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Energy Poverty and Life Expectancy in Nigeria

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ABSTRACT: Nigeria has continued to experience a persistent energy crisis marked by limited access to clean, affordable, and reliable energy, which poses significant risks to public health and overall well-being. This study investigated the effect of energy poverty on life expectancy in Nigeria. Time series data for the period covering 1981 to 2023 was used. Using the Autoregressive Distributed Lag (ARDL) estimation technique, the study examined both the short-run and long-run impacts of energy poverty on life expectancy. The results revealed that energy poverty has a statistically significant and negative effect on life expectancy in both the short and long term, indicating that prolonged energy deprivation continues to undermine the health and longevity of the Nigerian population. Based on these findings, the study recommends that the Nigerian government and relevant stakeholders prioritize energy sector reforms aimed at expanding access to modern energy services, particularly in rural and underserved communities. Investment in renewable energy, improvement of electricity infrastructure, and implementation of policies that promote energy affordability are critical. Such interventions are essential not only for enhancing energy security but also for improving public health outcomes and achieving sustainable development goals, particularly those related to health and energy.

KEYWORDS: Energy Poverty, Life Expectancy, ARDL Model, Nigeria, Sustainable Development

JEL Classification Codes: I15, Q41, O55, C32

INTRODUCTION

Life expectancy is a fundamental indicator of a population's overall health and well-being, and it remains a crucial measure of national development (Ijoko & Mohammed, 2025). Recognizing its significance, the United Nations incorporated life expectancy into the Sustainable Development Goals (SDGs), particularly under Goal 3, which aims to ensure healthy lives and promote well-being for all at all ages. The global recognition of life expectancy as a development benchmark has prompted nations to explore various determinants that can improve the longevity of their populations. In particular, governments and development agencies have intensified efforts to identify socioeconomic and infrastructural factors that significantly influence health outcomes and life spans (Ezeudu & Fadeyi, 2024; Mouteyica, & Ngepah, 2025).

According to the World Health Organization (WHO), life expectancy is defined as the average number of years a newborn is expected to live, assuming they experience the prevailing sex- and age-specific mortality rates at the time of their birth. In Nigeria, current estimates place life expectancy at 54.9 years for women and 54.3 years for men, which is significantly lower than the global average of 73.3 years. Globally, women are expected to live up to 76 years, while men have an average life expectancy of 70.7 years, highlighting a substantial disparity between Nigeria and international standards (Abubakar et al, 2022; Adesola et al, 2024).

One critical, yet often underexplored, factor influencing life expectancy is energy access, which is enshrined in SDG 7—affordable and clean energy for all. Nigeria faces a severe energy crisis, where a significant portion of the population lacks access to reliable and modern energy services, resulting in a condition known as energy poverty. Energy poverty, defined as the lack of access to affordable, reliable, and clean energy, affects about 86 million Nigerians, accounting for roughly 43% of the population. This deprivation impacts health, education, and overall quality of life, thereby influencing life expectancy (Katoch et al, 2024).

Over the years, the Nigerian government has introduced several policies and initiatives aimed at addressing both low life expectancy and energy poverty. Programs such as the National Health Policy, the Renewable Energy Master Plan, and interventions under the Economic Recovery and Growth Plan (ERGP) have been implemented. However, despite these efforts, Nigeria's life expectancy figures remain among the lowest in West Africa. For instance, the current life expectancy of Nigerian males and females still lags behind countries like Ghana, Senegal, and Côte d'Ivoire (Mostert et al, 2025). Moreover, energy poverty remains prevalent and, in some regions, is even worsening due to poor infrastructure, policy inconsistency, and rapid population growth. This persistent challenge indicates that existing interventions may not be sufficient or effectively targeted.

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The justification for this study lies in the urgent need to address the worsening energy crisis in Nigeria, which continues to deprive millions of access to clean, affordable, and reliable energy, an essential component of healthy living. With hospitals lacking consistent electricity, households relying on harmful energy sources, and public infrastructure unable to support basic health services, energy poverty remains a silent driver of poor health outcomes and reduced life expectancy. In light of this, it becomes imperative to investigate the current state of life expectancy amid the persistent rise in energy poverty. The objective of this paper therefore is to determine the short run and long run effect of energy poverty on life expectancy in Nigeria.

Apart from this introductory section, the rest of the paper is structured as follows. Section 2 presents a review of relevant literature. Section 3 outlines the methodology adopted for the study. Section 4 discusses the empirical findings and their implications. Finally, Section 5 concludes and offers practical policy recommendations based on the results obtained.

LITERATURE REVIEW

Life Expectancy

The average life expectancy to the average number of years a person is expected to live based on prevailing mortality rates across all age groups within a given population (WHO, 2022). Ortiz-Ospina (2017) defined life expectancy as the estimated average number of years an individual within a specific population is anticipated to live, based on current mortality patterns. The average life expectancy is an indicator of a country's health outcome and indicates the cumulative effects of population income levels, access to quality healthcare, nutritional standards, level of sanitation and education, burden of disease and other socioeconomic factors present in the country (Abubakar et al. 2023; Popoola et al. 2024; Steel et al. 2025). Empirical evidence indicates that variations in life expectancy across countries and regions are significantly influenced by disparities in public health infrastructure, environmental quality, socio-economic conditions, and the effectiveness of government healthcare interventions (Omri et al. 2023; Uddin et al. 2024).

Energy Poverty

Gaye (2007) defined energy poverty as a condition where individuals or households are unable to access clean cooking energy services and do not have sufficient electricity to perform basic domestic or economic activities, particularly during evening hours. According to Reddy et al. (2000) energy poverty is the condition in which individuals or households are unable to access adequate, affordable, reliable, safe, and environmentally sustainable energy services necessary for supporting both human well-being and economic development. Energy poverty manifests in diverse dimensions including limited access to electricity, reliance on traditional biomass for cooking, and exposure to inefficient or unsafe energy sources (Byaro et al. 2024). The main drivers of energy poverty include low household income, poor energy efficiency in residential buildings, and high energy prices (Al Kez et al. 2024). Katoch et al. (2024) and Halkos and Aslanidis (2023) argue that energy poverty represents a major barrier to social and economic development, significantly affecting health, education, productivity, and environmental sustainability.

Stylized Fact

Figures 1 presents the trend of life expectancy at birth in Nigeria between 1981 and 2023. The data shows a gradual upward trend of 17.4% in life expectancy in Nigeria, from 46.5 years in 1981 to 54.6 years in 2023. The data shows that life expectancy remained below 46.7 years between 1981 to 1995. This period coincided with the Structural Adjustment era in Nigeria (Weider, 2024).). The figure shows an upward shift in life expectancy in 1999, with life expectancy increasing to 47.2 years by 2000. A more sustained increase was observed from 2003 onward, averaging an annual gain of approximately 0.2 to 0.4 years. This trajectory remained positive culminating in 54.6 years recoded in 2023.

Figure 2 illustrated the trend of energy poverty in Nigeria from 1981 to 2023, measured using access to electricity and access to clean fuels and technologies for cooking. The data showed a steady rise in energy poverty, with sharp increases from the mid-1980s, slight fluctuations around the early 2000s, and a more pronounced surge from 2010 onward. By 2023, the index exceeded 100%, indicating compounded energy access challenges. This upward trend reflected Nigeria's prolonged energy crisis, driven by unreliable electricity supply, dependence on biomass for cooking, and the underperformance of the national grid. Structural inefficiencies, weak policy implementation, rapid population growth, limited rural electrification, and economic shocks such as the 1993–1994 fuel subsidy removal and currency devaluation (Okwa et al., 2024; Jesuola, 2024) all contributed to the worsening situation. Despite various reforms, access to modern energy services remained severely limited.

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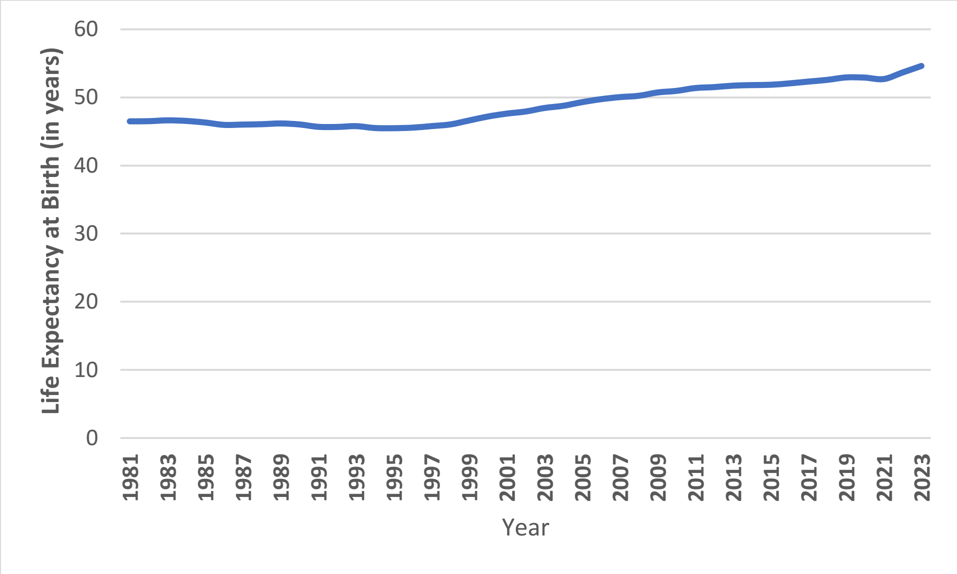

Figure 1: Life Expectancy at Birth in Nigeria (1981-2023). Source: World Development Indicators (2025)

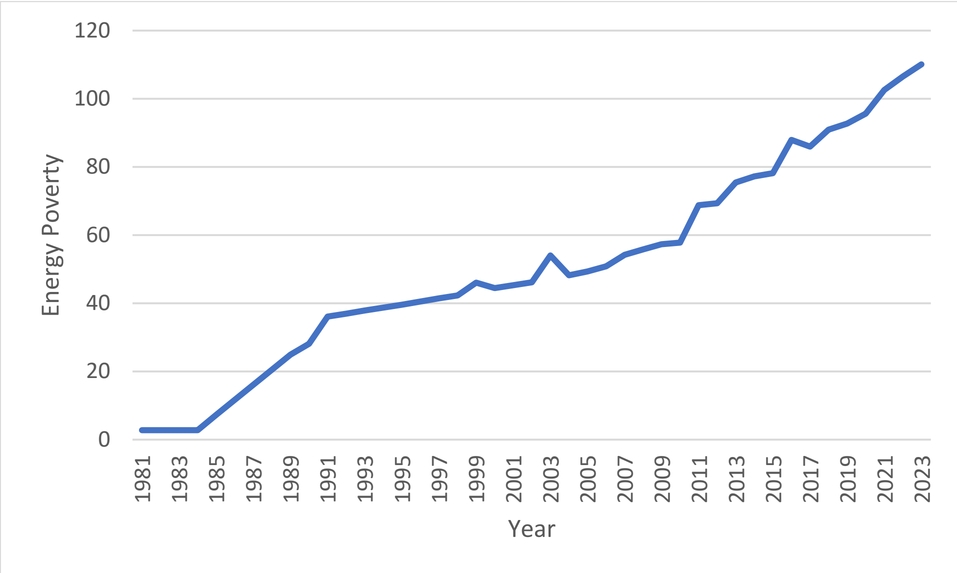

Figure 2: Trend of Energy Poverty in Nigeria (1981-2023). Source: World Development Indicators (2025)

Theoretical Framework

This study is anchored on the Human Capital Theory, originally propounded by Theodore W. Schultz in the early 1960s and further developed by Gary Becker. The theory posits that investments in people through education, health, and other life-enhancing services improve individual productivity and contribute significantly to economic development and societal well-being. Within this framework, health is considered a vital component of human capital, as it directly affects one's ability to work, learn, and contribute meaningfully to society. The theory emphasizes that societies that invest in human development, particularly health and education, experience better long-term socioeconomic outcomes, including higher life expectancy. In this regard, access to modern energy is not just a basic utility but a critical enabler of health services, clean environments, and overall improved living conditions, which are essential for a longer and healthier life.

The theory is essential to this study as it provides a clear lens through which the relationship between energy poverty and life expectancy can be examined. Inadequate access to electricity and clean cooking fuels leads to poor health outcomes such as respiratory diseases and limited access to modern healthcare facilities, ultimately reducing life expectancy. The strength of the theory lies in its broad applicability to various dimensions of human well-being, especially health-related outcomes driven by social and infrastructural investments. Several studies have applied this theory in similar contexts. For instance, Rafi **et** al (2021) employed the theory to assess the impact of multidimensional energy poverty on human capital development. Likewise, Uzoechina et al (2025) applied it in evaluating how public infrastructure, including energy, contributes to life expectancy in lower-middle income

West African countries. This demonstrates the theory's robustness and relevance to the current study's focus on energy poverty and life expectancy.

Empirical Review

Roy (2025) investigated the role of clean energy in promoting life expectancy across global populations. The study used data spanning 190 countries from 2000 to 2022. The pooled regression and Generalised Method of Moments (GMM) was used to analyse the data. Findings revealed that access to clean fuels and technologies for cooking positively and significantly increased life expectancy.

Olise (2025) examined the impact of disaggregate energy consumption on quality of life in Nigeria. Annual data for the period 1981 to 2023 were analyzed through the Autoregressive Distributed Lag (ARDL) model. The results showed that kerosene consumption significantly improved quality of life in both the long and short run, while premium motor spirit (PMS) had negative effects due to environmental and health concerns. Electricity consumption had no significant impact on life expectancy in Nigeria.

In another study, Onisanwa et al. (2024) investigated the determinants of life expectancy in Nigeria. Secondary data covering 1980 to 2022 were obtained and analysed. The autoregressive distributed lag (ARDL) approach was adopted as the estimation technique. The findings revealed that growth in per capita income, improved literacy rates, fertility rates, urbanization and environmental degradation were determinants of life expectancy in Nigeria.

Fan et al. (2024) examined the relationship between energy poverty and public health vulnerability across regions. Panel data from 143 countries for the period 2000 and 2016 were analysed through the. Fixed Effects, system GMM, and Quantile regression models. The findings indicated an adverse effect of energy poverty on health vulnerability, with the negative effects being more pronounced in high-income and more developed regions than low-income and developing regions.

The study by Dimnwobi et al. (2023) analyzed the effects of energy poverty and environmental degradation on agricultural productivity across Sub-Saharan Africa. In a panel approach, the study employed the generalized method of moments (GMM) and two stage least squares (2SLS) to analyse annual data. The findings revealed that energy poverty significantly reduced agricultural productivity at the continental level, while ecological footprint negatively affected agricultural productivity. However, the sub-regional results were found to vary based on developmental agricultural, and resource disparities

Said and Acheampong (2023) examined the relationship between financial inclusion and energy poverty reduction in Sub-Saharan Africa, using electricity access and clean cooking technologies as proxies. Analyzing data from 23 SSA countries between 2004 and 2019 through dynamic OLS, fully modified OLS, and canonical correlation regression techniques, the study found that financial inclusion significantly reduced energy poverty at the regional level. However, the impact varied substantially across individual countries, highlighting the importance of country-specific contexts in the financial inclusion-energy poverty nexus.

Abu and Orisa-Couple (2022) examined the link between energy poverty and burns incidents among low-income residents in Port Harcourt, Nigeria. Data on power outages, high fuel costs, and unsafe cooking systems, and health related risks, covering the period 2015-2021 were obtained from a retrospective review of patients at the University of Port Harcourt Teaching Hospital. The findings showed kerosene explosions caused 48% of cases, while incidences of generator-related flames, candle fires and gas explosions were 17%, 4%, and 27% respectively. The findings also indicated that the mortality rate was 5 deaths per 10 cases.

Okorie and Lin (2022) investigated causal relationships between energy poverty and catastrophic health expenditure among Nigerian households. Secondary data from the 2019 General Household Survey were sourced and analysed. The Logistic binary choice mode was employed to analyse the data. The findings indicated that energy poverty significantly increases the likelihood of catastrophic health expenditure The findings reveal that Osun and Niger recorded the lowest levels of catastrophic health expenditure, whereas Imo and Enugu recorded the highest levels. Additionally, Bauchi and Kogi are identified as high-risk states for future surges in catastrophic health expenditure.

Onwube et al. (2021) investigated the determinants of life expectancy in Nigeria. The study estimated annual data for the period 1981 to 2017 through the Autoregressive Distributed Lag (ARDL) estimation technique. The long-run results revealed that real GDP per capita, household consumption expenditure, and exchange rate had a positive and significant impact on life expectancy. Conversely, inflation rate, imports, and government consumption expenditure exhibited a negative influence on life expectancy. The study concluded that real GDP per capita, inflation, imports, household consumption expenditure, government consumption expenditure, and exchange rate are strong determinants of life expectancy in Nigeria.

Onwube et al. (2021) examined the drivers of life expectancy in Nigeria using annual data from 1981 to 2017. The Autoregressive Distributed Lag (ARDL) model was employed to analyse the data. Long run estimated showed that real GDP per capita, household consumption, and exchange rate positively influenced life expectancy. In contrast, inflation, import levels, and government consumption expenditure declined in life expectancy. Real income, inflation, trade patterns, and public sector spending were identified as drivers of life expectancy in Nigeria.

METHODOLOGY

Model Specification

The study followed the model by Churchill and Smyth, (2021) with a slight modification to the control variables. The functional form of the model is presented as follows:

$$LFE = f(EPI,\ GDPK, GHX, PVL, LTR) \quad 1$$

Where:

LFE = Life expectancy at birth

EPOV = Energy poverty measured by access to clean cooking technologies and fuels (% of population) and access to electricity (% of population)

GDPK = GDP per capita (constant 2015 US$)

GHX = Domestic general government health expenditure per capita (current US$)

PVL = Prevalence of undernourishment (% of population)

LTR = Literacy rate Proxied by (Secondary school enrollment)

In econometric terms equation 1 is formulated as;

$$LFE_t = \beta_0 + \beta_1 EPI_t + \beta_2 GDPK_t + \beta_3 GHX_t + \beta_4 PVL_t + \beta_5 LTR_t \varepsilon_t \quad 2$$

Where: β_0 denotes the constant term, $\beta_1 \dots \beta_5$ represents the coefficients of the independent variables, t represents time and ε_t is the error term. Equation (2) is subsequently natural transformed into its logarithmic form as:

$$\ln LFE_t = \beta_0 + \beta_1 lnEPI_t + \beta_2 lnGDPK_t + \beta_3 lnGHX_t + \beta_4 lnPVL_t + \beta_5 lnLTR_t \varepsilon_t \quad 3$$

In Equation (3), *ln* denotes the natural logarithm of each variable, applied to linearize the relationships and reduce heteroscedasticity in the model.

Apriori Expectation: $\beta_1 < 0;\ \beta_2 > 0;\ \beta_3 > 0; \beta_4 < 0; \beta_5 > 0$

Data Source and Requirement

This study analysed annual time series data spanning 43 years (1981 to 2023). The data were sourced from the World Bank's World Development Indicators (WDI, 2025) and the World Bank's Global Database of Inflation (2025). The dependent variable is life expectancy at birth, while the independent variable is energy poverty measured by access to clean cooking technologies and fuels (% of population) and access to electricity (% of population) as supported by Said and Acheampong (2023). The control variables are GDP per capita (constant 2015 US$), domestic general government health expenditure per capita (current US$), prevalence of undernourishment (% of population), and literacy rate proxied by (secondary school enrollment, % gross).

Estimation Techniques

In time series analysis, establishing the stationarity of variables is essential to prevent spurious regression and ensure valid econometric results (van Greunen & Heymans, 2023). To assess the stationarity of the variables, this study employs the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test. The ADF test is used to examine the null hypothesis of a unit root in the data, and it is specified as follows

$$y_t = c + \beta_t + \sigma y_{t-1} \sum_{i=1}^{p} \emptyset_i\, \sigma \Delta y_{t-1} + e_t \quad 4$$

Where y_t represents the variable being tested, *c* is a constant term, β_t is a trend component, σ is the coefficient of the lagged level of the variable, and Δy_t represents the lagged differences of the variable. Where $\sigma = 0$, the series has a unit root, whereas, if $\sigma < 0$ and significant, the series is considered stationary. The Phillips-Perron (PP) test is also applied to complement the ADF test. The equation of the PP test is expressed as:

$$\Delta y_{t-1} = x_0 + \lambda y_{t-1} + \mu_t \quad 5$$

Where $x_t$is the constant term, λ is the coefficient on the lagged level of the variable, and μ_t represents the error term.

Once stationarity has been established, the study employs the Autoregressive Distributed Lag (ARDL) model by Pesaran et al. (2001) to examine both the short- and long-run relationships dynamics among the variables in the model. The Autoregressive Distributed Lag (ARDL) Bound testing approach is applied to determine if a long-run equilibrium relationship exists between the dependent and independent variables. The long run dynamics of Equation (3) is presented in an ARDL framework.

$$\Delta lnLFE_t = \beta_0 + \beta_1 lnLFE_{t-1} + \beta_2 lnEPOV_t + \beta_3 lnGDPK_t + \beta_4 lnGHX_t + \beta_5 lnPVL_t + \beta_6 lnLTR_t + \varepsilon_t \quad 6$$

In Equation (7), Δ is the first difference operator, $\beta_1 \dots \beta_6$ are the estimates of the long-run coefficients of the independent variables and ε_t is the error term. Once the long-run relationship between the variables is established, the error correction model (ECM) is employed to capture the short-run dynamics. The short-run model with the error correction term is presented as

$$\Delta lnLFE_t = \alpha_0 + \sum_{j=1}^{n} \alpha_1 \Delta lnLFE_{t-k} + \sum_{j=1}^{n} \alpha_2 \Delta lnEPOV_{t-k} + \sum_{j=1}^{n} \alpha_3 \Delta lnGDPK_{t-k} + \sum_{j=1}^{n} \alpha_4 \Delta lnGHX_{t-k} + \sum_{j=1}^{n} \alpha_5 \Delta lnPVL_{t-k} + \sum_{j=1}^{n} \alpha_6 \Delta lnLTR_{t-k} + \phi ECM_t + \varepsilon_t \quad 7$$

Where α_0 is the constant term, $\alpha_1 \ldots \alpha_6$ are the short-run coefficients of the independent variables, ϕ is the coefficient of the error correction term.

Empirical Results

Descriptive Statistics

Table 4.1 provides the descriptive statistics for the variables being estimated. The average life expectancy at birth in Nigeria during the period was 48.78 years. The minimum and maximum values were 45.49 years and 54.59 years, respectively, with a standard deviation of 2.87, indicating relatively moderate changes in life expectancy over time. Energy poverty had a mean of 52.593%, and ranged from 28.200% to 86.100%, with a standard deviation of 13.598. This figure shows a volatile energy poverty environment in Nigeria. In terms of economic growth, GDP per capita had minimum and maximum values of $1,408.21 and $2,679.56, with an averaged $1,922.55 and a standard deviation of 466.60. On the other hand, government health expenditure per capita during the period was low, averaging $6.73, with a minimum of $0.30 and a maximum of $15.84. Prevalence of undernourishment averaged 10.61% of the population, with values ranging from 6.50% to 19.00%. The literacy rate, proxied by secondary school enrolment averaged 33.31%, with a minimum of 17.41% and a maximum of 54.88%.

Table 1. Descriptive Statistics

Statistic	LFE	EPOV	GDPK	GHEX	PVL	LTR
Mean	48.782	52.593	1922.546	6.730	10.607	33.309
Maximum	54.590	86.100	2679.555	15.835	19.000	54.883
Minimum	45.487	28.200	1408.209	0.295	6.500	17.409
Std. Dev.	2.874	13.598	466.604	5.621	2.682	9.793
Jarque-Bera	4.403	2.670	5.218	5.056	22.000	3.594
Probability	0.111	0.263	0.074	0.080	0.000	0.166

Source: Researcher's computation, 2025

Correlation Test

Table 2 presents the correlation results of the variables used. The correlation results indicate that GDP per capita (0.651), government health expenditure (0.598), and literacy rate (0.434) had moderate positive correlations with life expectancy. On the other hand, energy price inflation (–0.450) and the prevalence of undernourishment (0.333) had low correlations with life expectancy, with the former showing a negative relationship. These results suggest that while income, public health spending, and education are moderately associated with improvements in longevity in Nigeria, energy price volatility and undernourishment are weak correlated with life expectancy. Whereas, the correlation results also indicate that the independent variables are not highly correlated with the dependent variable in the model.

Table 2. Correlation Matrix

Variable	LFE	EPOV	GDPK	GHEX	PVL	LTR
LFE	1.000					
EPOV	-0.450	1.000				
GDPK	0.651	-0.408	1.000			
GHEX	0.598	-0.453	0.779	1.000		
PVL	0.333	0.063	0.249	-0.126	1.000	
LTR	0.434	-0.466	0.885	0.767	0.295	1.000

Source: Researcher's computation, 2025

Unit Root Test

To ensure reliability of the estimates of the parameters in the model and avoid the risk of spurious regression, the stationarity properties of the variables were assessed using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. As shown in Table 3, the results indicate that EPOV is stationary at level in both tests, suggesting that it is integrated of order zero, I(0). In contrast, LFE, GDPK, GHEX, PVL, and LTR are non-stationary at level but become stationary after first differencing, confirming their integration of order one, I(1).

Table 3. Unit Root Test (Constant and Trend)

Variable	ADF t-statistic		PP t-statistic	
LFE	-2.009	-5.430***	1.295	-5.395***
	(0.579)	(0.001)	(0.998)	(0.001)
EPOV	-5.109***		-3.752***	
	(0.002)		(0.007)	
GDPK	-1.537	-4.056**	-0.452	-3.921**
	(0.800)	(0.014)	(0.890)	(0.020)
GHEX	-0.484	-5.453	-1.387	-5.439***
	(0.981)	(0.000)	(0.580)	(0.000)
PVL	0.458	-4.853***	-0.207	-6.712***
	(0.999)	(0.002)	(0.930)	(0.000)
LTR	-2.118	-5.235***	-1.603	-5.215***
	(0.521)	(0.001)	(0.472)	(0.001)

Source: Researchers computation 2025

Note: ** denote significance at 5% and *** denote significance at 1%

Cointegration Test

The result of the F-Bound test is presented in Table 4. From the Table, the calculated F-statistic (6.206) exceeds the upper critical bounds at the 10% (3.00), 5% (3.38), and 1% (4.15) significance levels. Since the test statistic lies well above the upper bound across all conventional significance thresholds, the null hypothesis of no cointegration is firmly rejected. This shows strong evidence of a stable long-run equilibrium relationship between energy poverty and life expectancy over the study period.

Table 4. Cointegration Test

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	6.2062	10%	2.08	3
		5%	2.39	3.38
		1%	3.06	4.15

Source: Researchers computation 2025

Short Run and Long Run Estimates

Table 5 presents the short-run and long-run regression results of the impact of energy poverty on life expectancy in Nigeria. The results indicate that energy poverty exerts a significant negative effect on life expectancy in the short run. A 1% increase in EPOV leads to a 0.299% LFE. The result is significant at 5% which implies that energy poverty reduces life expectancy in Nigeria in the short run. However, the lagged effect of EPOV in the short run was insignificant, which suggests that the impact of energy poverty on life expectancy is more immediate rather than persistent. The long-term result shows that energy poverty continues to impact negatively and significantly on life expectancy. A 1% increase in EPOV results in a 0.699% decline in life expectancy. This indicates that prolonged exposure to energy poverty undermines public health over time in Nigeria. The result is consistent with the findings of Banerjee et al. (2021) and Fan et al. (2024).

The short run result shows a positive effect of economic growth on life expectancy. A 1% increase in GDP per capita increases LFE by 0.026%, albeit insignificant effect. In contrast, the long-run result shows a significant positive relationship between economic growth and life expectancy. A 1% increase in GDPK increases LFE by 0.332%. The results indicates that economic growth alone does not immediately lead to improvements in life expectancy, but that sustained economic growth, over time improves life expectancy in Nigeria. This result is in accord with Onwube et al (2021) and Țarcă et al. (2024).

The short run result also shows a positive relationship between government expenditure on health and life expectancy. A 1% increase in GHEX leads to a 0.071% rise in LFE. However, the long-run coefficient of GHEX is negative and insignificant. A 1% increase in GHEX is associated with a -0.054%. in LFE This suggests that while increased public health expenditure yields immediate benefits on life expectancy, the effectiveness of public health expenditure on life expectancy diminishes over time in Nigeria. This may be as a result of corruption, poor resource allocation and weak institutional capacity in the healthcare sector in Nigeria. The findings support the findings of Ijoko and Gombe (2022) and Adesete et al. (2022).

The short-run coefficient for the prevalence of undernourishment is also negative and significant, implying that rising food insecurity contributes to reduced life expectancy in the short term. From the result, a 1% increase in PVL reduces life expectancy by -0.377 at the significant level of 5%. Similarly, the effect of PVL on LFE is negative and statistically in the long run. A 1% increase in PVL results in a 0.225% decline in life expectancy. This confirms that prolonged exposure to food insecurity undermines the attainment of higher life expectancy in Nigeria. These results corroborate the findings of Marcus et al. (2023) and Ali et al. (2025). The literacy rate shows a positive relationship with life expectancy in both the short and long run, although, neither effect is significant. A 1% increase in LTR raises LFE by 0.003% and 0.044% respectively in the short and long run respectively, however, both effects were insignificant. This implies that improvement in literacy rate may not translate into immediate health and enduring health benefits in Nigeria. These findings align with that of Ali et al. (2023). The error correction term (-0.077) is negative and significant at the 1% level. This indicates that approximately 77.0% of deviations from the long-run equilibrium are corrected within a single year.

Table 5. Regression Results

Cointegrating From			
Variable	Coefficient	t-Statistic	Prob.
C	-0.004	-0.031	0.975
LFE(-1)*	0.077	0.856	0.399
EPOV(-1)	-0.002	-1.193	0.242
GDPK(-1)	-0.040**	-2.486	0.019
GHEX(-1)	0.004***	3.235	0.003
PVL**	-0.377**	-2.485	0.020
LTR**	0.003	0.268	0.791
D(EPOV)	-0.299**	-3.443	0.002
D(EPOV(-1))	0.002	1.518	0.139
D(GDPK)	0.026	0.768	0.448
D(GHEX)	0.071***	3.311	0.003
CointEq(-1)*	-0.077***	-7.220	0.000
Long-Run Form			
EPOV	-0.699***	-4.904	0.000
GDPK	0.332**	2.177	0.039
GHEX	-0.054	-0.751	0.459
PVL	-0.225***	-3.457	0.002
LTR	0.044	2.002	0.056
C	0.048	0.032	0.974

Source: Researchers computation 2025

Diagnostics Tests

Table 6 shows the results of the Breusch-Godfrey Serial Correlation LM test, the Breusch-Pagan-Godfrey Heteroskedasticity test, and the Ramsey RESET test. The diagnostic test results affirm the reliability of the estimated model. The tests for heteroskedasticity, serial correlation and model specification yields F-statistic values of 3.580, 6.045 and 0.896 respectively, with corresponding p-values of 0.603, 0.347 and 0.352 which are not significant. This suggests that the null hypothesis of the tests cannot be rejected. This indicates the absence heteroskedasticity and serial correlation in the model. It also suggests that the model is correctly specified.

Table 6. Serial Correlation, Heteroskedasticity and Ramsey RESET Test

Test	F-statistic	Prob.
Heteroskedasticity Test: Breusch-Pagan-Godfrey	3.580	0.603
Breusch-Godfrey Serial Correlation LM Test:	6.045	0.347
Ramsey RESET Test	0.896	0.352

Source: Researchers computation 2025

Stability Test

Figures 3 and 4 present the results of the CUSUM and CUSUM of squares tests, respectively. In both figures, the blue lines represent the cumulative test statistics, while the dotted red lines denote the 5% significance boundaries. The fact that the test statistics remain within these critical bounds throughout the sample period (1981–2023) indicates the absence of structural breaks or significant instability in the model. This suggests that the relationship between energy poverty and life expectancy in Nigeria remained stable over time, with no evidence of parameter instability that would undermine the validity of the estimated coefficients.

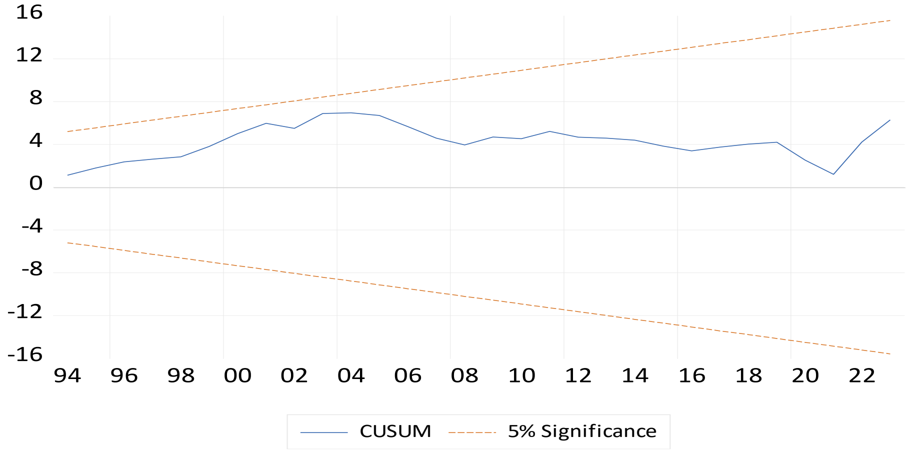

Figure 3. Cumulative Sum of Residuals (CUSUM)

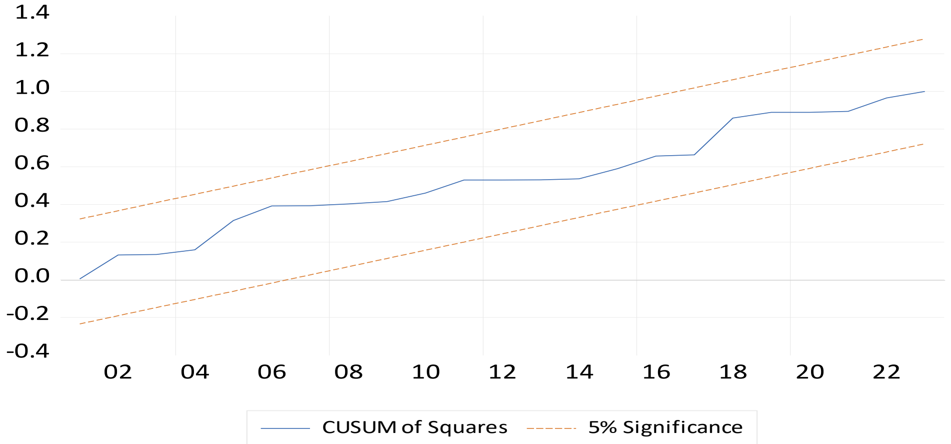

Figure 4. Cumulative Sum of Squares of Residuals (CUSUM)

CONCLUSIONS AND POLICY RECOMMENDATIONS

The study examined the impact of energy poverty on life expectancy in Nigeria between 1981 and 2023. The ARDL technique of estimation was employed to analyse both short-run and long-run effects. The findings revealed a significant negative relationship between energy poverty and life expectancy in both the short and long run. Additionally, government health expenditure positively influenced life expectancy in the short term, while its long-run effect was insignificant. Also, economic growth consistently improves life expectancy in both the short and long run, while prevalence of undernourishment was negatively impacted life expectancy in Nigeria.

Based on the findings, the government should prioritize large-scale investments in the energy sector to enhance on-grid power generation, transmission, and distribution, while simultaneously expanding access to affordable off-grid renewable energy solutions and clean cooking technologies. Policies should also be implemented to stabilize energy prices and ensure a reliable energy supply, thereby reducing household energy burdens and mitigating health risks associated with insufficient access to affordable, reliable energy. In addition, public health expenditure should be increased to improve healthcare infrastructure, facilities, and access to affordable healthcare services. This spending must be closely monitored to ensure its long-term effectiveness, with potential institutional reforms aimed at reducing corruption and improving transparency. Finally, addressing food insecurity through coordinated agricultural, nutritional, and welfare policies is essential, given the persistent negative effects of undernourishment on life expectancy.

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