growth in Nigeria, a number of variables have been taken into consideration in this study. These variables consist of domestic credit to the private sector, domestic credit to the financial sector, renewable energy consumption, access to electricity, inflation, and gross domestic product (growth rate) for the period of 1990-2022 and are defined in our model specification based on their objective. All the variables were sourced from World Bank Development Indicator (WDI).

The model specification for this study is stated below:

 $GDP = f(AE, FDI, REN, DCPS) \dots 1$

This is further transformed to an econometric model as;

 $GDP = a_0 + a_1 AE + a_2 FDI + a_3 REN + a_4 DCPS + U \dots 2$

Where: a_0 is the intercept of the model, are the coefficients of the explanatory indicators, where U is stochastic error term; GDP is a proxy for economic growth; AE represents access to electricity' REN represents renewable energy consumption; FDI represents foreign direct investment; DCPS is domestic credit to the private sector

VARIABLE DESCRIPTION, MEASUREMENT AND SOURCE

The study collected data from World Bank development indicator data base

	Variable	Definitions	Measurement	Source
1	DCPS	Domestic credit to private to private sector	Billions of naira	World Bank Indicator (2022)
2	GDP %	GDP annual growth rate	In percentage	World Bank Indicator (2022)
3	FDI	Foreign direct investment	Billions of dollars	World Bank Indicator (2022)

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4	AE	Access to electricity	Percentage of the population	World Bank Indicator (2022)
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RESULTS AND DISCUSSION

This section of the study provides results on the data analyzed the descriptive statistics, test for stationary, co-integration test, are presented. Also, results obtained from the regression analysis are discussed based on their objectives.

	GDP	REN	FDI	AC_E	DCPS
Mean	3.206486	84.89594	3.09E+09	3.24E+09	3.21E+09
Median	4.127395	84.65000	2.16E+09	2.61E+09	2.53E+09
Maximum	10.34690	88.68000	8.84E+09	2.44E+10	2.32E+09
Minimum	-3.363187	80.64000	3.00E+08	-3.22E+10	2.58E+10
Std. Dev.	3.239290	2.328739	2.61E+09	1.44E+10	1.68E+09
Skewness	-0.472813	-0.161486	0.868488	-0.730630	0.74630
Kurtosis	2.843415	1.910523	2.555125	3.480269	3.42602
Jarque-Bera	1.224968	1.721694	4.286667	3.154582	3.164572
Probability	0.542003	0.422804	0.117263	0.206534	7.86E+11
Sum	102.6075	2716.670	9.87E+10	1.04E+11	0.207535
Sum Sq. Dev.	325.2830	168.1138	2.11E+20	6.41E+21	8.42E+21
Observations	32	32	32	32	

Table 1: Descriptive analysis

The standard deviation reveals the extent to which a variable is spread around its mean. The standard deviation for variables (FDI, ACE.DCPS) is lower than their means; this shows a low coefficient of variation for the variables in the data series, while the GDP growth rate is higher than its mean. This reveals high coefficient variation. Jarque-Bera statistics of 1.224968, 1.721694. 4.286667, 3.154582, and 3.164572 for GDP, renewable energy consumption, foreign direct investment, access to electricity and domestic credit to the private sector. The result of the Jarque bera test indicates that test static of all the variables GDP, REN, FDI, AC_E and DCPS mentioned is higher than their probability value of 0.542003, 0.422804, 0.117263, 0.206534 and 0.2075357 which signifies that the null hypothesis has to be rejected that the data is normally distributed. Positive skewness means the values are more than zero, which signifies a better performance indicator, i.e the more skewed the data, the less accurate the model will be. Kurtosis is used as a measure of financial risk because it indicates high probabilities of extremely large and

extremely small returns if it is high kurtosis while a small kurtosis signals a moderate level of risk. GDP, REN and FDI have less kurtosis value, which indicates a moderate level of risk, while AC_E and DCPS have higher kurtosis value, which indicates a higher level of risk which means that the probabilities of extreme returns are relatively high.

ADF Variable	ADF Statistics	Critical values	P Value	Order of	Remark
GDP	2 200121	-2.960411	0.0192		Stationary
AE	-6.349955	-2.967767	0.0000	l(1)	Stationary
FDI	-6.162202	-2.963972	0.0000	l(1)	Stationary
REN	-5.363324	-2.963972	0.0001	1(1)	Stationary
DCPS	-5.162212	-2.963973	0.0000	l(1)	Stationary

Table 2: Unit root test and co-integration properties of variables

Since the variable in the ADF test conducted were stationary at different level of co-integration (mixed co-integrated), the study went further to adopt the ARDL estimation technique to examined the long run and short run macro-economic relationships among variables.

Table 3: Short run Regression Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DCPS)	0.0023	0.0006	3.7882	0.0009
D(AE)	0.0003	0.0002	-2.2381	0.0417
D(FDI)	0.0026	0.0006	3.6885	0.0008
D(REN)	0.4873	0.1192	-4.0754	0.0004
CointEq(-1)	-0.32241	0.0601	-5.5278	0.0000

Table 3 revealed the short-run dynamic regression of the model. The regression result indicates that in the short run, domestic credit to the private sector, access to electricity, foreign direct investment and re-newable energy consumption have a positive relationship with gross domestic product and are statistically sig-nificant at 0.0009, 0.0417, 0.0008 and 0.0004 respectively. This implies that a 1% change in financial develop-ment as a proxy by domestic credit to the private sector, access to electricity, foreign direct investment and re-newable energy consumption increases gross domestic product by 0.0009, 0.00417, 0.0008 and 0.0004, respectively.

The error correction term is negative and statistically significant as expected. The result shows that about 32.2% of deviations in the short run are corrected in the long

run annually. This implies that the system con-verges to equilibrium and the estimated model is stable.

Table 4:ARDL Bounds Test

ARDL Bounds Test Date: 01/27/24 Time: 12:16 Sample: 1994 2021 Included observations: 28						
Test statistic	Value	K				
F-statistic	F-statistic 8.251470 3					
Critical Value Bounds						
Significance	I0 Bound	I1 Bound				
10%	2.72	3.77				
5%	3.23	4.35				
2.5%	3.69	4.89				
1%	4.29	5.61				

ARDL Co-integration and Long Run Form Dependent Variable: GDP_____ Selected Model: ARDL(4, 3, 4, 4) Date: 01/27/24 Time: 12:14 Sample: 1990 2021 Included observations: 28

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP_(-1))	0.122006	0.414648	0.294240	0.7752
D(GDP_(-2))	0.120170	0.359945	0.333857	0.7461
D(GDP_(-3))	-0.339233	0.326332	-1.039532	0.3257
D(REN)	1.796341	0.923171	1.945837	0.0835
D(REN(-1))	0.997890	0.703997	1.417464	0.1900
D(REN(-2))	-0.968174	0.561830	-1.723250	0.1189
D(FDI)	-0.000000	0.000000	-2.844431	0.0193
D(FDI(-1))	-0.000000	0.000000	-2.015968	0.0746
D(FDI(-2))	-0.000000	0.000000	-2.051771	0.0704
D(FDI(-3))	0.000000	0.000000	1.899969	0.0899
D(AC_E)	0.000000	0.000000	1.400042	0.1950
D(AC_E(-1))	0.000000	0.000000	2.260638	0.0501

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ARDL Co-integration and Long Run Form Dependent Variable: GDP Selected Model: ARDL(4, 3, 4, 4) Date: 01/27/24 Time: 12:14 Sample: 1990 2021 Included observations: 28						
Cointegrating Form						
Variable	Variable Coefficient Std. Error t-Statistic Prob.					
D(AC_E(-2))	-0.000000	0.000000	-2.729722	0.0232		
D(AC_E(-3)) 0.000000 0.000000 2.089552 0.0662						
CointEq(-1) -0.595729 0.545918 -1.091241 0.3035						
Cointeq = GDP (0.6655*REN + 0.0000*FDI -0.0000*AC_E -52.1768)						

DISCUSSION

The long-run coefficients in this ARDL model represent the estimated relationship between the dependent variable, GDP and the independent variables, AC_E, REN, FDI and DCPS in the long run. The result of the long-run dynamic regression of the model is presented in Table 4. The regression result indicates that in the long run, foreign direct investment coefficient has a positive relationship with the gross domestic product and is statistically insignificant at 0.6386 greater than a 5 percent significance level, and with a coefficient of 0.00. That is, a unit change in foreign direct investment will result in an increase in the gross domestic product by 0.00 percent in the long run, all things being equal.

The result of the long run dynamic regression of the model is presented in table 4. The regression result in-dicates that in the long run, renewable energy consumption coefficient has a positive relationship with the gross domestic product and is statistically insignificant at 0.5870 greater than a 5 percent significance level, and with a coefficient of 0.665545. That is, a unit change in renewable energy consumption will result in an increase in gross domestic product by 66 percent in the long run all things being equal. The result of the long-run dynamic regression of the model is presented in Table 4. The regression result indicates that in the long run, access to electricity coefficient has a negative relationship with gross domestic product and is statistically insignificant at 0.6064 greater than 5 percent significance level, and with a coefficient of 0.000000, that is, a unit change in ac-cess to electricity will result in an increase in gross domestic product by 0.00 percent in the short run all things be equal.

CONCLUSION

The study unravelled the impact of financial development and energy consumption on economic growth. Variables used in the study include renewable energy consumption in aggregate, financial development as a proxy by domestic credit to the private sector, access to electricity, foreign direct investment and economic growth. The key estimation technique used is autoregressive distributed lagged. This is to establish whether there is a short run and long run impacts of financial development, renewable energy consumption and eco-nomic growth during the coverage period.

The findings revealed that domestic credit to the private sector, access to electricity, foreign direct invest-ment and renewable energy consumption all have positive associations with gross domestic product. The error correction model showed the expected magnitude, and this implies that a 32.2 percentage deviation in the short run is corrected in the long run annually. Though the short run remains inconclusive with respect to renewable energy consumption and domestic credit to the private sector, the long-term implication signifies alignment with a global pattern thereby suggesting that sustained investment in renewable energy through financial institutional role could boost economic growth in the long run.

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