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NIGERIA'S MACROECONOMY AND LIFE EXPECTANCY: EVIDENCE FROM A NONLINEAR ARDL TECHNIQUE

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Abstract

Nigerian's life expectancy rate falls below regional and international level despite being the largest economy in Africa. This study investigates the impact of Nigeria's macroeconomy on life expectancy using time series data from 1986 to 2023. The study employed the nonlinear autoregressive distributed lag model and the findings, both in the short and long run, positive and negative economic growth have positive and significant impact on life expectancy in Nigeria. Also, negative inflation and physician per capita have positive but insignificant impact on life expectancy in Nigeria. On the other hand, positive inflation has negative but significant impact on life expectancy in the short run but insignificant impact in the long run. Positive unemployment has negative but significant impact in the long run, while the impact in the short run was insignificant. The result further revealed that positive inflation in the long run has negative and insignificant impact while negative unemployment and institutional quality, both in the long and short run have negative and insignificant impact. Based on the findings of the study, it is recommended that policies that promote inclusive economic growth, stabilize prices, create employment opportunities, and enhance environmental sustainability are critical for achieving meaningful improvements in life expectancy, and overall health outcomes.

Keywords: Unemployment, inflation, exchange rate, economic growth, life expectancy, Nigeria
JEL Classification Codes: E24, E31, F31, F43, I15

1.0 Introduction

Health outcomes are indicators that are related to the health status of individuals and populations, such as life expectancy, mortality rates, prevalence of diseases, and accessibility to healthcare services. Such outcomes are determined by a number of factors that include economic status, environmental conditions, quality of health care available, and public health policies in general (World Health Organization, WHO, 2021). Positive health outcomes are usually characterized by the highest possible life expectancy, reduction in morbidity and mortality rates, and lesser

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prevalence of both communicable and non-communicable diseases. Improvement in health outcomes involves ensuring access not only to healthcare but also taking into consideration social determinants such as education, nutrition, and economic stability, which are deemed important for overall health and well-being (Marmot et al., 2012; Becchio et al., 2022; Bloom et al., 2019; Kolawole, 2016). Health outcomes refer to various measures used to evaluate the health status of a population, such as life expectancy, infant mortality, maternal mortality, and the prevalence of diseases like malaria and HIV.

The macroeconomy captures the overall functioning, performance, and structure of a country's economy, and explains and predicts how the economy behaves on a large scale. The Macroeconomy is usually measured by three important indicators: the growth rate of GDP, the rate of inflation, and the rate of unemployment (Bloom et al., 2019; Central Bank of Nigeria, 2023; Sachs, 2014). The rate of economic growth is a function of measuring the percentage change in output for the given period for a country's economy, showing the well-being of an economy on the whole (Adebayo, 2019; Nwosu, 2018). Inflation is the rise in general price level for goods and services, revealing a declining purchasing power of people and a rising cost of living in an economy (Adeniran & Yusuf, 2021; Nwanosike, et al., 2015). The Unemployed refers to people in the workforce who are not employed but in active search of jobs (Ajakaiye & Adeyeye, 2016; African Development Bank, 2024; Nigerian Economic Summit Group, NESG, 2024). Actually, all these three indicators are interrelated. Inflation reduced purchasing power, and slow GDP growth and recession generally lead to higher unemployment rates (Adeniran & Yusuf, 2021).

Despite being Africa's largest economy, Nigeria's life expectancy remains low by regional and global standards. Life expectancy rose modestly from about 46 years in the mid-1980s to approximately 56 years in 2023, well below the global average of over 73 years (World Bank, 2023; WHO, 2023). Periods of strong GDP growth did not consistently translate into proportional improvements in longevity, largely due to persistent inflationary pressures and rising unemployment, which constrained household access to healthcare and basic needs (Adebayo, 2022; Abubakar et al., 2023). While inflation control and growth in the 2000s supported gradual improvements, escalating unemployment in recent years offset these gains, leaving life expectancy misaligned with Nigeria's macroeconomic progress.

Beyond core macroeconomic indicators, structural factors such as physician availability, institutional quality, and environmental conditions also influence life expectancy. Higher physician-per-capita ratios improve access to skilled medical care and early disease detection, which are essential for reducing preventable deaths and extending longevity (WHO, 2019). Institutional quality determines the efficiency and equity of resource allocation, influencing whether economic growth translates into effective healthcare delivery and improved population health (Anyanwu & Erhijakpor, 2015). Environmental factors, particularly air quality, have been shown to significantly affect life expectancy through their impact on respiratory and cardiovascular health (Amegah & Agyei-Mensah, 2017). Ignoring these factors may therefore lead to an incomplete understanding of the macroeconomy–health nexus.

Although several studies have examined the relationship between macroeconomic variables and life expectancy in Nigeria, most have relied on linear modelling approaches, limited variable sets, and outdated data. For instance, Abubakar et al. (2023) examined inflation and unemployment effects using linear ARDL techniques but did not account for asymmetric responses to positive and negative economic shocks. Other studies similarly excluded critical structural variables such as physician density, institutional quality, and environmental conditions, thereby limiting the depth of policy insights. Moreover, few studies extend their analysis to recent years marked by significant economic volatility.

Against this background, this study investigates the impact of macroeconomic conditions on life expectancy in Nigeria from 1986 to 2023. By employing a nonlinear autoregressive distributed lag (NARDL) framework, the study captures both short-run and long-run asymmetric effects of economic growth, inflation, and unemployment on life expectancy, while controlling for physician-per-capita ratios, institutional quality, and air quality. This approach provides a more comprehensive and up-to-date understanding of how macroeconomic dynamics influence longevity in Nigeria and offers policy-relevant insights for improving population health and achieving Sustainable Development Goal 3 on good health and well-being.

2.0 Literature Review

2.1 Theoretical Framework

This study is anchored on the Economic Opportunity Theory and the Preston Curve Theory, which together explain how macroeconomic conditions influence life expectancy in Nigeria. The Economic Opportunity Theory asserts that economic conditions such as income and employment and resource accessibility determine health behaviours and healthcare utilization whereas economic growth needs to create equal access for all socioeconomic groups which will result in better health outcomes because existing health disparities will remain without such changes (Meara et al., 2001). The Preston Curve Theory demonstrates that income and life expectancy share a positive relationship which operates as a nonlinear connection because rising income enables better access to healthcare and nutrition and living standards yet this relationship decreases at higher income levels which shows that economic growth cannot provide permanent health benefits (Preston, 1975). Applying the combined framework to Nigeria situation demonstrates that life expectancy responds to both GDP growth and macroeconomic stability and structural elements which include inflation rates, unemployment levels, physician per capita and institutional effectiveness because these factors dictate how well economic assets convert into health benefits and extended lifespans.

2.2 Empirical Literature

Sede and Ohemeng (2015) analysed the socio-economic determinants of life expectancy in Nigeria from 1980 to 2011. Based on the endogeneity feature of the variables, a VAR and VECM frameworks were adopted. The socio-economic features were proxy by secondary school enrolment, government expenditure on health, per capita income, unemployment rate and the Naira foreign exchange rate. The result revealed that the traditional socio-economic variables, which were supposed to be very effective in explaining the life expectancy of developing countries, such as per capita income, education, and government expenditure on health, was not significant in the case of Nigeria.

Janlert et al. (2015) analysed the relationship between the cumulative length of intermittent spells of unemployment and different health-related outcomes using data from a longitudinal study of school leavers. All pupils who completed compulsory schooling in 1981 in a medium-sized town in northern Sweden (N = 1083) were followed for 14 years with repeated questionnaires including questions about unemployment, health and health behaviour. The results showed that men tended to react with a steady state or a levelling off of health symptoms with increased unemployment, whereas women showed deteriorating health symptoms. For health behaviour, the reverse occurred. Women's health behaviour was less connected with increased unemployment while men's health behaviour tended to deteriorate. It was concluded that cumulative length of unemployment was correlated with deteriorated health and health outcomes.

In their research, Abubakari et al. (2019) analysed the influence of selected socio-economic factors have on life expectancy in Sub-Saharan Africa (SSA). Using the time-series data from 44 SSA countries for the period of 2000-2015, along with the GMM estimation technique, the study established that GDP per capita, health expenditure per capita, and education positively and statistically significantly impacted life expectancy. On the other hand, HIV/AIDS prevalence rate and CO2 emissions had a negative and significant effect on life expectancy. Finally, geographical location had a differential impact on life expectancy.

Kelani et al. (2019) studied macroeconomic policies and health status in Nigeria. The objective of the study was to ascertain the most viable macroeconomic policy variables on the health status of Nigerians, using secondary annual time series data spanning the period of 37years from 1981 and 2017. Empirically, the estimates finally confirmed that public capital expenditure, domestic debt, and financial deepening have a long run significant impact on health status in Nigeria. Inflation is the only macroeconomic variable that does not significantly affect health status (life expectancy).

Yamben and Asaah (2020) empirically analysed the relationship between unemployment and health in Sub Saharan Africa (SSA). The study used the modified Generalized Methods of Moment (GMM) for the period 2006 to 2017, while the results revealed that, the co-integration analysis support a robust long run relationship between our variables. Consequently, unemployment rate increased total mortality rates in middle income countries. However, in low-income countries unemployment rate reduced total mortality rate.

Ajak and Ogeto (2020) estimated the effect of economic growth on health in Sub-Saharan Africa, using data from 1991 to 2015. This was done by employing Pooled OLS and a two-way fixed effect method where the health outcomes were measured by infant mortality rate, fertility rate, and life expectancy (total years), along with other explanatory variables. The results showed a strongly significant negative relationship between economic growth and health outcomes. It further revealed that economic growth led to a decline in infant mortality and fertility rate due to improved health services and also contributed to improved life expectancy. Other intervening variables that had a major impact on health status include agriculture, services, and population, while per capita income was found to be an important health determinant in Sub-Saharan Africa.

Lawal et al. (2021) focused on the examination of inflation and life expectancy in Nigeria using causal analysis from 1980 to 2019. The study adopted Granger Causality test to determine the direction of causality between inflation and life expectancy. The Granger causality result affirmed no causality between life expectancy and inflation rate in Nigeria over the years of analysis while there was uni-directional causality in the other variable (exchange rate) and life expectancy over the period of analysis in Nigeria. This means inflationary trend in Nigeria was not significant influencing life expectancy in Nigeria while exchange rate does.

Onwube et al. (2021) investigated the determinants of life expectancy in Nigeria from 1981 to 2017. Adopting the ARDL estimation technique, the study found that real GDP per capita (Rgdppc), inflation rate (infr) at lags 1 and 2, Imports (lag 1), and government consumption expenditure (GCE) at lag 1 were positively related to life expectancy in the short run, whereas current inflation rate, imports, household consumption expenditure (HCE), HCE (lag 1), GCE, exchange rate (EXR) and EXR (lag 1) were inversely related to life expectancy. The long-run results indicated that while real GDP per capita, HCE and EXR impacted positively on life expectancy, inflation rate, while imports, and GCE impacted negatively on life expectancy.

Nikolov (2021) examined how GDP correlated with health outcomes from 1990 to 2019. The variables included were GDP per capita, life expectancy at birth, mortality rates, and access to medical services. A cross-sectional regression analysis was performed using data from 100 countries and the findings found a positive correlation between GDP and health outcomes, that is, the higher the GDP of a country, the better the health outcomes it had.

The relationship existing between inflation and the wellbeing of people in Nigeria was considered by Olabiyi (2022), using the ARDL technique. The study considered annual time series data, using life expectancy as the proxy of wellbeing, on inflation, unemployment, GDP per capita, and openness on Nigeria, covering the period of 1981-2019. The results showed evidence of short- and long-run relationships between people's wellbeing and inflation in Nigeria during the study period. It was established that a percentage increase in the rate of inflation affects the wellbeing status of a Nigerian by -0.24%.

Abubakar et al. (2023) evaluated the impact of macroeconomic variables on life expectancy in Nigeria using data from 1991 to 2021. The short-run ARDL Error Correction Model was estimated, and the findings revealed that inflation has a deterring effect on life expectancy in

Nigeria, both in the short and long run. On the other hand, economic growth was found to positively influence life expectancy in Nigeria only in the long run. While unemployment was not significant in influencing life expectancy both in the short and long run.

Ikubor et al. (2023) ascertained the drivers or determinants of life expectancy at birth in North Africa using selected countries based on population size between the period 1985-2018, employing panel fixed effect least squared dummy variable regression analysis and the Driscoll-Kraay robust standard errors. The result also showed that, for North Africa, old-age dependency ratio and life expectancy at birth are jointly causal to each other.

The impact of some socio-economic variables on global average life expectancy was investigated by Udoumoh et al. (2023). The Binary Logistic Regression model was considered and the analysis was done using the Forward Stepwise (Likelihood Ratio) procedure. Using the data of life expectancy of 70 countries in year 2020, results revealed that GDP per capita, unemployment total labour force, unemployment of youth total, adjusted national income, access to electricity and health expenditure per capita positively impacted on life expectancy.

Empirical findings related to determinants of life expectancy demonstrate that health outcomes are determined consistently by socioeconomic and health system-level factors – education, health expenditure and income – in developing countries, while macroeconomic features, namely, economic growth, inflation, unemployment, affect population health and health outcome factors by affecting access to health services or quality of life and standards of living (Sede & Ohemeng, 2015; Abubakari et al., 2019; Kelani et al., 2019). Relevant studies by researchers in Nigeria and Sub-Saharan Africa demonstrating the relationship between macroeconomic variables and life expectancy generally demonstrate mixed, and conversely contradictory, results based on the use of VAR, ARDL, GMM and panel regression methods, especially in the cases of inflation and unemployment. Further, most empirical studies use linear models and panel data and from across nations, potentially obscuring regional variations, without considering nonlinear or asymmetric relationship effects of macroeconomic shocks. As a result, there is little evidence of how positive and negative economic changes might differentially impact on life expectancy in Nigeria over time. The present study addresses these gaps here by using a nonlinear ARDL model to investigate the short-run and long run asymmetric effects of the major macroeconomic variables on life expectancy in Nigeria.

3.0 Data and Methods

3.1 Model Specification

The empirical model specification for this study is guided by both the theoretical framework and empirical literature reviewed, ensuring that the functional relationship between economic growth and selected health outcomes in Nigeria is effectively captured. The economic opportunity theory and Preston curve theory informed the selection of variables and their relationships within the models. Thus, based on the model of Adebayo (2022) which this present study adapted, the model is specified as:

LIF = f (IPC, UNE, INF, EXD, EXC, GHX) (3.1)

Where, LIF is life expectancy at birth; IPC is income per capita; UNE is unemployment rate; INF is inflation rate; EXD is external debt; EXC is foreign exchange rate; and GHX is government health expenditure. The model of Adebayo (2022) is adapted for the current study to include more variables with the view to develop a comprehensive model on health outcomes in Nigeria. This model defines life expectancy at birth (LEXP) through its relationship with economic growth (GDPG) and inflation (INFR) and unemployment (UNER) and social factors (INSQ) and (PHYS) which demonstrate how economic and institutional elements affect health outcomes. This comprehensive specification enables researchers to investigate the relationship between macroeconomic variables and governance systems to life expectancy outcomes in Nigeria. The general form of the health outcomes equation is expressed as follows:

LEXP = *f* (GDPG, INFR, UNER, PHYS, INSQ) (3.2)

Where, LEXP is life expectancy; GDPG is gross domestic product growth rate; INFR is inflation rate; UNER is unemployment rate; PHYS is physicians per capita; and INSQ is institutional quality. Equation 3.2 is specified in mathematical form as:

LEXP = GDPG + INFR + UNER + PHYS + INSQ (3.3)

The econometric form is specified as:

$$LEXP = \beta_0 + \beta_1 GDPG + \beta_2 INFR + \beta_3 UNER + \beta_4 PHYS + \beta_5 INSQ + \varepsilon \quad (3.4)$$

Where β_0 is the intercept, $\beta_1 - \beta_5$ are the coefficients. ε represents the stochastic error terms and the *t* denotes time measured in years.

3.2 Data Analysis Techniques

The study applies NARDL to capture both short-run and long-run relationships between macroeconomic indicators and health outcomes. Non-linear auto regressive distributed lag model which was developed by Shin et al. (2014) has several advantages over other approach. The method is an improvement of the linear ARDL which can be used to model cointegrating relationships in small or finite samples. It uses positive and negative partial sum decomposition which detects the asymmetric effects in the long and short term. The model does not require that all the variables be integrated of order one or I(1). However, none of the variables must be integrated of order two i.e I(2) or above, if so, the none linear auto regressive distributed lag approach will not be applicable. The Augmented Dickey–Fuller (ADF) test is used to check for stationarity, while the bounds testing approach determines cointegration among variables. Diagnostic tests, including normality, serial correlation, heteroskedasticity, and stability (CUSUM and CUSUMSQ) are conducted to ensure model robustness. This approach allows for detecting asymmetric effects of GDP growth, inflation, and unemployment on life expectancy and maternal mortality in Nigeria. The NARDL is expressed as;

$$\begin{aligned} \mathrm{InLEXP_t} = {} & \mathrm{In}\beta_0 + \beta_1 InLEXP_{t-1} + \beta_2\text{-}InNEG(GDPG)_{t-1} + \beta_3\text{-}InNEG(UNER)_{t-1} \\ & + \beta_4\text{-}InNEG(INFR)_{t-1} + \beta_{5^+}InPOS(GDPG)_{t-1} + \beta_{6^+}InPOS(UNER)_{t-1} \\ & + \beta_{7^+}InPOS(INFR)_{t-1} + \sum_{i=1}^{p} \alpha_1\, \Delta InLEXP_{t-1} + \sum_{i=1}^{p} \alpha_2 \\ & - \Delta InNEG(GDPG)_{t-1} + \sum_{i=1}^{p} \alpha_3 - \Delta InNEG(UNER)_{t-1} + \sum_{i=1}^{p} \alpha_4 \\ & - \Delta InNEG(INFR)_{t-1} + \sum_{i=1}^{p} \alpha_5 + \Delta InPOS(GDPG)_{t-1} + \sum_{i=1}^{p} \alpha_6 \\ & + \Delta InPOS(UNER)_{t-1} + \sum_{i=1}^{p} \alpha_7 + \Delta InPOS(INFR)_{t-1} + \mu_t \end{aligned} \qquad 3.5$$

Where, Δ is the first difference operator; β_1, β_2, β_3….. β_7 represent short-run dynamics of the model; α_1, α_2, α_3 ….. α_7 represent the long-run elasticities.

3.3 Sources of Data

Table 3.1: Nature and Sources of Data

S/N	Variables	Nature of the Variables	Sources of Data
1	Life expectancy (LEXP)	It is calculated as the average number of years a newborn is expected to live if current mortality rates at each age remain constant in the future	World Health Organization (WHO) (2024), World Bank (2024)
2	Gross domestic product growth rate (GDPG)	It is calculated as the percentage change in real GDP (i.e., GDP adjusted for inflation) between two periods—usually year-on-year.	World Bank (2024), National Bureau of Statistics (2024)

3	Inflation rate (INFR)	The variable is calculated as the percentage change in the Consumer Price Index (CPI) over a specified period.	National Bureau of Statistics (2024)
4	Unemployment rate (UNER)	The unemployment rate is calculated by dividing the number of people who are actively seeking employment but are without work by the total labor force (which includes both the employed and the unemployed) and then multiplying the result by 100 to express it as a percentage.	National Bureau of Statistics (2024)
5	Physicians per capita (PHYS)	It is measured by the number of physicians per 1000 people	WHO (2020), World Development Indicators (2024)
6	Institutional quality (INSQ)	Institutional quality is calculated using composite indices that measure different aspects of institutions, such as governance, regulatory quality, corruption, and the rule of law. It is measured in index	World Bank, Transparency International (2024)

Source: Authors' Compilation, 2025

4.0 Presentation of Results and Discussion of Findings

4.1 Result Presentation

4.1.1 Correlation Matrix

The correlation matrix measures how closely related two variables in the model are which can be used to check if multicollinearity exists or not. Multicollinearity in a model means there exists perfect or exact linear relationship in a model. If this exists, it violates the rule of OLS and our estimates become unreliable.

Table 4.1: Correlation Matrix Result

	LEXP	GDPG	INFR	UNER	PHYS	INSQ
LEXP	1.000000					
GDPG	-0.121304	1.000000				
INFR	-0.311436	-0.324521	1.000000			
UNER	0.619546	0.044670	-0.293019	1.000000		
PHYS	0.660463	0.044621	-0.362689	0.533460	1.000000	
INSQ	0.583521	-0.129089	-0.074581	0.695431	0.537526	1.000000

Source: Researchers' Compilation, 2025 using Eviews 13.0

The correlation matrix reveals the existence of strong associations between the variables of concern. LEXP has a strong positive relationship with UNER, PHYS and INSQ, which indicate that improved social and healthcare conditions lead to high life expectancy. On the contrary, LEXP has weak negative correlations with GDP growth and inflation rate, suggesting that fast economic growth or inflation could have unforeseen negative impacts on health outcomes as a result of stresses in healthcare delivery or compromised access to critical services. Among the independent variables, UNER shows strong correlation with PHYS, suggesting possible government action for increasing healthcare access in economically disadvantaged regions.

4.1.2 Augmented Dickey Fuller Stationarity Test

This subsection deals with the test of unit root. Since time series data usually exhibit unit root, ADF unit root test was employed to test for stationarity. This test is necessary so as not to have misleading results. The result is thus presented on Table 4.2.

Table 4.2: Augmented Dickey Fuller (ADF) Unit Root Test

Variables	ADF @Level	Critical Value @5%	ADF@ Ist Diff.	Critical Value @5%	Order of Integration
LEXP	-2.0693	-2.9571	-3.4111	-2.9571	I(1)
GDPG	-4.0941	-2.9434	-10.843	-2.9458	I(0)
UNER	-1.0130	-2.9434	-6.4049	-2.9458	I(1)
INFR	-3.8681	-2.9458	-5.4097	-2.9458	I(0)
PHYS	-1.4337	-2.9434	-8.0425	-2.9458	I(1)
INSQ	-0.4176	-2.9434	-6.7094	-2.9458	I(1

Source: Authors' Computation using Eviews 13.0

ADF unit root test statistics revealed the stationarity characteristics of the variables. At level, the majority of the variables (LEXP, UNER, PHYS, INSQ) were not stationary since their ADF values are lower than the 5% critical values. But after first differencing, these variables were stationary since their ADF statistics are greater than the respective critical values, which is evidence that they are integrated of order one, I(1). Alternatively, GDPG and INFR are stationary at level since their ADF statistics are greater than the respective critical values, which is evidence that they are integrated of order zero, I(0). This means that GDPG and INFR can be used in their natural form for analysis, while the other variables must first be differenced to make them stationary. It is then concluded that the variables are stationary and our estimates can produce consistent and unbiased results.

4.1.3 Lag Length Selection

This section presents the appropriate lag length for this study before estimating the long and short run coefficients of the model.

Table 4.3: Lag Order Selection Criteria

Model Selection Criteria Table					
Dependent Variable: LEXP					
Sample: 1986 2023					
Included observations: 37					
Model	LogL	AIC*	BIC	HQ	Specification
1	38.253528	-1.419110	-0.896650	-1.234918	ARDL(1,1,1,1,1,1)

Source: Authors' Computation using Eviews 13.0

Before estimating the NARDL, it is essential to determine the appropriate number of lags to use in the regression. The optimum number of lags can be selected by using the available lag length criteria according to Akaike information criterion as presented on Table 4.3. From the result, the combination of (1,1,1,1,1,1) is chosen as the appropriate lag length. This indicates that including one lag of the endogenous variables is sufficient to capture the dynamics of the model without overfitting. The results ensure that the model is well-specified and suitable for further analysis.

4.1.4 Non-linear Autoregressive Distributed Lag Bounds Test for Cointegration

The next step after determining the order of integration of the variable is to apply a bound F-test in order to establish a long-run relationship among the variables. The results of the bounds test for NARDL co-integration approach alongside with critical values are reported on Table 4.4.

Table 4.4: Non-linear ARDL Bounds Test

Null hypothesis: No levels relationship						
Number of cointegrating variables: 5						
Trend type: Rest. constant (Case 2)						
Sample size: 37						
Test Statistic			Value			
F-statistic			46.728421			
	10%		5%		1%	
Sample Size	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
35	2.331	3.417	2.804	4.013	3.900	5.419
40	2.306	3.353	2.734	3.920	3.657	5.256
Asymptotic	2.080	3.000	2.390	3.380	3.060	4.150

Source: Authors' Computation using Eviews 13.0

Table 4.4 presents the summary of NARDL Bounds test for cointegration to establish a long run relationship among the variables. The result however showed that there is cointegration among the variables since the F statistic value of 46.7284 is greater than the upper and lower bounds at 5 percent critical level. This leads to the rejection of the null hypothesis which states that there is no long run relationship among the variables. It is therefore concluded that there is long run relationship amongst the variables.

4.1.5 Non-Linear Autoregressive Distributed Lag (NARDL) Model

The NARDL is necessary in this study because there is long run relationship among the variables. Thus, the result is presented in Tables 4.5.

Table 4.5: Long Run Estimates

Dependent Variable: D(LEXP)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEXP(-1)*	0.078402	0.038070	2.220704	0.0378
GDPG_POS(-1)	0.051162	0.007697	6.647103	0.0000
GDPG_NEG(-1)	0.019811	0.009527	4.824832	0.0000
INFR_POS(-1)	-0.004164	0.003187	-1.306658	0.2078
INFR_NEG(-1)	0.001528	0.001298	1.177570	0.2543
UNER_POS(-1)	-0.010062	0.004113	-2.446701	0.0249
UNER_NEG(-1)	-0.000433	0.005660	-0.076549	0.9398
PHYS(-1)	0.533179	0.929199	0.573805	0.5732
INSQ(-1)	-0.004018	0.006335	-0.634154	0.5340
C	-8.067743	0.452287	-17.83766	0.0000

Source: Authors' Computation using Eviews 13.0

The long-term estimates on Table 4.5 reveal the impact of the explanatory variables on life expectancy (LEXP). The value of lagged life expectancy, LEXP(-1), has a coefficient of 0.078, which is positive and significant. This means that a one percent increase in the previous year's life expectancy led to a 0.08% increase in the current year's life expectancy, indicating considerable persistence in life expectancy over time. Positive GDP growth (GDPG_POS) has a coefficient of 0.0512, which is positive and significant. This implied that a one percent increase in positive GDP growth led to a 0.051% increase in life expectancy, highlighting that increased economic growth improved life expectancy. On the other hand, negative GDP growth (GDPG_NEG) has a coefficient of 0.019, which is also significant, indicating that a one percent increase in negative GDP growth significantly increased life expectancy by 0.019%.

Positive unemployment (UNER_POS) has a coefficient of -0.010, which is negative and significant. This means that a one percent increase in positive unemployment led to a 0.010% decrease in life expectancy, showing that negative unemployment reduced life expectancy. Conversely, negative unemployment (UNER_NEG) has a coefficient of -0.0004, which is negative and insignificant, suggesting that a one percent increase in positive unemployment reduced life expectancy by about 0.0004%. Positive inflation (INFR_POS) has a coefficient of -0.0041, which is negative and insignificant. This indicated that a one percent increase in positive inflation led to a 0.0041% decrease in life expectancy, demonstrating that higher inflation adversely affects life expectancy. On the other hand, negative inflation (INFR_NEG) has a coefficient of 0.0015, showing positive but insignificant impact, and this implies that a one percent increase in negative inflation caused increase of about 0.0015% in life expectancy.

Physicians per capita (PHYS) has a positive coefficient of 0.533. The value is however insignificant. This suggested that a one percent increase in the number of physician per capita also insignificantly increased life expectancy in the long run. Similarly, institutional quality (INSQ) has a coefficient of -0.0040, which is negative and insignificant, indicating that a one percent increase in institutional quality insignificantly reduced life expectancy in Nigeria.

Table 4.6: Short Run Estimates

Dependent Variable: D(LEXP)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
COINTEQ*	-0.198402	0.084330	-25.43634	0.0000
D(GDPG_POS)	0.010480	0.005080	2.062888	0.0489
D(GDPG_NEG)	0.026442	0.004004	6.604002	0.0000
D(INFR_POS)	-0.002661	0.001149	-2.316902	0.0283
D(INFR_NEG)	0.001694	0.001202	1.409620	0.1701
D(UNER_POS)	0.004758	0.002977	3.365559	0.0021
D(UNER_NEG)	-0.001340	0.004098	-0.326983	0.7462
D(PHYS)	0.229367	0.353493	0.648859	0.5219
D(INSQ)	-0.004640	0.003814	-1.216733	0.2342
R-squared	0.937639	Mean dependent var		0.269500
Adjusted R-squared	0.919162	S.D. dependent var		0.214463
S.E. of regression	0.060976	Akaike info criterion		-2.544347
Sum squared resid	0.100389	Schwarz criterion		-2.148467
Log likelihood	54.79824	Hannan-Quinn criter.		-2.406174
F-statistic	50.74545	Durbin-Watson stat		1.344114
Prob(F-statistic)	0.000000			
* *p-values are incompatible with t-Bounds distribution.*				

Source: Authors' Computation using Eviews 13.0

The short-run coefficients for the D(LEXP) as dependent variable revealed the direct impact of the explanatory variables on short-run changes in life expectancy. The cointegrating term, which is the error correction mechanism is -0.198. This is negative and highly statistically significant, and it showed that deviations from the long-run equilibrium were corrected by 0.20% every year, revealing that the adjustment process is moderate during the period covered in this study. The positive GDP growth (D(GDPG_POS)) is 0.010, indicating a positive relationship, and it implies that a one percent increase in positive GDP growth led to a 0.010% rise in life expectancy. The negative GDP growth (D(GDPG_NEG)) has a coefficient of 0.0264 with the p value of 0.0000, which is positive and statistically significant, meaning that negative GDP growth increased life expectancy by about 0.03% in Nigeria.

The coefficient of the positive unemployment rate (D(UNER_POS)) is 0.0048. This is positive, showing that an increase of one percent in positive unemployment resulted in a 0.0048% increase in life expectancy. Conversely, negative changes in unemployment D(UNER_NEG) has a coefficient of -0.0013 which is negative, suggesting that negative unemployment decreased life expectancy though this is not significant. The positive inflation rate D(INFR_POS) has a significant but negative coefficient of -0.003 and this indicates that positive inflation of about one percent reduced life expectancy by 0.003%. The negative

inflation (D(INFR_NEG)), on the other hand, has an insignificant positive coefficient of 0.0016, indicating that negative inflation had no significant impact although it increased life expectancy by 0.0016%. The coefficient of physicians per capita (D(PHYS)) is 0.2293. This is positive but not significant indicating that a one percent increase in the ratio of physicians to population would cause a 0.23% increase in life expectancy at birth in Nigeria. The coefficient of institutional quality (D(INSQ)) is -0.0046, negative and not significant, indicating that a one percent increase in INSQ insignificantly reduced life expectancy by 0.0046%.

From the result, R^2 of 0.9376 showed that about 94 percent of the variations in LEXP are explained by GDPG, UNER, INFR, PHYS and INSQ while the remaining 6 percent can be attributed to other variables which influenced LEXP but are captured by error term. The percentage is quite high and it showed our model is a good fit. The F-calculated of 50.7455 is greater than F-tabulated (2.53), which made the study to reject the null hypothesis (H_0). This indicated that the model is well specified and therefore showed that the independent variables jointly have a significant influence on the dependent variable.

4.1.6 Post Estimation Tests

Test for Serial Correlation

Table 4.7: Serial Correlation Test

Breusch-Godfrey Serial Correlation LM Test:			
Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	4.449932	Prob. F(2,16)	0.4291
Obs*R-squared	12.86734	Prob. Chi-Square(2)	0.2616

Source: Authors' Computation using Eviews 13.0

The result of the Breusch-Godfrey serial correlation is reported in Table 4.7, and it revealed that the probability value of F-statistic, which is 0.4291 is greater than the critical value at 5 percent level of significance. The study therefore accepts the null hypothesis which states that there is no serial correlation in the model.

Test of Heteroscedasticity

Table 4.8: Heteroscedasticity Test

Heteroscedasticity Test: Breusch-Pagan-Godfrey			
Null hypothesis: Homoscedasticity			
F-statistic	0.698125	Prob. F(17,18)	0.7682
Obs*R-squared	14.30463	Prob. Chi-Square(17)	0.6454
Scaled explained SS	2.063756	Prob. Chi-Square(17)	1.0000

Source: Authors' Computation using Eviews 13.0

Table 4.8 reports the diagnostic test for heteroscedasticity. The test showed that the variance of the error is homoscedastic at 5% level of significance. This is shown from the probability values of F-statistic of 0.7682 which is greater than 0.05. The study therefore fails to reject the null hypothesis that the error variance is homoscedastic. This means that the variance of the error term is constant.

Test for Normality

The test was carried out to know if the residuals are normally distributed or not, and the result is reported in Figures 4.1.

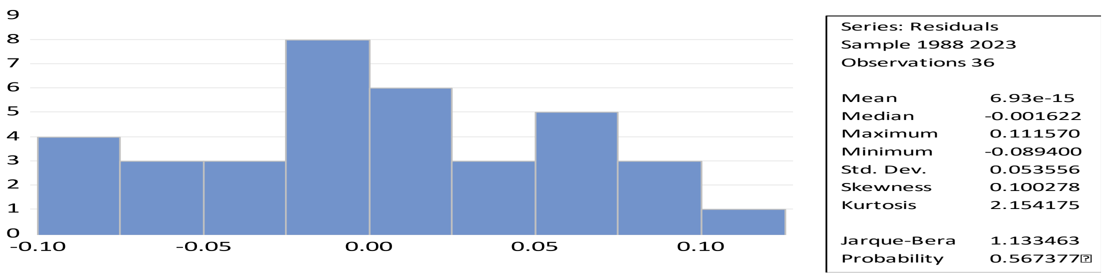

Figure 4.1: Histogram Normality Test

Source: Authors' Computation using Eviews 13.0

The histogram and accompanying statistic present an analysis of residuals from the model. The mean residual value is close to zero, indicating that the model's prediction is, on average, accurate and unbiased. The Jarque-Bera, with the probability values of 0.5674, suggested that the residuals are approximately normally distributed at the 5% significance level.

Test for Stability

This test is necessary in a time series to ascertain the stability nature of a model. In this study, the results are reported in Figures 4.2 and 4.3 for cumulative sum and cumulative sum of squares tests respectively.

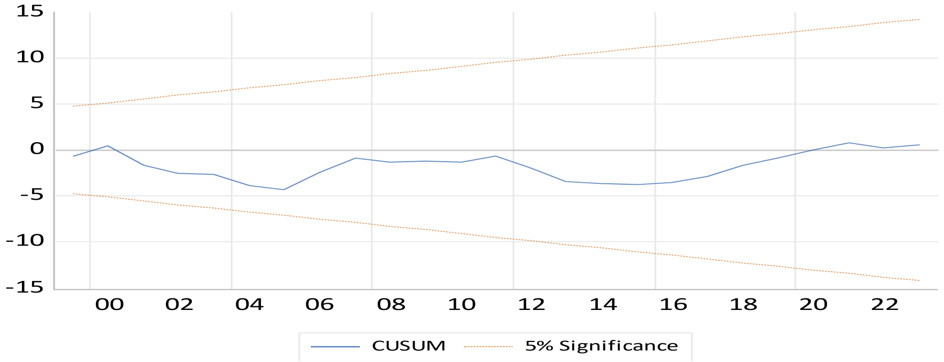

Figure 4.2: Cumulative Sum Result
Source: Authors' Computation using Eviews 13.0

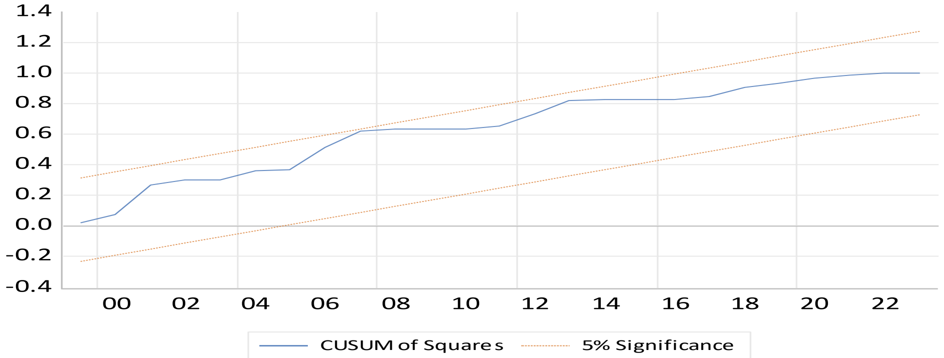

Figure 4.3: Cumulative Sum of Squares Result
Source: Authors' Computation using Eviews 13.0

From the results of this test, the CUSUM and CUSUM of Squares lines fell inside the critical boundaries, and it indicated that our model is stable and that there are consistent relationships among the variables throughout the sample period.

4.2 Discussion of Findings

The results showed that the lagged value of life expectancy (LEXP(-1)) had a high positive and significant impact on the current life expectancy, indicating high persistence in health outcomes over time.

This implies that past advancements in healthcare infrastructure, education, and access to medical services had long-term cumulative effect on life expectancy. Positive GDP growth (GDPG_POS) positively and significantly impacted life expectancy because economic growth improvements lead to better living standards which boost government health funding and create better food and medical treatment accessibility. The negative GDP growth (GDPG_NEG) produced a positive effect on life expectancy which was less significant than other effects. This means that during economic downturns, health outcomes could be maintained despite limited resources which affected access for vulnerable populations. These findings are in line with Abubakari et al. (2019), Ajak and Ogeto (2020), and Nikolov (2021), who observed that economic growth improves life expectancy through better health access and services. Unemployment exhibited a mixed effect. Positive unemployment reduction (UNER_POS) improved life expectancy, implying that employment enables individuals to provide for their health, while negative unemployment (UNER_NEG) had adverse effects. This supports the works of Janlert et al. (2015) and Udoumoh et al. (2023), which showed that unemployment negatively affects health outcomes, though the effect differs depending on context. Inflation (INFR) was also a contributing factor. Positive inflation (INFR_POS) reduced life expectancy due to loss of purchasing power, making healthcare and basic needs less affordable. Conversely, negative inflation (INFR_NEG) slightly improved life expectancy. This aligns with the findings of Olabiyi (2022), Lawal et al. (2021), and Abubakar et al. (2023), which highlighted that inflation can diminish access to health services and affect wellbeing. Physicians per capita (PHYS) had a positive but insignificant impact on life expectancy, indicating that while more healthcare personnel can improve access, factors like quality of care and infrastructure may play a more decisive role (Abubakari et al., 2019). Institutional quality (INSQ) had an insignificant negative effect, suggesting that persistent system-level problems restrain its influence on overall health outcomes.

5.0 Conclusion and Recommendations

The results of the study reinforced the relationship between macroeconomic indicators and life expectancy in Nigeria. Life expectancy is not an outcome of any single factor. Rather, it is an outcome of the combined effects of economic development, employment opportunities, inflation rates, and institutional quality. This is because health is a multidimensional concept. Therefore, an improvement in the quality of living standards, income distribution, and social conditions contributes to an increase in life expectancy. The lag effect of past life expectancy on current life expectancy showed that health outcomes are not achieved within a short period. Therefore, it requires sustained efforts to improve health outcomes. In other words, economic fluctuations over the short term are not sufficient to improve life expectancy. In conclusion, improving life expectancy in Nigeria is closely related to other development issues. Therefore, it requires efforts to stabilize macroeconomic factors, access to healthcare, and the provision of basic social services. Therefore, improving life expectancy is not only important for health outcomes. Rather, it is an important factor for development.

Based on the findings, the study recommended that;

i. The government should prioritize economic diversification by investing in other industries not dependent on oil such as manufacturing, agriculture, and renewable energy. The dependence on the exportation of oil exposes Nigeria to oil price shock in the world, whose negative impacts include reducing GDP growth. To do this, the government can offer incentives for private investors in agro-processing businesses and agriculture, build infrastructure like roads, electricity, and water supply to facilitate industrial growth, and attract foreign direct investment (FDI) in renewable energy ventures to tap Nigeria's abundant solar and wind resources.

ii. The Central Bank of Nigeria (CBN) should adopt a proactive monetary policy aimed at curbing inflation by stabilizing food prices as well as making essential commodities cheaper. To mitigate such impacts, the government must prioritize policies that stabilize commodity prices, especially essential commodities like food and medicine, while, at the same time, improving the health system to provide access and affordability to everyone.

iii. The government must initiate a National Youth Employment Program to provide employment in high-potential industries. For this, the government must collaborate with the private sector in offering vocational education and apprenticeships in high-demand areas like technology, construction, and renewable energy. Offering tax incentives to firms that employ and train youth workers and establishing public work programs to construct critical infrastructure such as roads, schools, and health facilities, while providing employment opportunities are equally essential measures.

iv. Since there are other factors that contributed to health outcomes, the Nigerian government needs to introduce a comprehensive health sector reform that focuses on equitable access, human resource development, and system effectiveness. This involves increasing public health investment, especially in rural infrastructure, leveraging digital health platforms for outreach and monitoring, and instituting accountability mechanisms to ensure that resources committed actually have a direct impact on service delivery and population health.

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