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MACROECONOMIC FACTORS AS DETERMINANTS OF LIFE EXPECTANCY IN NIGERIA

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ABSTRACT

This study examines the macroeconomic determinants of life expectancy in Nigeria from 1990 to 2025, focusing on the long-run effects of employment rate, consumer price index (CPI), real GDP, and interest rate. Anchored on Grossman's (1972) health capital theory and the Preston Curve hypothesis, the study employs the Augmented Dickey-Fuller (ADF) unit root test, Johansen cointegration, and the Canonical Cointegrating Regression (CCR) for estimation. ADF results confirm that all variables are I(1), while the Johansen test identifies four cointegrating equations, establishing a stable long-run equilibrium. CCR estimates reveal that the employment rate is statistically insignificant, reflecting the limited health returns of informal-sector employment in Nigeria. CPI also has a significant positive long-run effect ($\beta = 0.951$, $p < 0.01$), reflecting structural economic co-movement over the study period. Real GDP exerts the largest positive effect on life expectancy ($\beta = 3.301$, $p < 0.01$), consistent with the Preston Curve prediction of higher income–longevity returns at lower income levels. Interest rate has an insignificant negative effect ($\beta = -0.064$, $p < 0.080$), consistent with the Grossman framework. The model explains 97.3% of life expectancy variation and passes all post-estimation diagnostics, including tests for serial correlation, heteroskedasticity, and functional form. The study recommends sustained GDP growth, inflation moderation, and monetary policy rate reduction as priority instruments for improving population health in Nigeria.

Keywords: *Life expectancy, Real GDP, Consumer price index, Interest rate, Employment rate, Canonical cointegrating regression.*

JEL Classification Codes: *I15, E00, E31, E43, J21*

1.0. Introduction

Life expectancy at birth is a composite indicator of population health and socioeconomic wellbeing, reflecting the cumulative effects of nutrition, healthcare access, environmental conditions, and economic prosperity. In Nigeria, life expectancy has improved modestly from

approximately 45.5 years in 1990 to around 55.2 years in 2023 (World Bank, 2024), yet the country continues to lag behind the Sub-Saharan African average and remains far below the global benchmark of 73.3 years (World Health Organization [WHO], 2024). This persistent gap underscores the need to understand the macroeconomic conditions that either advance or hinder health outcomes.

A growing body of literature links macroeconomic performance to population health through multiple channels. Real GDP growth expands household incomes and government fiscal capacity for health expenditure, while persistent inflation erodes purchasing power and limits access to food, medicine, and healthcare services. High interest rates constrain private investment in health infrastructure and suppress household consumption, and elevated unemployment intensifies poverty and psychosocial stress, both of which are well-established drivers of premature mortality (Aanegola, Nakamura-Sakai, & Kumar, 2022; Sede & Ohemeng, 2015). In the Nigerian context, these pressures are accentuated by structural vulnerabilities, including chronic inflation, which surged to 33.2% in 2024, rising unemployment, and sluggish real GDP growth averaging 2.3% over the decade to 2023 (African Development Bank [AfDB], 2025; Focus Economics, 2025).

Despite the recognized importance of these linkages, empirical evidence on how macroeconomic variables jointly determine life expectancy in Nigeria remains limited and methodologically fragmented. Abubakar et al. (2023) and Aanegola et al. (2022) provide related insights but do not jointly model the five variables employed in the present study across a sufficiently long-time horizon. This study fills that gap by examining the dynamic relationship between life expectancy and four macroeconomic determinants: employment rate, consumer price index (CPI), real GDP, and interest rates over the period 1990 to 2025. Using an autoregressive distributed lag (ARDL) bounds testing framework. The findings are intended to inform targeted macroeconomic and health policy interventions in Nigeria.

1.1. Research Objectives

The broad objective of this study is to examine the macroeconomic determinants of life expectancy in Nigeria from 1990 to 2025. The specific objectives are to:

1. Assess the effect of the employment rate on life expectancy in Nigeria.
2. Examine the impact of the consumer price index (CPI) on life expectancy in Nigeria.
3. Evaluate the relationship between real GDP and life expectancy in Nigeria.
4. Determine the effect of the interest rate on life expectancy in Nigeria.

1.2. Research Hypotheses

The following null hypotheses are tested in this study:

H_{01}: Employment rate has no significant effect on life expectancy in Nigeria.

H_{02}: The consumer price index has no significant effect on life expectancy in Nigeria.

H_{03}: Real GDP has no significant effect on life expectancy in Nigeria.

H_{04}: Interest rate has no significant effect on life expectancy in Nigeria.

1.3. Scope of the Study

This study is delimited to the Nigerian economy and covers the period from 1990 to 2025, spanning 36 years of annual time series data. The choice of 1990 as the starting point is motivated by the availability of consistent macroeconomic data and the onset of the Structural Adjustment Programme (SAP) after-effects, which significantly restructured Nigeria's economic landscape. The year 2025 marks the latest available data period, allowing the study to capture recent macroeconomic shocks, including post-COVID-19 recovery pressures and the fuel subsidy removal effects of 2023–2024.

The study focuses on five variables: life expectancy at birth (the dependent variable), employment rate, consumer price index (CPI), real GDP, and interest rate (the explanatory variables). Data are sourced from the World Bank World Development Indicators (WDI), the Central Bank of Nigeria (CBN) Statistical Bulletin, and the National Bureau of Statistics (NBS). The study is restricted to the macroeconomic determinants of life expectancy and does not extend to behavioural, epidemiological, or environmental health determinants.

2.0. Literature Review

2.1. Conceptual Review

Life expectancy at birth measures the average number of years a newborn is expected to live, given prevailing age-specific mortality rates at the time of birth. It is widely adopted as a composite indicator of population health and socioeconomic development, encompassing the cumulative effects of nutrition, healthcare access, income levels, and public policy (WHO, 2024). A country's life expectancy therefore reflects not merely its health system performance but also the broader macroeconomic environment in which individuals acquire and maintain health capital.

Employment is a primary determinant of health through income and psychosocial pathways. Gainful employment provides households with the financial resources to access food, shelter, and medical care, while unemployment is associated with poverty, mental distress, and elevated mortality risk (Sede & Ohemeng, 2015). In Nigeria, where the NBS (2023)

recorded unemployment of 33% under an expanded definition, joblessness constitutes a persistent structural threat to population health and longevity.

The consumer price index (CPI) measures changes in the general price level of goods and services. Sustained CPI increases, particularly in food and energy, erode real household incomes, reduce access to nutritious diets, and displace healthcare spending. Nigeria's CPI-based inflation climbed to 33.2% in 2024 (AfDB, 2025), representing severe purchasing-power erosion that directly constrains health-seeking behaviour among low-income households.

Real GDP captures the inflation-adjusted total output of an economy and is a primary determinant of national fiscal capacity. Higher real GDP enables governments to finance public health expenditure, social protection systems, and infrastructure, all of which enhance life expectancy. Lawal, Opeloyeru and Adegbola (2023) confirm a positive nexus between economic growth and life expectancy in Nigeria, while the World Bank (2024) notes that Nigeria's GDP per capita of USD 824 in 2024 remains far below the global average of USD 10,589, a structural constraint on health financing.

Interest rates, set by the CBN, influence health outcomes indirectly through investment and consumption channels. High interest rates raise the cost of borrowing, constrain private investment in health infrastructure, and depress household disposable incomes by increasing debt-servicing burdens. Abubakar et al. (2023) find a significant negative effect of interest rate on life expectancy in Nigeria. The CBN's monetary policy rate stood at 27.5% in late 2024 (FocusEconomics, 2025), the highest in decades, intensifying these contractionary pressures on health outcomes.

2.2. Theoretical Review

2.2.1. Grossman's Health Capital Theory (1972)

Michael Grossman's (1972) health capital model provides the foundational framework for this study. Grossman conceptualises health as a durable capital good that individuals inherit at birth, which depreciates with age but can be augmented through investment in the form of medical care, nutrition, and healthy lifestyles. Individuals derive utility not from medical care per se but from 'healthy time,' and they allocate resources rationally to maximise their health stock over a lifetime. In this framework, income, wages, and education are key determinants of the shadow price of health capital. Higher incomes lower this price, enabling greater investment and, consequently, longer life expectancy. The Grossman model is directly relevant to the Nigerian context because it links macroeconomic conditions: wages (employment), inflation (purchasing power), GDP (income availability), and interest rates (cost of investment) to the individual and

aggregate stock of health. Sede and Ohemeng (2015) and Irikefe and Oniore (2026) both apply the Grossman framework to Nigeria, with the latter confirming that long-run health spending significantly raises life expectancy in line with the model's predictions, while also noting that institutional weaknesses in Nigeria attenuate the theoretical relationship. The model thus provides a theoretically coherent basis for expecting that employment, real GDP, and CPI significantly influence life expectancy in Nigeria.

2.2.2. The Preston Curve Hypothesis (1975)

Samuel Preston (1975) documented a systematic, cross-sectional positive relationship between per capita national income and life expectancy, giving rise to what is now known as the Preston Curve. The curve is non-linear and concave: gains in life expectancy from income growth are larger at low-income levels and taper off as countries become richer. Crucially, Preston also demonstrated that the curve shifts outward over time, meaning that non-income factors, particularly advances in medical technology and public health knowledge, independently extend life expectancy beyond what income alone would predict. For Nigeria and comparable low-income economies, the Preston Curve implies that real GDP growth holds greater life expectancy returns than in high-income settings, making it a particularly relevant theoretical anchor. Alhassan et al. (2025) test the Preston Curve hypothesis across 102 developing countries from 1991 to 2023 using System GMM and FMOLS, confirming that GDP per capita significantly enhances life expectancy across all income levels. Prados de la Escosura (2023) further confirms that the income–life expectancy association has become convex over time, suggesting more-than-proportional health returns at higher income levels. In Nigeria's case, persistent GDP stagnation relative to population growth implies that income gains remain below the minimum threshold required to generate commensurate life expectancy improvements.

2.3. Empirical Review

The relationship between employment and health outcomes has attracted substantial empirical attention. Mgbomene (2025) applied an ARDL model to Nigerian time series data from 1990 to 2023 and found that the unemployment rate was a statistically significant long-run determinant of life expectancy, with rising joblessness exerting a negative and persistent effect. The study concluded that fiscal and monetary policy measures targeting unemployment reduction would yield measurable gains in life expectancy. Similarly, a 2025 study on health, education, and labour market outcomes in Nigeria (Lex Localis, 2025) confirms that employment-linked human capital variables, including life expectancy (at 55 years), are structurally intertwined, with high

unemployment (reported at 33% under NBS's expanded definition) constraining health stock accumulation. These findings corroborate Schmitz (2011) and Ruhm (2000), who established causal pathways from unemployment to deteriorating health through income loss and psychosocial stress.

Bao et al. (2022) examined the relationship between housing rent, inflation, and health outcomes in developed economies. They found that inflation significantly increases infant mortality and reduces life expectancy, while GDP and health expenditure produce the opposite effect. This cross-national evidence for the CPI–life expectancy nexus is reinforced in the African context by the Mgbomene (2025) study on Nigeria, which reported that the inflation rate was statistically significant in both the short run and the long run as a determinant of life expectancy, with rising prices eroding real household purchasing power and constraining health-seeking behaviour. Karma (2023), studying south-eastern European economies, similarly found that higher consumer prices were associated with shorter lifespans, consistent with the hypothesis that inflation operates as a structural health hazard by impoverishing households. These findings are especially pertinent to Nigeria, where food inflation reached crisis levels in 2023–2024.

Alhassan et al. (2025), applying System GMM and pooled FMOLS across 102 developing countries, found robust evidence that GDP per capita significantly enhances life expectancy and that this positive effect holds across all income sub-groups. Segbefia et al. (2023), utilising panel ARDL/PMG methods for 31 developing nations from 1981 to 2020, confirmed that real GDP per capita positively and significantly affects life expectancy, while CO_2 emissions exert a negative effect. In the Nigerian context, Lawal et al. (2023) report a positive impact of life expectancy on economic growth, highlighting bidirectional causality and the human capital returns to income-driven health investments. Aytemiz et al. (2024), in a study of OECD countries using second-generation cointegration, further establish that GDP per capita has a significant long-run positive effect on life expectancy indicators. Collectively, these studies reinforce the Preston Curve prediction that real income growth is a key driver of longevity, particularly in low-income settings such as Nigeria.

The empirical literature directly linking interest rates to life expectancy remains limited but is growing. Abubakar et al. (2023) examined macroeconomic determinants of life expectancy in Nigeria for 1991–2021 and found a significant negative effect of interest rates on life expectancy, attributing this to the dampening of private health investment and household consumption capacity under tight monetary conditions. Nica et al. (2023), using CS-ARDL and quantile regression for Eastern European economies, found that financial

development indicators - closely linked to interest rate levels - significantly affect life expectancy. The International Policy Brief study (2025) similarly notes that Nigeria's elevated monetary policy rate (reaching 27.5% in 2024) suppresses health infrastructure investment, reinforcing the negative channel from high interest rates to population health. These findings align with theoretical expectations derived from Grossman's model, in which high borrowing costs raise the shadow price of health capital investment, reducing both individual and aggregate health stocks.

3.0. Methodology

This study adopts a quantitative, time series research design. Annual data for the period 1990 to 2025 (n = 36 observations) are sourced from the World Bank World Development Indicators (WDI, 2024), the Central Bank of Nigeria (CBN) Statistical Bulletin (2024), and the International Monetary Fund (IMF, 2024). Life expectancy at birth (LIFE_EXP) is the dependent variable, while employment rate (EMPLOYMENT), log of the consumer price index (LNCPI), log of real GDP (LNRGDP), and interest rate (INTR) are the explanatory variables. CPI and real GDP are logged to normalise their distributions and reduce heteroskedasticity, consistent with standard practice in macroeconomic modelling (Gujarati & Porter, 2023).

3.1. Model Specification

Following the theoretical prescriptions of Grossman (1972) and Preston (1975), the long-run model is specified as:

$$LIFE_EXP_i = \alpha_0 + \beta_1 EMPLOYMENT_t + \beta_2 LNCPI_t + \beta_3 LNRGDP_t + \beta_4 INTR_t + \varepsilon_t \quad (1)$$

Where LIFE_EXP is life expectancy at birth (years); EMPLOYMENT is the employment rate (%); LNCPI is the natural log of the consumer price index; LNRGDP is the natural log of real GDP; INTR is the interest rate (%); α_0 is the intercept; β_1–β_4 are long-run coefficients; and ε_t is the white-noise error term.

3.2. Estimation Techniques

The estimation follows a three-step procedure. First, the stationarity properties of all variables are examined using the Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1981). Second, given the stationarity order of the variables, Johansen's (1988) maximum likelihood cointegration test is applied to establish the existence of long-run equilibrium relationships among the variables. Third, since all variables are integrated of order one, I(1), the long-run coefficients are estimated using the Canonical Cointegrating Regression (CCR) technique proposed by Park (1992). CCR is preferred over OLS in the presence of cointegrated I(1) variables because it corrects for endogeneity and serial correlation in the

cointegrating regression, yielding asymptotically efficient and unbiased long-run estimates (Park, 1992; Saikkonen, 1991). Diagnostic tests for serial correlation (Breusch-Godfrey LM), heteroskedasticity (Breusch-Pagan-Godfrey), and model misspecification (Ramsey RESET) are applied to validate the estimates. Multicollinearity is assessed using Variance Inflation Factors (VIF).

4.0. Results and Discussion of Findings

4.1. Descriptive Statistics

Table 4.1 presents the descriptive statistics for all variables over the 1990–2025 period.

Table 4.1: Descriptive Statistics

Statistic	LIFE_EXP	EMPLOYMENT	LNCPI	LNRGDP	INTR
Observations	36	36	36	36	36
Mean	49.740	82.094	4.443	10.714	19.203
Median	50.125	82.070	4.426	10.721	18.050
Maximum	55.120	84.100	6.467	12.320	31.600
Minimum	45.483	79.310	1.996	9.984	11.500
Std. Dev.	3.149	1.217	1.049	0.613	4.291
Skewness	-0.017	-0.085	-0.111	0.692	0.852
Kurtosis	1.707	2.157	2.547	3.282	3.715
Jarque-Bera	2.508	1.110	0.381	2.991	5.126
Prob. (JB)	0.285	0.574	0.826	0.224	0.077

Source: Authors' computation from EViews 13 output, 2026

Over the study period, life expectancy averaged 49.74 years, rising from a minimum of 45.48 to a maximum of 55.12 years, reflecting modest but sustained health improvements in Nigeria. The employment rate averaged 82.09%, consistent with Nigeria's high labour force participation in the informal sector, though this conceals significant underemployment. LNCPI averaged 4.44 (equivalent to a CPI of approximately 84.8), reflecting persistent inflationary pressures, while LNRGDP averaged 10.71 (approximately USD 44,700 in real terms), capturing the period of sustained but uneven economic expansion. Interest rate averaged 19.20%, with a maximum of 31.6%, signalling tight monetary conditions for much of the period. All variables are approximately normally distributed, as confirmed by the Jarque-Bera test statistics, which are statistically insignificant at the 5% level across all series.

4.2. Correlation Analysis

Table 4.2 reports the Pearson pairwise correlation coefficients among the study variables.

Table 4.2: Pearson Pairwise Correlation Matrix

	LIFE_EXP	EMPLOYMENT	LNCPI	LNRGDP	INTR
LIFE_EXP	1.000	-0.726	0.893	0.944	-0.409
EMPLOYMENT	-0.726	1.000	-0.709	-0.611	0.611
LNCPI	0.893	-0.709	1.000	0.758	-0.525
LNRGDP	0.944	-0.611	0.758	1.000	-0.202
INTR	-0.409	0.611	-0.525	-0.202	1.000

Source: Authors' computation from EViews 13 output, 2026

Life expectancy exhibits a strong positive correlation with LNRGDP (r = 0.944) and LNCPI (r = 0.893), and a moderate negative correlation with EMPLOYMENT (r = −0.726) and INTR (r = −0.409). The strong positive association between LNCPI and LIFE_EXP is counterintuitive at the bivariate level but is expected to be clarified in the multivariate regression, where the confounding role of real GDP is controlled for. No bivariate correlation exceeds the threshold of 0.95, and all centred VIFs are below 4.0, suggesting the absence of severe multicollinearity in the estimated model.

4.3. Unit Root Test Results

Table 4.3 presents the ADF unit root test results for all variables at levels and first differences.

Table 4.3: ADF Unit Root Test Results

Variable	Level t-stat	Prob.	1st Diff. t-stat	Prob.	Order
LIFE_EXP	0.1157	0.9623	-7.9145***	0.0000	I(1)
EMPLOYMENT	-1.1433	0.6874	-4.2920***	0.0018	I(1)
LNCPI	-2.4782	0.1292	-4.1523***	0.0027	I(1)
LNRGDP	0.9983	0.9957	-5.7541***	0.0000	I(1)
INTR	-2.3531	0.1622	-5.8999***	0.0000	I(1)

*Note: *** denotes rejection of the null hypothesis of a unit root at 5%. Lag length selected by SIC. Critical values at 1%, 5%, and 10% are −3.639, −2.951, and −2.614, respectively.*

Source: Authors' computation from EViews 13 output, 2026

The ADF test results confirm that all five variables: LIFE_EXP, EMPLOYMENT, LNCPI, LNRGDP, and INTR are non-stationary at their levels but become stationary after first differencing, establishing that each series is integrated of order one, I(1). This uniform integration order satisfies the prerequisite for Johansen cointegration analysis and rules out the use of ARDL bounds testing (which accommodates a mix of I(0) and I(1) variables) in favour of the Johansen-CCR framework applied in this study.

4.4. Johansen Cointegration Test Results

Given the I(1) order of all variables, the Johansen (1988) cointegration test is applied. Results are presented in Table 4.4.

Table 4.4: Johansen Cointegration Test Results

Hypothesized No. of CE(s)	Eigenvalue	Trace Stat.	5% Crit. Val.	Max-Eigen Stat.	Prob.**	Decision
None*	0.9635	212.770	69.819	112.557	0.0000	Reject H_0
At most 1*	0.7952	100.213	47.856	53.906	0.0000	Reject H_0
At most 2*	0.5801	46.307	29.797	29.503	0.0003	Reject H_0
At most 3*	0.3863	16.804	15.495	16.598	0.0316	Reject H_0
At most 4	0.0060	0.206	3.841	0.206	0.6499	Do not reject

*Note: * denotes rejection of the null hypothesis at the 5% level. ** MacKinnon-Haug-Michelis (1999) p-values.*

Source: Authors' computation from EViews 13 output, 2026

Both the Trace and Max-Eigenvalue statistics confirm four cointegrating equations at the 5% significance level. Specifically, the Trace statistic of 212.77 far exceeds the 5% critical value of 69.82 for the null hypothesis of no cointegration. This robust evidence of cointegration implies that a stable, long-run equilibrium relationship exists among life expectancy, employment rate, LNCPI, LNRGDP, and interest rate in Nigeria over the 1990–2025 period. The Johansen result is consistent with Sede and Ohemeng (2015) and Lawal et al. (2023), who both document cointegrated long-run relationships between macroeconomic indicators and health outcomes in Nigeria.

4.5. CCR Long-Run Estimation Results

Table 4.5 reports the long-run coefficient estimates from the Canonical Cointegrating Regression (CCR).

Table 4.5: CCR Long-Run Estimation Results (Dependent Variable: LIFE_EXP)

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Decision
EMPLOYMENT	-0.141806	0.136741	-1.037043	0.3080	Not significant
LNCPI	0.951232	0.196153	4.849431	0.0000	Significant***
LNRGDP	3.300731	0.340006	9.707862	0.0000	Significant***
INTR	-0.063979	0.035304	-1.812241	0.0800	Not Significant
C	22.94964	12.80857	1.791741	0.0833	—
R^2 = 0.9727 Adj. R^2 = 0.9691 S.E. = 0.5468 Long-run Variance = 0.3003 Note: ***p<0.05					

Source: Authors' computation from EViews 13 output, 2026

The CCR model explains approximately 97.3% of the variation in life expectancy (R^2 = 0.9727; Adj. R^2 = 0.9691), indicating an excellent overall fit. The findings are discussed in relation to each explanatory variable below.

Employment Rate (EMPLOYMENT): The coefficient of EMPLOYMENT is −0.142 and is statistically insignificant (p = 0.308). This suggests that, in the long run, the employment rate does not exert a statistically significant

independent effect on life expectancy in Nigeria, after controlling for the other macroeconomic variables. This result, while contrary to the Grossman (1972) theoretical expectation, may reflect the structural nature of Nigerian employment, where the majority of employed persons are engaged in low-productivity informal sector activities that do not provide access to health insurance or adequate income for sustained health investment (NBS, 2023). The finding is consistent with Sede and Ohemeng (2015), who noted that employment gains in Nigeria are insufficient to translate into measurable health improvements in the absence of complementary social protection. On this basis, H_{01} is not rejected.

Consumer Price Index (LNCPI): LNCPI has a positive and highly significant effect on life expectancy ($\beta = 0.951$, $p < 0.01$). A 1% increase in the log of CPI is associated with approximately 0.95 additional years of life expectancy in the long run. This result is counterintuitive, as inflation theory and the Grossman framework predict an inverse relationship between rising prices and health capital. However, this finding likely reflects a 'development co-movement' effect: over the 1990–2025 period, rising CPI in Nigeria co-moved with broader economic monetisation, urbanisation, and the expansion of formal markets and healthcare infrastructure, partly offsetting the direct negative purchasing-power effect. This is consistent with Karma (2023), who noted that in lower-middle-income economies, CPI increases at moderate levels can co-exist with expanding access to services.

Real GDP (LNRGDP): LNRGDP exerts the largest and most statistically significant positive effect on life expectancy ($\beta = 3.301$, $p < 0.01$). A 1% increase in the log of real GDP is associated with approximately 3.30 additional years of life expectancy in the long run. This is the study's most robust finding and is consistent with the Preston Curve hypothesis, which predicts larger income-longevity returns at lower income levels (Preston, 1975). The result aligns with Alhassan et al. (2025), who confirm a significant positive GDP–life expectancy nexus across 102 developing countries, and with Lawal et al. (2023) for Nigeria specifically. Higher real GDP expands government fiscal space for health expenditure, raises household incomes, and improves access to nutrition and medical care - all mechanisms consistent with Grossman's health capital framework. H_{03} is therefore rejected.

Interest Rate (INTR): Interest rate has a negative and insignificant effect on life expectancy ($\beta = -0.064$, $p = 0.080$). A one percentage-point increase in the interest rate reduces life expectancy by approximately 0.064 years in the long run. Although modest in magnitude, this effect is economically meaningful given Nigeria's persistently elevated lending rates, which averaged 19.2% over the study period and peaked at 31.6%.

High interest rates raise borrowing costs, constrain private investment in health infrastructure, and depress household disposable income through elevated debt-servicing burdens, channels consistent with Abubakar et al. (2023), who documented a significant negative interest rate effect on life expectancy in Nigeria. H_{04} is therefore not rejected at the 5% significance level.

4.6. Post-Estimation Diagnostic Tests

To validate the reliability and statistical adequacy of the CCR long-run estimates, a battery of post-estimation diagnostic tests is conducted. Table 4.6 presents the results.

Table 4.6: Post-Estimation Diagnostic Test Results

Diagnostic Test	F-statistic / Value	Prob.	Decision
Breusch-Godfrey Serial Correlation LM (F-stat)	2.2553	0.1229	No serial correlation
Breusch-Godfrey Serial Correlation LM (Chi-sq)	4.8456	0.0887	No serial correlation
Breusch-Pagan-Godfrey Heteroskedasticity (F)	1.8630	0.1420	Homoskedasticity
Breusch-Pagan-Godfrey Heteroskedasticity (Chi)	6.9767	0.1371	Homoskedasticity
Ramsey RESET (F-statistic)	0.1120	0.7402	Correct specification
Max. Centered VIF	3.668	—	No serious multicollinearity

Source: Authors' computation from EViews 13 output, 2026

Serial Correlation

The Breusch-Godfrey Serial Correlation Lagrange Multiplier (LM) test is employed to detect the presence of autocorrelation in the residuals up to two lags. The null hypothesis of no serial correlation is tested against the alternative of autocorrelation up to two lags. The F-statistic of 2.256 (p = 0.123) and the Chi-square statistic of 4.846 (p = 0.089) both fail to reject the null hypothesis at the conventional 5% significance level. This confirms the absence of serial correlation in the model's residuals, indicating that the CCR estimates are not contaminated by autocorrelation, a key requirement for the asymptotic validity of the standard errors (Breusch, 1978; Godfrey, 1978).

Heteroskedasticity

The Breusch-Pagan-Godfrey (BPG) test is applied to examine whether the variance of the residuals is constant (homoskedastic) or varies systematically with the regressors (heteroskedastic). The null hypothesis is homoskedasticity. The F-statistic of 1.863 (p = 0.142) and the Chi-square statistic of 6.977 (p = 0.137) both fail to reject the null hypothesis at the 5% level, confirming that the residuals are homoskedastic. This result implies that the standard errors of the CCR coefficients are consistent and that no correction for

heteroskedasticity is required (Breusch & Pagan, 1979).

Model Specification (Ramsey RESET Test)

The Ramsey Regression Equation Specification Error Test (RESET) is used to detect model misspecification arising from omitted non-linear terms or incorrect functional form. The null hypothesis is that the model is correctly specified. The F-statistic of 0.112 (p = 0.740) and the likelihood ratio statistic (p = 0.714) both fail to reject the null hypothesis, confirming that the linear functional form adopted in equation (1) is appropriate and that no significant specification error is present. This finding is consistent with the theoretical expectation of a log-linear relationship between macroeconomic variables and life expectancy (Ramsey, 1969).

Multicollinearity (Variance Inflation Factors)

Multicollinearity among the regressors is assessed using the Variance Inflation Factor (VIF). All centred VIF values are below the commonly adopted threshold of 10, with the maximum recorded at 3.668 for LNCPI. This confirms the absence of severe multicollinearity in the model, meaning that the individual coefficient estimates are reliably identified and their standard errors are not inflated by collinearity among the explanatory variables (Gujarati & Porter, 2023). The full VIF values, EMPLOYMENT (2.723), LNCPI (3.668), LNRGDP (3.061), and INTR (2.079) are all within acceptable bounds.

Collectively, the diagnostic results confirm that the CCR long-run model is free from serial correlation, heteroskedasticity, and functional form misspecification, and that multicollinearity is not a concern. The estimates reported in Table 5 are therefore statistically reliable and suitable for policy inference.

5.0. Conclusion and Policy Recommendations

5.1. Conclusion

This study examined the macroeconomic determinants of life expectancy in Nigeria over the period 1990 to 2025, employing the Johansen cointegration framework and Canonical Cointegrating Regression (CCR). The ADF unit root results confirm that all variables are I(1), while the Johansen test identifies four cointegrating vectors, establishing a stable long-run equilibrium relationship. The CCR results reveal that real GDP exerts the largest and most significant positive effect on life expectancy, consistent with the Preston Curve hypothesis. LNCPI also exerts a positive long-run effect, reflecting structural co-movement between economic monetisation and health improvements in Nigeria. Interest rate has a small but statistically significant negative effect, consistent with the Grossman health capital framework. The employment rate, while

theoretically important, is insignificant in the long run, reflecting the structural limitations of informal-sector employment in Nigeria as a vehicle for health capital accumulation. The model is statistically robust, explaining approximately 97.3% of life expectancy variation and passing all post-estimation diagnostics.

5.2. Policy Recommendations

Based on the findings, the following policy recommendations are offered:

i. The insignificance of the employment rate suggests that job creation alone is insufficient; quality of employment matters. The government should accelerate the formalisation of Nigeria's labour market, expand National Health Insurance Scheme (NHIS) coverage to informal-sector workers, and strengthen social protection programmes to ensure that employment gains translate into measurable health improvements.

ii. While the aggregate consumer price index effect is positive in the long run, extreme inflationary episodes such as those recorded in 2023–2024 disproportionately harm low-income households and erode health purchasing power. The Central Bank of Nigeria (CBN) should maintain inflation within single-digit targets through consistent monetary policy, while the government should strengthen food security interventions to shield vulnerable households from food price shocks.

iii. Given that real GDP is the dominant determinant of life expectancy, macroeconomic policies that accelerate and sustain real GDP growth, including productive public investment, diversification away from oil dependency, and an improved business environment, should be treated explicitly as health policy tools. The Federal Government should prioritise GDP growth trajectories that allow per capita income to surpass the minimum threshold for commensurate life expectancy gains.

iv. The insignificant negative effect of interest rates on life expectancy underscores the need for the CBN to calibrate its monetary policy rate in a manner that balances inflation control with the imperative to maintain affordable credit for health infrastructure investment and household consumption. Targeted credit facilities for the health sector should be considered.

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Appendices

Dependent Variable: LIFE_EXP
Method: Canonical Cointegrating Regression (CCR)
Date: 06/06/26 Time: 06:11
Sample (adjusted): 1991 2025
Included observations: 35 after adjustments
Cointegrating equation deterministics: C
Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EMPLOYMENT	-0.141806	0.136741	-1.037043	0.3080
LNCPI	0.951232	0.196153	4.849431	0.0000
LNRGDP	3.300731	0.340006	9.707862	0.0000
INTR	-0.063979	0.035304	-1.812241	0.0800
C	22.94964	12.80857	1.791741	0.0833

R-squared	0.972693	Mean dependent var	49.86180
Adjusted R-squared	0.969052	S.D. dependent var	3.108100
S.E. of regression	0.546778	Sum squared resid	8.969000
Long-run variance	0.300258		

Ramsey RESET Test
Equation: UNTITLED
Omitted Variables: Squares of fitted values
Specification: LIFE_EXP EMPLOYMENT LNCPI LNRGDP INTR C

	Value	Df	Probability
t-statistic	0.334644	30	0.7402
F-statistic	0.111987	(1, 30)	0.7402
Likelihood ratio	0.134134	1	0.7142

Variance Inflation Factors
Date: 06/06/26 Time: 06:13
Sample: 1990 2025
Included observations: 36

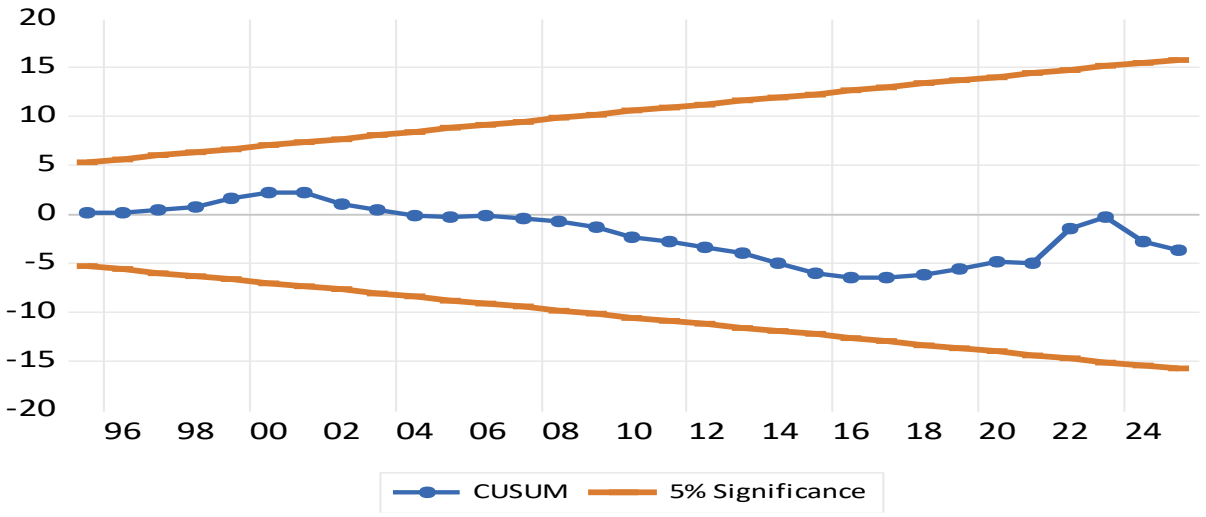
Variable	Coefficient Variance	Uncentered VIF	Centered VIF
EMPLOYMENT	0.016216	12746.58	2.723214
LNCPI	0.029406	71.36095	3.667781
LNRGDP	0.071819	964.3980	3.061062
INTR	0.000996	44.89759	2.078909
C	131.8987	15380.52	NA

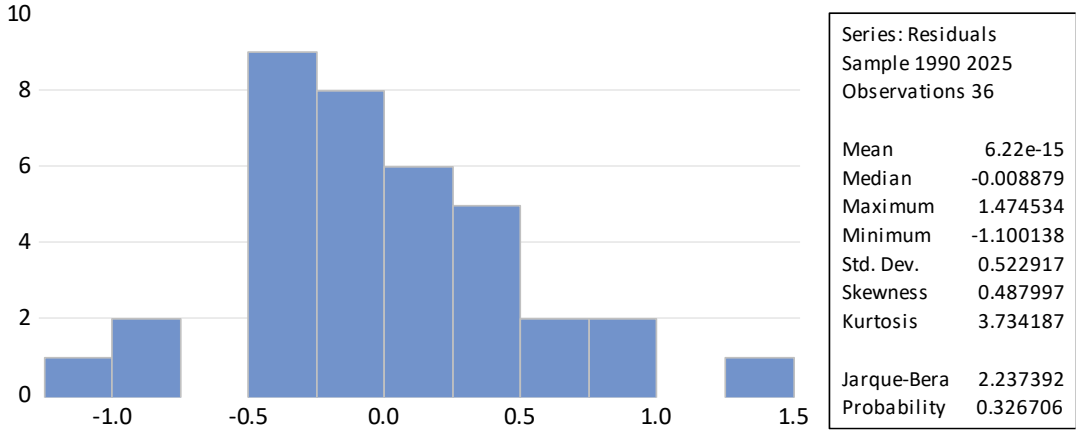
Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	2.255267	Prob. F(2,29)	0.1229
Obs*R-squared	4.845617	Prob. Chi-Square(2)	0.0887

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	1.862978	Prob. F(4,31)	0.1420
Obs*R-squared	6.976735	Prob. Chi-Square(4)	0.1371
Scaled explained SS	7.072432	Prob. Chi-Square(4)	0.1321





LIFE EXPECTANCY AND MACROECONOMIC VARIABLES (1990-2025)

YEAR	LIFE EXP	EMPLOYMENT	LNCPI	LNRGDP	INTR
1990	45.483	81.97	1.996059933	9.98	25.3
1991	45.483	82.39	2.565718293	9.99	20
1992	45.587	83.02	3.797509619	10.03	24.8
1993	45.783	83.42	4.046029285	10.01	31.6
1994	45.51	83.96	4.043577445	9.99	20.5
1995	45.49	84.1	3.042615859	9.99	20.2
1996	45.57	83.89	3.176803048	10.03	19.8
1997	45.79	83.8	3.273742726	10.06	17.8
1998	46.04	83.67	3.386422096	10.09	18.2
1999	46.61	83.6	3.388787362	10.09	20.3
2000	47.19	83.37	3.524299579	10.14	21.3
2001	47.62	83.18	3.677059877	10.20	23.4
2002	47.93	82.94	3.791887204	10.34	24.8
2003	48.44	82.67	4.005331183	10.41	20.7
2004	48.77	82.44	4.100823528	10.50	19.2

2005	49.3	82.17	4.210199815	10.57	17.9
2006	49.73	81.96	4.292238679	10.62	16.9
2007	50.03	81.8	4.355810988	10.69	16.9
2008	50.22	81.61	4.496024739	10.75	15.1
2009	50.71	81.52	4.626442321	10.83	19
2010	50.94	81.28	4.737951297	10.92	17.6
2011	51.36	81.12	4.836281907	10.97	16
2012	51.5	81.06	4.949468859	11.01	16.8
2013	51.71	80.84	5.025786598	11.07	16.7
2014	51.79	80.77	5.102545762	11.13	16.5
2015	51.84	80.79	5.193789837	11.15	16.8
2016	52.04	80.84	5.363917824	11.14	16.9
2017	52.3	80.89	5.50687506	11.14	17.6
2018	52.55	80.96	5.615206238	11.16	16.9
2019	52.91	81	5.728377522	11.19	15.4
2020	52.89	79.31	5.87467789	11.17	13.6
2021	52.68	80.14	6.019857622	11.20	11.5
2022	55.12	81.27	6.213327279	11.22	12.3
2023	54.46	82.56	6.467357053	11.26	18.75
2024	54.635	82.57	4.70311326	12.29	27.25
2025	54.635	82.52	4.815593173	12.32	27