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Energy Consumption and Life Expectancy in Nigeria

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Abstract

This study examined the effect of energy consumption (decomposed into renewable and non-renewable energy) on life expectancy in Nigeria from 1981 to 2022. The data for the study is sourced from Central Bank Statistical Bulletin. Energy consumption is proxied by Alternative and Nuclear Energy (ANE), Per Capita Electricity Consumption (CPN) and Fossil Fuel Energy Consumption (FEN), while Life expectancy is proxied by life expectancy at birth. The variables were subjected to stationarity tests and the result shows that the variables were integrated of mixed order of integration (level i(0) & first difference i(1)). This justified the adoption of the Autoregressive Distributed Lag (ARDL) as technique of analysis. The ARDL Bounds test result indicates that long-run relationship exist among the variables in the model. The long result showed that Per Capita Electricity Consumption (EPN) and Per Capita Income (PCI) have positive effect on life expectancy, while Fossil Fuel Energy, Trade Openness, and Alternative and Nuclear Energy (ANE) have negative effect on Life Expectancy in Nigeria. The short run result also shows that per capita electricity consumption has positive effect on life expectancy, while fossil fuel energy consumption and trade openness have negative effect on life expectancy in Nigeria. The study concludes per capital electricity consumption affects life expectancy positively, while fossil fuel energy consumption and alternative and nuclear energy affect life expectancy negatively in Nigeria. This study therefore recommends the adoption of green energy consumption as to improve life expectancy in Nigeria,

Keywords: *Energy Consumption, Life expectancy, Renewable and Non-renewable energy*

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Background to the Study

The quest for economic growth and the need to meet the consumption demand of the teeming population lead to increasing demand for energy. Consumption of energy especially fossil fuel is the primary source of carbon (iv) oxide emission responsible for climate change worldwide and, Nigeria has been acknowledged as one of the main producers and consumers of fossil fuel (Alege, Oye & Adu, 2017). Without mincing words energy consumption especially fossil fuel consumption worsens environmental quality and creates serious harm to people's health and affect aquatic life adversely. The consequence of this is the degradation of the environment, and this has implication for budgetary allocation in terms of health care financing (Balan, 2016).

The continuous consumption of energy regrettably posse a continuous threat to the environment and human life as a result of environmental degradation leading to decline in life expectancy at birth. To guarantee healthy lives and general well-being for all, the United Nations Sustainable Development Goal (SDG3) number three emphasizes good health and well-being of citizens in developing economies by 2030. The Nigeria experience shows the citizens' welfare has been on the decline in the last few decades especially those in the Niger Delta region, given the high rate of pipeline vandalization, and the operation of illegal refinery that gave rise to black soot. This act (illegal refineries operation) increases the rate of respiratory tract diseases with its attendant consequences on the health of the poor.

WHO (2020) opined that the top 10 causes of death in Nigeria in 2019 are mental disorders, accounting for 12.25% of deaths; malaria, 12.2%; diarrhea, 11.36%; respiratory infections, 10.85%; HIV/AIDS, 5.18%; ischemic heart disease, 4.37%; stroke, 3.98%; congenital birth defects, 3.26%; tuberculosis, 2.84%; and meningitis, 2.82%. The sum of these ailments alone accounted for almost 69% of Nigerian deaths in 2019. In 2021, life expectancy at birth in Nigeria is 59 years for males and 63 years for females. Nigeria has one of the highest tuberculosis burdens in the world (311 per 1000), resulting in the largest burden in Africa (UNCED, 2018). These health-related challenges are attributed to the unsustainable use of energy resources in Nigeria.

Although there has been an array of empirical literature relating to the effect of energy consumption on health outcomes with varying degrees of impact, For instance, the empirical studies of Afolayan and Aderemi (2019), Urhie, Afolabi, Matthew, Osabohien and Ewetan (2020), Musa and Maijama (2020), Maji and Adamu (2021) and Oyedele (2022) shows that energy consumption has a positive effect on health outcomes, while the work of Osakede and Sanusi (2018), Matthew, Osabohien and Fasina, (2018) and Rahman and Alam (2022) indicates that health outcomes decrease as energy consumption increases. To these ends, there is no consensus of opinion among scholars on the influence of energy consumption on health outcomes, and to fill that research gap, this study investigates the effect of energy consumption on life expectancy in Nigeria. The question begging for answer is, does energy consumptions disaggregated into renewable and non-renewable energy consumption has any effect on life expectancy in Nigeria? This study is divided six subsections; introduction in section one, followed by literature review in section two. Section three is the methodology, followed by data analysis and discussion of findings in section four and conclusion and recommendations in section five.

Literature Review

Theoretical Literature

Pollution Haven Theory

Copeland and Taylor proposed the Pollution Haven Hypothesis (PHH) in 1994. The pollution haven theory stated that major industrialized countries seek to establish factories or offices abroad, due to profit motive. However, doing so frequently results in actions that are harmful to the environment. Due to this, businesses primarily relocate abroad frequently to nations with lax environmental regulations or inadequate enforcement. PHH emphasizes that pollution costs influence the margins, where they have some influence on trade flows and investment decisions. Costs associated with pollution control are significant enough to have an impact on commerce and investment. To entice investment or boost exports, nations lower their environmental standards below those that would maximize societal efficiency.

The empirical support to the PHH is mixed as (Jaffe et al., 1995; Tobey, 1990) did not find any evidence to claim that stringency of environmental regulation of a country had any impact on the trade of pollution-intensive goods. On the other hand, Mani and Wheeler (1998**),** found temporary evidence in favour of the PHH. Cole (2004) also found that pollution intensive industries grew at rapid speed in developing countries in the periods when environmental regulations in OECD countries had been very stringent. Similarly, Frankel and Rose (2005) also found a support for the PHH from a city-level study of SO2 concentrations and Cole and Elliott (2005) also supported these results.

Nevertheless, Dinda (2004), rejected the PHH stance. He submitted that the polluting industries that tend to locate in the developing countries would also raise the income levels of the host country. Resultantly, these host countries would also start imposing the stringent environmental regulations. Therefore, sooner or later there would be no country where polluting industries can be relocated, and all countries would be on same playing level.

The criticism against the PHH is; thus, first, it is argued that firms while shifting to a country that has lax environmental regulations also consider that pollution reduces the productivity of the labour force that may raise the labour cost of the firm. Second, the firms also consider the huge sunk cost when they decide to shift the production operation to another country. Third, the countries with lax environmental regulations usually have a weak legal system and ill-defined commercial laws. Whereas the investors from developed countries prefer the countries that have clear regulations and effective enforcement of laws. Therefore, they are likely to avoid investing in those countries that have lax environmental regulations (Ethier, 1982; Helpman, 1984; Markusen, 1984). From the PHH stand point, the stringent environmental regulations in developed countries lead to relocation of the polluting industries from developed to developing countries and cause pollution to rise in developing countries. While on the other hand, PH holds that, stringent environment regulations prompt advanced technologies and innovations that reduce relocation of the industries, improve the competitiveness of the industries, and thus improve the environment. The empirical studies reveal that environmental regulations play a different role in different perspective.

The relevance of the PHH to the current study is that multinational corporation (MNC) trade and investment have a disrupting health outcome due to the impact of pollution (transfer of dirty goods) on the environment in the developing countries. For example, as more dirty firms migrate to country with lax environmental control or regulations, there are likelihood FDI inflow is guaranteed but overtime the activities of the MNC tends to create pollutant that pollute the environment which in turn causes health hazards. It is upon this basis that PHH is imperative to underscore the nexus between energy consumption and health outcome. This is also because, MNC requires fossil fuel energy to power their plants which causes gas flaring and thus disrupts the ecosystem and the sustainable environmental condition of the place where production activities had occurred. The Niger Delta of Nigeria is a classic example of the long-run implication of PHH migration to areas with lax environmental control. Overtime there has been massive environmental degradation, decline in biodiversity, and high mortality occasioned by disrupting pollution. Thus, as the scale of production of the MNCs increase there is high tendencies that life expectancy would decline.

Empirical Literature

Energy Consumption and Life Expectancy

Oyedele (2022), examined the health consequences of environmental quality due to carbon dioxide emission in Nigeria for the period 1980 to 2016. Using two health outcome measures and decomposing carbon dioxide emission by sector and type of fuel consumed a bound co-integration approach and an autoregressive distributed lag model were also employed. The results and a sensitivity analysis revealed that aggregate carbon dioxide emission significantly explained both infant mortality and under five mortality rates. However, when disaggregated, carbon dioxide emission from solid fuel had the greatest contribution to poor health outcomes. Rahman and Alam (2022), examined the effects of globalization, energy consumption and information communication technology on health status in Australia: the role of financial development and education using the data period of 1990–2018, a series of econometric techniques: the Dickey-Fuller test, Autoregressive Distributive Lag bounds test, fully modified ordinary least square method and the pairwise Granger causality test, are applied. The findings disclosed that globalization, renewable energy use, information and communication technology, per capita gross domestic product, education rate, and financial development increased during this period, but non-renewable energy use reduced life expectancy at birth. Unidirectional causal associations of the studied variables with life expectancy at birth are also revealed. The study concluded that the effective, efficient, and inclusive policies considering globalization, renewable and non-renewable energy consumption, information and communication technology, financial development, education rate, and economic growth should be formulated and executed for guaranteeing health status.

Gershon and Emekalam (2021), empirically analyzed the determinants of Nigeria's renewable energy consumption between 1990 and 2014, a period of twenty-four years using

Toda- Yamamoto method. Long-run relationship exists between renewable energy consumption and its determinants in Nigeria. Real income (real GDP) and emissions of CO2 are the most significant determinants of oil products import demand in Nigeria. Trade Openness was found to be insignificant. The analysis showed no causality between the consumption of renewable energy and some of its determinants. However, unidirectional causality runs from CO2 emission to GDP which implies that fossil fuels are significant drivers of real GDP or economic growth for Nigeria. It is evidenced that environmental considerations are less critical than real income to the consumption and development of renewable energy in Nigeria.

Maji and Adamu (2021), examine the impact of renewable energy consumption on sectoral environmental quality in the presence of government effectiveness in Nigeria. A regression analysis was used to estimate a dataset for the period of 1989–2019. Sectoral environmental quality indicators and sectoral output were considered from the agricultural sector, manufacturing and construction sector, transportation sector, oil sector, residential buildings and commercial and public services sector, other sectors and per capita indicator. The result shows that renewable energy consumption does not have a favourable impact on the environmental quality of the agricultural sector, manufacturing and construction sector and oil sector. However, renewable energy consumption has a favourable impact on the environmental quality of the transportation sector, residential buildings, commercial and public services sector. Nevertheless, renewable energy consumption has a neutral impact on the environmental quality of other sectors. Policy implications were drawn after considering the expected value of sectoral environmental quality indicators with significant elasticities.

Urhie et al., (2020), examined economic growth, air pollution and health outcomes in Nigeria: A moderated mediation model. The third of the sustainable development goals is to ensure healthy living and promote well-being for all by 2030. The Nigerian government has made several efforts at achieving this goal. Economic experts have projected that the Nigerian economy must grow at a minimum rate of 6–8% yearly to catch up with global development and contribute positively to goals set by nations of the world. However, the attainment of high levels of economic growth could have implications for the attainment of other development objectives in the economy. One of such implications is pollution of the environment caused through productive activities. In carrying out productive activities, a cycle from production to consumption occurs to affect the release of emissions into the atmosphere and environment which in turn hampers health stability. In order to assess the cyclical effects of these economic relationships, this study adopted the use of a moderated mediation model. The model helped in the explanation of interactions among economic growth, air pollution and health performance. The interactions were analyzed with process macro, an analytical tool developed by Hayes. The study found air pollution and government expenditure on health as a significant interaction that affects health performance in Nigeria. Consequently, efforts by the government to ensure environmentally friendly production and consumption will minimize air pollution and prevent adverse health outcomes. Manufacturing firms that emit poisonous gases into the air should be sanctioned. This will serve as a deterrent to others.

Musa and Maijama (2020), investigated the influence of economic growth and energy consumption on environmental pollution in Nigeria for over 1981-2014 periods and utilized Augmented Dickey Fuller (ADF) and Philip Perron (PP) unit root tests together with Autoregressive Distributed Lag (ARDL) Model in the process of achieving the desire objective. The outcome revealed that all the variables were stationary at first difference and cointegrated whereas the long-run outcome revealed that economic growth and energy consumption have significant positive effects on environmental pollution and this implies that increasing economic growth and energy consumption are responsible for the increasing level of environmental pollution while crude oil price has negative and significant influence on environmental pollution which implies that crude oil price reduces environmental pollution in the long-run. All the short-run outcomes corroborate their long-run counterparts. Nigeria government should emphasis more on the consumption of renewable energy in order to lessen the damaging impacts of economic activities and fossil fuels energy consumption on the quality of the country's environment.

Yahaya, (2019), examines the relationships between energy consumption, financial development, GDP, urbanization, and environmental pollution in Nigeria from the period 1980- 2011 by applying autoregressive distributed lag (ARDL) method. The finding shows that in the short-run energy use is positively related with environmental pollution, while financial development and GDP reduce environmental pollution. The long-run analysis shows that energy consumption is positive and significant in influencing environmental pollution. The results suggest that Nigerian policymakers should formulate efficient policies, such as adoption of low emissions technology in Nigeria to achieve a clean environment.

Wang, Yin and Zeng (2019) examined how the widespread adoption of natural gas as a source of clean energy improves the health of pregnant women: Using variation across provinces and over time in the density of natural gas infrastructure in China, the result identified a significant and negative clean energy adoption – maternal mortality relationship in China. The time series data covered 2000-2014. Specifically, it was shown that a one-unit increase in natural gas density measured by the length of natural gas pipelines per 10,000 persons caused the maternal mortality rate to decrease by 4%, which translated into an annual gain of approximately 648 pregnant women's lives. The finding suggests that natural gas adoption has substantial health externalities and should be an important part of policy discussions surrounding clean energy production.

Afolayan and Aderemi (2019), empirically examined the relationship between environmental quality (proxied by carbon dioxide, CO_2) and health effect; and its implications for achieving sustainable economic development in Nigeria from 1980 to 2016. DOS and causality test were employed that CO_2 emissions and mortality rate are negatively but insignificantly related. However, total electric power consumption and mortality rate have a positive relationship which is significant at 5% level. Also, Fossil fuel combustion and mortality rate have a significant positive relationship. From the causality test; the study found a unidirectional causality which runs from CO_2 emission to electric power consumption is observed, CO_2 emission granger causes government health expenditure, life expectancy granger causes electric power consumption and fossil fuel consumption granger causes mortality rate, and a unidirectional causal relationship flowing from life expectancy and mortality rate to government health expenditure.

Research Design

Research design means the template for data collections in the form of experimental and quasi-experimental design. This study will adopt a quasi-experimental research design since it is the most suitable research design for social sciences. The quasi-experimental research design will enable the researcher to determine the cause-and-effect relationship between dependent and independent variables and does not rely on random assignment of data.

Model Specification

The baseline study for this paper is built on Suleiman and Abdul-Rahim (2018) model. The study captured the impact of population growth and economic growth on environmental quality. Suleiman and Abdul-Rahim (2018) estimated the effect of population and economic growth on carbon dioxide emission (proxy as CO2) in Nigeria using a recursive ordering model given in equation 1 such as;

$$CO2_t = \beta_1 + \beta_2 Y_t + \beta_3 EC_t + \beta_4 PG_t + \mu_t$$

Where:
C02t = Carbon dioxide emission per capita
Yt= Real GDP per-capita
ECt= Energy consumption per capita
PGt= Population growth rate
μt= Stand for random term/disturbance

This foregoing baseline study showed a functional relationship between CO2 emissions and energy consumption and growth. The paper did not consider the impact of energy consumption on health outcomes in Nigeria. Given, the imperative of policy shift towards energy mix it is apt to therefore deepens the literature's concern on the nexus between energy consumption and health in Nigeria. In this study, energy consumption is decomposed into renewable energy and non-renewable energy. Therefore, life expectancy (LEX) is proxied by life expectancy at birth.

Model Specification:

LEX = f (ANE, EPN, FEN, PCI, TOP) 2

The econometrics form of the equation is expressed as follows:

$LEX_= \beta_0 + \beta_1 ANE + \beta_2 EPN + \beta_3 FEN + \beta_4 PCI + \beta_5 TOP + \mu$ 3

Where:
LEX = Life expectancy
ANE = Alternative and nuclear energy use

EPN = Electric power consumption
FEN = Fossil fuel energy consumption
PCI = Per Capita Income - Controlled variable
TOP =Trade openness – Controlled variable
A priori $\beta 1, \beta 4, \beta 5 >< 0$ while $\beta 2, \beta 3 < 0$

Data Analyses & Interpretation
Descriptive Statistics
Table 1: Descriptive Statistics: Life Expectancy Model (LEX)

	LEX	ANE	EPN	FEN	PCI	TOP
Mean	48.57507	0.374938	108.7436	19.47865	1798.366	46.98951
Median	46.51000	0.350200	100.8853	18.95003	1607.000	48.45000
Maximum	54.68700	0.561356	156.7972	22.84479	2564.000	81.81000
Minimum	45.63700	0.274464	50.90104	15.85414	1324.000	21.12000
Std. Dev.	3.235404	0.079401	29.84129	1.549048	446.8618	18.33401
Skewness	0.745887	0.675946	0.117544	0.327402	0.447819	-0.003192
Kurtosis	1.939505	2.732707	1.675576	2.688815	1.555531	1.727264
Jarque-Bera	5.722983	3.244220	3.091001	0.897905	4.934790	2.767326
Probability	0.057183	0.197482	0.213205	0.638296	0.084805	0.250659
Sum	1991.578	15.37248	4458.488	798.6247	73733.00	1926.570
Sum Sq. Dev.	418.7136	0.252180	35620.09	95.98201	7987420.	13445.43
Observations	41	41	41	41	41	41

Source: Authors compilation, 2023

From the descriptive result in Table 1, the result shows that the mean value, which is the average of the distribution between 1981 and 2021 for LEX, ANE, EPN, FEN, PCI, and TOP is 48.57507, 0.374938, 108.7436, 19.47865, 1798.366, and 46.98951, while the median value is 46.51000, 0.350200, 100.8853, 18.95003, 1607.000, 48.45000 and 17.89500. Relatively, all the series have the capability to withstand external aggression since their median values are close to their mean. The maximum and minimum values for the distributions are: 54.68700, 0.561356, 156.7972, 22.84479, 2564.000, 81.81000 and 19.40800 and 45.63700, 0.274464, 50.90104, 15.85414, 1324000, 21.12000 and 11.63000 respectively. The measure of dispersion or spread in the series is gauged by standard deviation as 3.235404, 0.079401, 29.84129, 1.549048, 446.8618, and 18.33401 for LEX, ANE, EPN, FEN, PCI, and TOP respectively. This shows how the series deviates from the mean. The skewness statistics shows that LEX, ANE, EPN, FEN and PCI have a long right tail, while TOP has a long-left tail. The Kurtosis which measures the peakness of the distribution indicates that LEX, EPN, PCI, and TOP have a flat and plytokurtic disposition, while ANE and FEN present a mesokurtic disposition, relative to normal. Finally, the Jacque-Bera statistics and the associated probability values of the variables indicate that the residual follows a normal distribution because their probability values are greater than the 5% statistically significant level.

Unit Root Test

The unit root test for the stationarity condition of the series was performed using the Augmented Dickey-Fuller (ADF). Test statistics are extracted and presented in Table 2.

Table 2: Unit Root Result

Variables Constant And Trend	At Level, T-stat @5% Critical value		First Differencing T-stat @5 %, Critical value		Order
LOG(LEX)	-3.3006761	-3.527759	-6.321356	-3.529758	I(1)
ANE	-3.945138	-3.526609	-	-	I(0)
LOG(EPN)	-3.686895	-3.526609	-	-	I(0)
FEN	-3.235413	-3.526609	-6.471925	-3.529758	I(1)
LOG(PCI)	-1.569833	-3.533083	-3.713407	-3.533083	I(1)
TOP	-1.920088	-3.526609	-4.071247	-3.552973	I(1)

Source: Authors compilation, 2023

Evidence from the stationarity test table 2 conducted with a unit root procedure proposed by Augmented Dickey Fuller (ADF) indicated that the variables have a mixed order of integration. Majority of the variables in the model attained stationarity after first difference in line with the proposition of Box and Jenkins (1976). Box and Jenkins (1976) argued that a non-stationary series will be made stationary after first differencing, while LITR was mean-reverting. Mean reverting in this context implies that literacy rate was stationary at level. This justifies the application of autoregressive distributed lag (ARDL) model as was proposed by Pesaran, Shin and Smith (2001.

Co-integration Test

Table 3: Bound Co-integration Test LEX Model

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	6.477874	10%	2.08	3
K	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

Source: Author's Computation from Eviews 9, 2023

Table 3 indicate the Bounds Co-integration test in estimating Energy Consumption and life expectancy in Nigeria using time series data spanning 1981-2021 sourced from CBN Statistical bulletin for the various years. It can be inferred from the output above that the F-Stat value of 6.477874 is greater than the upper bound critical value of 3.38 at 5% evidenced by the presence of a long-run co-integrating relationship among the series in the model. Hence, the Null Hypothesis of no level relationship or no co-integration is rejected; and the Alternative

Hypothesis is accepted. The researcher, therefore, proceeds to estimate the long-run and short run coefficients since there is co-integration among the series.

Long Run ARDL Result

Table 4: ARDL Long Run Result LEX

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ANE	-0.078698	0.087949	-0.894808	0.3842
LOG(EPN)	0.198158	0.075826	2.615798	0.0234
FEN	-0.013931	0.004188	-3.326489	0.0043
LOG(PCI)	0.357695	0.101635	3.519420	0.0028
TOP	-0.000724	0.000312	-2.319870	0.0339
C	2.288824	0.421847	5.425722	0.0001

Source: Authors compilation, 2023

Evidence from Table 4 shows that Electric Power Energy Consumption (EPN) and Fossil Fuel Energy have a negative effect on Life Expectancy in Nigeria and are statistically significant at 5%. Ceteris paribus, a unit increase in EPN and FEN will reduce life expectancy by 15.8% and 1.4% respectively. These results are in consonant with a priori expectation and align with the work of University of Leeds (2020) which opined that countries could improve their citizens' lives without requiring more energy consumption.

In the long run result from table 4, Per Capita Income is positively related to Life Expectancy and it is statistically significant at 5%. All things being equal, a unit increase in PCI will increase life expectancy by 35.8%. This is in line with theory; Per capita Income is expected to increase life expectancy at birth through increasing economic growth and development in a country which leads to longevity. This result supports the position of Miladinov (2020).

Evidence from table 4 finally showed that Trade Openness has a negative relationship with Life Expectancy and it is statistically significant at 5%. This contradicts a priori expectation and did not agree with the work of Byaro et al., (2021). However, the reduction in LEX as a result of one unit increase in TOP is infinitesimal.

ARDL Short Run Result for Model one (LEX)

Table 5: ARDL Short Run Result for LEX Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(LEX(-1))	0.020146	0.113951	0.176794	0.8619
DLOG(LEX(-2))	3.448252	0.372374	9.260189	0.0000
DLOG(LEX(-3))	-2.762532	0.322235	-8.573041	0.0000
D(ANE)	-0.022851	0.006157	-3.711452	0.0019
DLOG(EPN)	0.005936	0.003262	1.819918	0.0875
DLOG(EPN(-1))	0.019121	0.003121	6.127415	0.0000
DLOG(EPN(-2))	0.014957	0.002668	5.605129	0.0000
DLOG(EPN(-3))	0.013005	0.002418	5.377952	0.0001
D(FEN)	-0.000656	0.000235	-2.784664	0.0133
D(FEN(-1))	-0.000768	0.000214	-3.591438	0.0024
DLOG(PCI)	0.032374	0.008233	3.932049	0.0012
D(TOP)	-5.26E-07	2.28E-05	-0.023087	0.9819
D(TOP(-1))	0.000118	2.83E-05	4.147555	0.0008
D(TOP(-2))	6.44E-05	2.42E-05	2.657513	0.0172
ECM (-1)	-0.123451	0.015634	-7.896172	0.0000
R-squared	0.855769	Mean dependent var		0.004496
Adjusted R-squared	0.727622	S.D. dependent var		0.004879
S.E. of regression	0.001313	Akaike info criterion		-10.14282
Sum squared resid	3.79E-05	Schwarz criterion		-9.489741
Log likelihood	202.6421	Hannan-Quinn criter.		-9.912576
Durbin-Watson stat	2.303014			

Source: Authors compilation, 2023

Table 5 illustrates the short-run (SR) results and the Error Correction Mechanism. The R^2 valued at 85% shows the model has a good fit, while the adjusted R^2 valued at 72% indicates that the 72% variation in CEM is accounted for by the explanatory variables in the model, while the remaining 28% is exogenously determined by variables outside the model or captured in the error term. The Durbin-Watson statistics valued at 2.303014 indicate the absence of first-order autocorrelation in the model, while the log likelihood of 202.6421 shows that the entire model has a good fit and will be sustainable over time. The ECM term appears with a normal sign (-) and it is statistically significant at 5% (P-value). Therefore, the past disequilibrium will be adjusted at the speed of 12% annually, meaning that disequilibrium in the previous year's caused by variables in the model can be corrected in the present year to equilibrium at the speed of 12%.

In the short run, the coefficient of ANE, FEN, and PCI have a negative effect on Life Expectancy and it is statistically significant at 5%. A unit increase in ANE, FEN, and PCI will reduce Life Expectancy by 0.022851, 0.000656 and 0.032374 respectively. FEN conforms to a priori expectation. Increase in energy consumption (non-renewable) will generate more carbon dioxide which reduces life expectancy. But its past realization DFEN(-1) is positively related and statistically significant; meaning that an increase in FEN, will increase LEX by (0.000768), this does not conform to theory. However, ANE defied apriori expectation in that it is expected that increase in alternative nuclear energy (renewable) will help to increase life expectancy. In like manner, PCI also defied aprori, this is because Per capita Income is expected to increase life expectancy at birth through increasing economic growth and development in a country which leads to longevity. This contradicts the position of Miladinov (2020). Evidence from the short-run result from table 4a shows that the past realization of Dlog(LEX(-2) has a positive relationship on itself and it is statistically significant at 5 percent. The meaning of the result is that a unit increases in the past value of LEX increase life expectancy and therefore spurs effective aggregate demand which in turn increase demand for energy. The positive impact of LEX therefore stimulates economic growth in general.

Also in the short run, the past realization of DEPN(-1), DEPN(-2), DTOP(-1) and TOP(-2) have a positive relationship with life expectancy and are statistically significant. However, EPN's positive relationship does not conform to theory but defies apriori expectation; energy consumption is expected to reduce life expectancy. TOP on the other hand is in consonant with the theory. TOP is supposed to boost the economy and increase LEX. This agrees with the work of Byaro et al., (2021).

Table 6: Post Estimation Test for LEX Model

S/N	TEST	F-STATISTICS	P-VALUE
1	Normality Test (J-B)	0.730198	0.694128
2	Serial Correlation	1.155139	0.3002
3	Heteroskadasticity	4.995296	0.1010
4	Ramsey L-M Test	0.742238	0.4025

Source: Author's Compilation, 2023

Information from the diagnostic checking shows that the residual of the model is normally distributed, given the probability value of (0.694128) of the bell-shaped histogram and the associated Jarque-Bera value of (0.730198). There is no presence of serial correlation and Heteroskedasticity in the residual, given that their probability values are above 5%. Finally, the CUSUM test proposed by Brown et al. (1975) is applied to confirm that the model has satisfied the stability test. Figure 4 below indicates that the model is within the critical bounds.

Conclusion

The study investigated the effect of energy consumption on life expectancy on Nigeria from 1981 to 2021. The study used renewable and non-renewable energy to proxy energy consumption as the independent variables while life expectancy is the dependent variable. Per Capita Income and Trade openness were used as check variables. Descriptive statistics, unit root test, bound cointegration test as well as Autoregressive distributed lag (ARDL) were employed to analyze the data. The study reveals that in the long-run Electric Power Energy Consumption (EPN) and Fossil Fuel Energy have a negative effect on Life Expectancy in Nigeria and are statistically significant at 5%. Ceteris paribus, a unit increase in EPN and FEN will reduce life expectancy by 15.8% and 1.4% respectively. Per Capita Income (PCI) is positively related to Life Expectancy, and it is statistically significant at 5%. Also, the result showed that trade openness has a negative relationship with Life Expectancy and it is statistically significant at 5%. The study concludes that energy consumption has time-varying impact on life expectancy in Nigeria within the period under review.

In view of the findings from the study, the following recommendations are advanced for consideration:

(i) Government should pursue policy that will cause gradual policy shift from CO2 emissions generating energy systems to green solutions system that can support local productivity without disrupting value chain in the country.
(ii) Government should levy environmental tax on multinational companies to reduce the rate of carbon (iv) oxide emission.

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