The Impact of Macroeconomic Variables on Life Expectancy in Nigeria (1990 – 2023)

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A b s t r a c t

Nigeria's life expectancy has remained low despite government health policies as compared to other countries with people living longer. This paper investigated the impact of macroeconomic variables on life expectancy in Nigeria from 1990 to 2023 using the autoregressive distributed lag and error correction models. This paper found that inflation has an insignificant negative impact on life expectancy in Nigeria. Interest rate has a significant and negative impact on life expectancy in Nigeria, unemployment has an insignificant and negative impact on life expectancy, while exchange rate has a significant and positive impact on life expectancy in Nigeria, while real gross domestic product in Nigeria has a significant and positive impact on life expectancy in Nigeria. The paper recommended that the central bank of Nigeria should implement policies to control inflation, maintain stable and favourable exchange rates to reduce the cost of imported medical supplies, and implement policies to moderate interest rates, thereby encouraging investments in health infrastructure and improving life expectancy. National Directorate of Employment should roll out policies for enabling a business environment, reduce unemployment, and equip the unemployed to improve their skills.

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Background to the Study

Life expectancy is considered one of the measures of the health of every society and also socioeconomic advancement. Life expectancy studies have been the subject of global research, which is crucial as it gives room for new policies that are targeted for the improvement of life expectancy while ensuring stability in the economy. Developing countries experience the effect of more fluctuations of macroeconomic variables on life expectancy than the developed countries because of resources that are limited, infrastructures in healthcare that are not enough, and also because of the high propensity to economic shocks; it makes these countries more prone to instability in the economy (Abubakar *et al.,* 2023). The impact of these variables can be seen in the quality and healthcare service accessibility, thereby affecting overall life expectancy. Globally, the relationship between macroeconomics and life expectancy has been rated by so many events and trends in the past decades, like the Asian financial crisis in 1997, the global economic downturn of 2008, the HIV/AIDS epidemic, outbreaks of Ebola and Lassa fever, and the covid-19 pandemic in 2020, which have shown how macroeconomic downturns can lead to adverse health outcomes, reducing life expectancy. Unemployment, reduced income levels, and decreased spending in health as a result of this instability in the economy, which in turn has worsened healthcare as it reduces life expectancy (Aigheyisi, 2021; Arikpo *et al.,* 2019). The World Health Organisation and World Bank have started the importance of stable economic policies in improving healthcare delivery and low life expectancy in low- and middle-income countries (World Health Organisation, 2019; World Bank, 2018).

Over the past three decades, Nigeria has experienced fluctuations in oil prices, political instability, demographic changes, and economic transformations, transitioning from military rule to a democratic governance system, which has had varying implications for its economic policies and health sector. The fluctuation of oil prices, in particular, has had a profound impact on Nigeria's economy, given that the nation is heavily reliant on oil exports. These economic shifts have inevitably affected healthcare financing, access, and quality in Nigeria as the inflation rate has seen periods of hyperinflation causing widespread socio-economic challenges (Atia *et al.,* 2022; Barkat *et al.,* 2024). High inflation rates generally lead to increased costs of healthcare services and pharmaceuticals, making it difficult for a large segment of the population to afford necessary medical care, which has led to a reduction in life expectancy due to decreased access to essential health services and nutrition (Cavusoglu *et al.,* 2021; Mushay *et al.,* 2024).

The interplay of macroeconomic variables like inflation, interest rates, unemployment, exchange rates, and real GDP. These variables collectively paint a complex picture of how economic conditions shape healthcare access, quality, and outcomes. Interest rates, as one of the instruments used to control inflation and stabilise the economy, affect healthcare, as high interest rates reduce investments in healthcare infrastructure and prevent private investment in healthcare due to the increased cost of borrowing, which, as a result, reduces the quality of healthcare, evidenced by reduced life expectancy (Abubakar *et al.,* 2023). On the other hand, lower interest rates can attract investors in

healthcare. Also, high unemployment rates increase poverty levels. This reduction in adequate balanced diet, healthcare access, and quality disproportionately affects the most vulnerable, leading to increased decreased life expectancy (Aigheyisi, 2021).

Conversely, periods of lower unemployment are generally associated with better healthcare due to improved economic conditions and increased healthcare spending. The real GDP of Nigeria has been subject to cycles of growth and recession since 1990. Economic growth, reflected by increases in real GDP, typically leads to enhanced governmental capacity to invest in healthcare infrastructure, services, and personnel, resulting in better life expectancy (Akiri *et al.,* 2020). An expanding economy can afford better healthcare services, nutritional programs, and public health initiatives, which contribute to higher life expectancy (Barkat *et al.,* 2024). Conversely, economic recessions tend to constrain healthcare spending and access, leading to poorer healthcare (Aigheyisi, 2021). Furthermore, the Nigerian healthcare system has been plagued by various challenges, including underfunding, corruption, inadequate facilities, and brain drain, among others. These issues are intertwined with the country's economic conditions. For instance, oil revenue, which constitutes a significant portion of Nigeria's economy, has been subject to global price fluctuations, directly impacting government spending on health (Atia *et al.,* 2022). Additionally, policies such as structural adjustment programs (SAPs) in the 1990s had profound effects on healthcare financing and accessibility in Nigeria (Abah *et al.,* 2016).

Comparatively, other countries with similar economic backgrounds have shown varying levels of success in managing the impact of macroeconomic variables on life expectancy. Countries like Brazil and India have implemented policies that focus on inclusive growth, investing in social programs, and improving healthcare systems, which have led to improved health despite economic challenges (World Bank, 2019). The responses to these health crises and their outcomes were significantly influenced by the country's economic conditions and policies at those times (Umaru *et al*., 2023). Furthermore, the adoption of the Sustainable Development Goals (SDGs) in 2015, with Goal 3 focusing on good health and well-being, has prompted Nigeria, like other nations, to reassess and realign its economic policies towards improving healthcare outcomes (United Nations, 2015).

The comparisons revealed significant insights into how different policy approaches, implementations, and investments in health can lead to divergent health outcomes. This paper provided valuable lessons for Nigeria in terms of policy formulation and implementation aimed at improving life expectancy amidst economic fluctuations. Based on the backdrop of global and national economic developments, this paper aimed at revealing impact of selected macroeconomic variables on life expectancy in Nigeria by analysing data from 1990 to 2023, as the period under study encapsulates significant economic fluctuations and health challenges. The paper is structured into five sections, which are the introduction, literature review, methodology, presentation and interpretation of results, and conclusion and recommendation.

The following hypotheses were tested to achieve the objective of the paper:

H_{01}: Inflation rate has no significant impact on life expectancy in Nigeria.

H_{02}: There is no statistically significant impact of interest rate on Nigerian life expectancy.

H_{03}: There is no statistically significant impact of the unemployment rate on Nigerians' life expectancy.

H_{04}: There is no statistically significant impact of exchange rate on Nigerian life expectancy.

H_{05}: There is no statistical impact of real gross domestic product on the life expectancy of Nigerians.

Literature Review
Conceptual Review
Macroeconomic Indicators
Macroeconomic Indicators are linked with total economic behaviour in a population or country. These total economic behaviours include production in businesses, families, individuals, and the public sector. We use macroeconomic variables such as gross domestic product, inflation, unemployment, government spending, interest rates, and exchange rates to examine economic outcomes. According to Mankiw (2020), who introduced macroeconomic variables by categorising them as national income, inflation, and unemployment rates, these indicators provide insights into the state of an economy and guide policymakers in their decisions. This foundational perspective lays the groundwork for understanding the broader economic landscape. Building on this, Blanchard (2016) emphasised the interplay between these variables, explaining that interactions among macroeconomic variables such as GDP, inflation, and unemployment can illuminate the underlying mechanisms of economic fluctuations, thereby highlighting the interconnected nature of economic indicators.

While in the research of Abubakar *et al.* (2023) where he delved into the importance of macroeconomic variables in understanding economic cycles, asserting that by analysing trends in growth, inflation, and employment, economists can predict phases of expansion and recession, which showcases the predictive power of these indicators. In the same vein, Arikpo *et al.* (2019) expanded the scope of macroeconomic variables to include income distribution and environmental sustainability, arguing that traditional macroeconomic variables must be complemented with measures of inequality and ecological impact to fully assess economic well-being, thus advocating for a more comprehensive approach.

Inflation Rate
Inflation is the rate at which the general level of prices for goods and services rises, eroding purchasing power over time, leading to higher costs for goods and services, including healthcare. Increased inflation reduces the ability of individuals to afford a balanced diet and health services, which will affect life expectancy (Onyeanu, 2023).

Interest Rate

interest rates are the cost of borrowing money, expressed as a percentage of the loan amount, influencing economic activity and consumer spending. Higher interest rates can deter investments in healthcare infrastructure and make personal loans for medical expenses more expensive, limiting access to necessary services and negatively affecting life expectancy. Conversely, lower interest rates may encourage healthcare investments, enhancing service availability and quality (Ewubare & Ushang, 2022).

Unemployment Rate

While u**nemployment** refers to the proportion of the labour force that is jobless and actively seeking employment, indicating economic health. **Unemployment** affects income levels and access to healthcare. When unemployment goes up, it means low income reduces individual ability to pay for quality health services and a healthy lifestyle, thereby lowering life expectancy (Nwaru & Eke, 2017).

Exchange Rate

Exchange rates denote the value of one currency in terms of another. **Exchange rates** determine the cost of imported goods, including medical supplies and pharmaceuticals. A depreciating local currency makes imports more expensive, potentially leading to shortages or higher costs for essential medical products, which can compromise healthcare quality and accessibility, thereby affecting life expectancy (Akiri *et al.,* 2020).

Real Gross Domestic Product

Real Gross Domestic Product measures the total value of all goods and services manufactured in an economy, adjusted for inflation, reflecting economic growth and living standards. **Real Gross Domestic Product** reflects a country's economic health and its capacity to fund public services, including healthcare. Higher real Gross Domestic Product enables greater government expenditure on healthcare infrastructure, services, and social programs, which can improve population health and increase life expectancy. In contrast, economic downturns constrain public spending, potentially leading to deteriorations in healthcare quality and accessibility (Atia *et al.*, 2022).

Life Expectancy

Life expectancy at birth reflects the population's overall mortality level. It summarises the mortality pattern that prevails across all age groups—children and adolescents, adults, and the elderly (WHO, 2024). To put it another way, life expectancy serves as a comprehensive indicator that reflects the overall mortality level of a population (Marvellous, 2017; WB, 2019). It encompasses a wide range of factors, including healthcare access, the quality of medical services, public health practices, and socioeconomic conditions. Economic indicators such as real GDP and interest rates have a significant impact on life expectancy. Economic growth (reflected in rising real GDP) often leads to improved healthcare infrastructure and services, which can extend life expectancy (Bloom *et al.*, 2004). Conversely, high interest rates may deter investments in healthcare sectors, potentially stunting improvements in life expectancy (Strauss &

Thomas, 1998). Typically, life tables, constructed from current age- and sex-specific death rates in a given population, calculate life expectancy at birth, a more complex measure. While there isn't a simple formula for IMR, the basic idea behind life expectancy calculation is to first compile data on the number of individuals (or proportion of a cohort) dying at each age or age group. Then, calculate the proportion surviving at each age (from birth).

Empirical Review

Ogundipe and Anagun (2024) analysed the impact of macroeconomic stability, including inflation, interest rates, exchange rates, and unemployment, on life expectancy in Nigeria from 1990 to 2021. The study used the Autoregressive Distributed Lag methodology, indicated that fluctuations in interest rates, along with other macroeconomic factors, significantly affect life expectancy in Nigeria and recommended that maintaining macroeconomic stability is important for increasing life expectancy.

In another studies, Granados and Ionides (2024) evaluated the causal relationship between income and life expectancy using methods of cointegration using time series data from multiple 150 countries. They found that standard cointegration methods may not reliably infer causality between income and life expectancy while recommending the development of more robust methodologies to accurately assess the income. While, Barkat *et al.* (2024) investigated the relationship between food prices and life expectancy in emerging countries using a dataset of 120 emerging economies over the period 2000–2021, employing the dynamic panel threshold and system-generalized method of moments (GMM) models. Our findings reveal a nonlinear inverted U-shaped relationship where, beyond a specific threshold, higher food prices tend to shorten life expectancy.

By using Autoregressive Distributed Lag (ARDL), Ukangwa and Onyenze (2023) examined how exchange rate fluctuations impact the standard of living in Nigeria, with implications for life expectancy in Nigeria. Autoregressive Distributed Lag (ARDL) was found to have significant fluctuations in exchange rates, negatively impacting the standard of living, potentially resulting in a lower life expectancy. Stabilising exchange rates is crucial to improving living standards and, consequently, life expectancy. Abubakar *et al.* (2023) examined the impact of macroeconomic variables on life expectancy in Nigeria for the period spanning 1991 to 2021. As the variables were subjected to the ARDL-bound procedure for co-integration, it was employed to investigate the long-run relationship among the variables of the study. The ARDL bound test significantly co-integrated the study's variables, leading to an estimate of the short-run ARDL Error Correction Model (ECM). Inflation has a negative impact on Nigeria's life expectancy, both in the short run and the long run. In the long run, economic growth had a significant and positive impact on Nigeria's life expectancy. In the short and long term, unemployment does not have a significant impact on life expectancy. Hence, this study concluded that economic growth and inflation are the major macroeconomic determinants of life expectancy in Nigeria over the period of 1991 to 2021. One of the

study's important recommendations is that macroeconomic policymakers should focus more energy on pursuing economic growth and reducing inflation in order to improve life expectancy.

Wen-Sheng *et al.* (2022) also examined the effects of real estate prices, specifically housing rent, and inflation on population health from 1996 to 2019. Health was measured by infant mortality rates and life expectancy at birth, which are the dependent variables, while inflation, GDP, and unemployment are the independent variables, and the descriptive method was used for analysis. The empirical results indicate that housing rent has a positive and significant effect on infant mortality rates. In contrast, renting a house increases life expectancy. They found that an increase in inflation positively affects the infant mortality rate and has a negative effect on life expectancy. GDP and health expenditure tend to improve health by increasing life expectancy and reducing the infant mortality rate.

Ibikunle *et al.* (2022) investigated how rising food prices affected public health improvements in six African countries with high poverty levels from 2000 to 2020. They measured this in terms of life expectancy, infant mortality rate, under-5 mortality rate, and neonatal mortality rate. The findings revealed that rising food prices have a significant detrimental effect on nutrition, resulting in higher levels of infant under-five and neonatal mortality while reducing the expected life expectancy in African countries. The inflation of food has a long-term impact on the health of the public. So therefore, they recommended that the government in Africa should focus on reducing high prices of food, improving per-capita income, and improving awareness of environmental sanitation while focusing on pregnant women and young children.

Similarly, Adesete *et al.* (2022) investigated the impact of public health spending and macroeconomic uncertainty on health outcomes in Nigeria from 1981 to 2020. They used the autoregressive distributed lag (ARDL) model to analyse the study's objectives, using health outcomes as a proxy for infant mortality rate (IMR) and life expectancy rate (LER). The independent variables included macroeconomic uncertainty (MUN), public expenditure on health (PHE), gross domestic product per capita (INCOME/GDPPC), and urbanisation (UBN). The Generalised Autoregressive Conditional Heteroscedasticity (GARCH) model also used conditional variance to proxy macroeconomic uncertainty, with the inflation rate as the main macroeconomic variable. Finally, public income was identified as the most important determinant of health outcomes in Nigeria, both in the long and short run, and is positively related to health outcomes. The obtained results indicated that an increase in public income is likely to improve life expectancy rates and reduce infant mortality rates. According to the study, Nigerian governments should efficiently allocate public health expenditure and implement welfare-enhancing policies in order to improve households' income levels and well-being.

Bao *et al.* (2022) investigated the impact of real estate prices and inflation on health outcomes, specifically infant mortality rates and life expectancy from 1996 to 2019. The study employs advanced econometric techniques of GMM and 2SLS estimation approaches to analyse the relationship between housing rents, inflation, and health indicators and found that a 1% increase in inflation is associated with a 0.058% rise in infant mortality rates and a 0.241% reduction in life expectancy. Suggesting that policymakers should consider the health implications of inflation and implement measures to mitigate its adverse effects on vulnerable populations

Lawanson and Umar (2021) looked at the relationship between life expectancy, growth, and poverty reduction by using the modified ordinary least squares method, based on the endogenous growth theoretical approach, to estimate the link between life expectancy, poverty incidence, and economic growth. Findings showed that health contributes positively to economic growth and also mitigates the adverse effect of poverty on economic growth in Nigeria. The study established a minimum life expectancy threshold of 64.4 years as a health improvement annual benchmark. Therefore, for Nigeria to achieve sustainable economic growth and significant poverty reduction, policies aimed at achieving the newly determined health improvement threshold from the current annual average of 47.8 years are fundamental.

Chen *et al.* (2021) assessed the effects of economic development and environmental factors on life expectancy from 20 countries from 2004 to 2016 using Pearson correlation coefficients and multiple regression models. They found that both economic and environmental factors significantly impact life expectancy, with variations across countries. They recommended that implementation of integrated policies addressing economic growth and environmental protection to enhance life expectancy.

Freeman *et al.* (2020) examined factors contributing to discrepancies between income levels and life expectancy outcomes. Comparative analysis of Brazil, Ethiopia, and the United States. Mixed-methods approach, including quantitative analysis and scoping reviews. They found that social determinants, healthcare access, and political contexts significantly influence life expectancy beyond income levels. They recommended that social inequalities and strengthen healthcare systems to improve life expectancy relative to income. Venkataramani *et al.* (2020) examined how economic factors, including inflation, influence population health and life expectancy in the United States with a focus on recent decades. The study analysed economic data alongside health outcomes to identify correlations and potential causal relationships. The study indicated that economic downturns and associated factors, such as unemployment and reduced income, negatively impact life expectancy. They advocated for economic policies that promote stability and growth to improve public health outcomes.

He and Li (2018) investigated the long- and short-run relationships between life expectancy and economic growth across countries with varying ageing levels, with 65 countries categorised by ageing levels, from 1980 to 2014. Panel cointegration analysis

and panel causality tests. They found a positive long-run relationship between life expectancy and GDP per capita, with stronger effects in countries with higher ageing levels, and recommended that policies should focus on enhancing life expectancy to promote economic growth, especially in ageing populations. Sede and Ohemeng (2015) investigated the socio-economic factors influencing life expectancy in Nigeria, including the impact of unemployment rates from 1980 to 2011 by utilising Vector Autoregression (VAR) and Vector Error Correction Model (VECM) frameworks to analyse the data. The study found that higher unemployment rates negatively affect life expectancy in Nigeria. The authors suggested that implementing policies aimed at reducing unemployment to improve life expectancy.

Theoretical Framework
This paper utilises Grossman's Health Production Theory, which conceptualises health as a form of capital that depreciates over time, necessitating investments to maintain or enhance it (Grossman, 1972). Individuals can augment their health capital through medical care, healthy behaviours, and lifestyle choices, thereby improving productivity and extending longevity. Health serves a dual role: as a consumption good, it provides immediate utility by enhancing well-being; as an investment good, it increases the number of healthy days available for work, thereby boosting earning potential and overall economic productivity. Individuals "produce" health by making decisions regarding medical care, nutrition, exercise, and other factors while contending with health depreciation due to illness and ageing.

In the context of this research on the impact of macroeconomic variables on life expectancy in Nigeria, Grossman's theory offers a framework to understand how economic factors such as inflation, unemployment, interest rates, exchange rates, and GDP growth indirectly influence health outcomes. For example, higher unemployment rates can reduce individuals' ability to invest in their health due to loss of income, leading to lower health capital and decreased life expectancy (Adofu & Abdulganiyu, 2018). Inflation can increase the cost of medical services and goods, making healthcare less affordable and accessible. Elevated interest rates may deter households from borrowing for health-related expenditures, thereby limiting healthcare investments (Adesete *et al.*, 2022). Fluctuations in exchange rates can affect the cost of importing essential medical supplies, impacting the quality and availability of healthcare services (Ohioze *et al.*, 2022). A growing GDP generally enhances health capital by providing resources for improved healthcare infrastructure and better living conditions (Edeme & Olisakwe, 2019).

Methodology
This paper employs an ex post facto research design, analysing secondary annual time series data from 1990 to 2023. Key macroeconomic variables—including inflation rate, interest rate, exchange rate, and gross domestic product (GDP) growth rate—were obtained from the Central Bank of Nigeria's Statistical Bulletin (December 2024). Unemployment rate data were also retrieved from the World Bank Online Data Bank

(2024). These datasets were selected for their relevance in analysing the impact of macroeconomic variables on life expectancy in Nigeria. The study employed the Autoregressive Distributed Lag (ARDL) method, introduced by Pesaran and Pesaran in the late 1990s. The ARDL technique is particularly useful for analysing the dynamic relationships between variables, as it allows for the examination of both short-run and long-run effects within a single framework.

Model Specification

This paper employed the Autoregressive Distributed Lag (ARDL) methodology, aligning with the theoretical framework established herein. The model is adapted from Ohioze *et al.* (2022), who investigated the uncertainties of macroeconomic variables and their effects on health outcomes in Nigeria.

Their functional relationship model is expressed as:

$$Hoct = f(X\_unc)t + ut \tag{1}$$

In this equation, *Hoct* represents the dependent variable, and $XuncX\_\{unc\}Xunc$ denotes a vector of uncertainties associated with the macroeconomic variables. For this paper, the vector of uncertainties has been replaced with the relevant explanatory variables.

$$Hoct = \beta 0 + \beta_1 EXR\_UNCt + \beta_2 INFR\_UNCt + \beta_3 LnPCI\_UNCt + u_t \tag{2}$$

For this paper, *Hoct* represents health outcomes, *Exr_unc* denotes exchange rate uncertainty, *Infr_unc* is inflation rate uncertainty, and *LnPCI_UNCt* stands for the natural logarithm of per capita income uncertainty, with "t" representing the time period from 1980 to 2019. The coefficient is represented by *β*.

Equation (2) is modified to align with the objectives of this research and to establish the functional relationship between macroeconomic variables and life expectancy rate in Nigeria. Consequently, the functional form of the model for this study, which includes macroeconomic variables and life expectancy indicator, is expressed in the following implicit model:

$$LEN = f(IRN, ITN, URN, ERN, GDPN) \tag{3}$$

Where;

LEN is the Life expectancy, IRN is Inflation Rate, ITN is Interest Rate, URN is Unemployment Rate, ERN is Exchange Rate, GDPN is Real Gross Domestic Product

This research further specifies equation (3) in a stochastic (linear regression) form to gives:

$$LEN_t = \alpha_0 + \alpha_1 IRN_t + \alpha_2 ITN_t + \alpha_3 URN_t + \alpha_4 ERN_t + \alpha_5 GDPN_t + \mu_t \tag{4}$$

Where;

The α_0 is Intercept, $\alpha_1, \alpha_2, \alpha_3, \alpha_4,$ and α_5 are Slope and μ_t is the Error Terms. The Autoregressive Distributed Lagged (ARDL) model that was used in this paper is specified as follows:

$$LEN = \alpha_0 + \sum_{g=1}^{i} \alpha_{1_i} \Delta LEN_{t-i} + \sum_{h=1}^{j} \alpha_{2_i} \Delta IRN_{t-i} + \sum_{i=1}^{k} \alpha_{3_i} \Delta ITN_{t-i} + \sum_{j=1}^{l} \alpha_{4_i} \Delta URN_{t-i} + \sum_{i=1}^{m} \alpha_{5_i} \Delta ERN_{t-i} + \sum_{i=0}^{n} \alpha_{6_i} \Delta GDPN_{t-i} \tag{5}$$
$$+ \alpha_{7_i} \Delta LEN_{t-i} + \alpha_{8_i} \Delta IRN_{t-i} + \alpha_{9_i} \Delta ITN_{t-i} + \alpha_{10_i} \Delta URN_{t-i} + \alpha_{11_i} \Delta ERN_{t-i} + \alpha_{12} \Delta GDPN_{t-i} + \mu_t$$

Equation (5) was employed to assess both the short-run and long-run relationships, as well as the impact of macroeconomic variables on mortality rate in Nigeria. The Error Correction Model (ECM) utilized in this investigation is formulated as follows:

$$\Delta LEN = \alpha_0 + \sum_{g=1}^{i} \alpha_{1_i} \Delta LEN_{t-i} + \sum_{h=1}^{j} \alpha_{2_i} \Delta IRN_{t-i} + \sum_{i=1}^{k} \alpha_{3_i} \Delta ITN_{t-i} +$$
$$\sum_{j=1}^{l} \alpha_{4_i} \Delta URN_{t-i} + \sum_{k=1}^{m} \alpha_{5_i} \Delta ERN_{t-i} + \sum_{l=0}^{n} \alpha_{6_i} \Delta GDPN_{t-i} + ECM_{t-i} + \mu_t \tag{6}$$

Equation (6) was employed to assess both the short-run and long-run relationships, as well as the impact of macroeconomic variables on mortality rate in Nigeria.

Variable Description, Measurements and Apriori Expectation
Table 1: Description of the Variables Used for the Model

Variable	Description/Measure	Type	Source	Apriori Expectation
LEN	Life expectancy (Age)	Dependent	World Bank (Online Databank), 2024	Not Applicable
IRN	Inflation Rate	Independent	Central Bank of Nigeria (CBN)	$\alpha_1 < 0$
ITN	Interest Rate (Lending interest rate %)	Independent	Central Bank of Nigeria (CBN)	$\alpha_2 < 0$
URN	Unemployment Rate (% of total labor force)	Independent	National Bureau of Statistics (NBS)	$\alpha_3 < 0$
ERN	Exchange Rate (Naira per US Dollar)	Independent	CBN Statistical Bulletin, 2023	$\alpha_4 < 0$
RGDPN	Real Gross Domestic Product (N Billion)	Independent	CBN Statistical Bulletin, 2023	$\alpha_5 > 0$

Source: Author Compilation, (2025)

The presupposition for this paper is that the coefficients of the independent variables $\alpha_1, \alpha_2, \alpha_3, \alpha_4,$ may signify negative impact with life expectancy (LEN) while $_5$ may signal positive impact with life expectancy. Specifically, it is expected that rising$_1$, An increase in the inflation rate is expected to negatively affect life expectancy. Rising prices can erode purchasing power, making healthcare services and nutritious food less affordable, thereby adversely impacting life expectancy and α_2 (Interest Rate) and α_3 (Unemployment Rate) will have negative relationships with LEN, implying higher

interest rates are anticipated to have a detrimental effect on life expectancy. Increased borrowing costs can discourage investments in healthcare infrastructure and personal health expenditures, leading to reduced access to medical services. Also, an increase in the unemployment rate is projected to lower life expectancy. Joblessness often results in loss of income and health insurance, limiting individuals' ability to afford healthcare and maintain healthy lifestyles.

Similarly, α_4 (Exchange Rate); Depreciation of the national currency is presumed to negatively impact life expectancy. A weaker currency can raise the cost of imported medical supplies and pharmaceuticals, reducing their availability and affordability. Conversely, α_5 (Gross Domestic Product Growth Rate) is expected to have a positive relationship with LEN, as A higher real GDP is expected to enhance life expectancy. Economic growth typically increases government revenues and personal incomes, enabling greater investment in healthcare services and improved living conditions

Presentation and Discussion of Results
Descriptive Statistics
Table 2: Descriptive Statistics

	LEN	IRN	ITN	URN	ERN	RGDPN
Mean	49.55882	18.27912	18.07529	4.067353	161.3147	45229.70
Median	50.00000	12.94500	17.77000	3.854000	130.7550	42044.78
Maximum	54.00000	72.84000	29.80000	5.633000	645.1900	76684.94
Minimum	46.00000	5.390000	12.14000	3.507000	8.040000	21462.73
Std. Dev.	2.830475	15.90238	3.723789	0.538521	143.1272	20491.60
Skewness	-0.021923	2.180516	0.928026	1.557654	1.425237	0.162433
Kurtosis	1.513961	6.855680	4.703478	4.399505	5.187665	1.389244
Jarque-Bera	3.131164	48.00357	8.991256	16.52366	18.29069	3.825104
Probability	0.208966	0.000000	0.011158	0.000258	0.000107	0.147703
Sum	1685.000	621.4900	614.5600	138.2900	5484.700	1537810.
Sum Sq. Dev.	264.3824	8345.223	457.5980	9.570170	676017.9	1.390000
Observations	34	34	34	34	34	34

Source: Researcher's EViews computation, (2025)

Table 2 descriptively expatiate that life expectancy (LEN) which represent life expectancy in Nigeria of mean, median, maximum, minimum value of 49, 50 years, 54 years, 46 respectively from 1990 to 2023. As the skewness value is -0.022 showing that a slight leftward skew. Also, the 18.28 represent the mean value for inflation rate (IRN), 12.95 percent for median, 72.84 and 5.39 percent for maximum and minimum respectively. Interest Rate (ITN) shows a mean value of 18.08 percent, while the median, maximum, minimum are 17.77, 29.80, 12.14 percent respectively. Values for the mean for unemployment rate (URN) in Nigeria is 4.1 percent with median, maximum, minimum value of 3.85, 5.63, 3.51 respectively, while exchange rate (ERN) in Nigeria shows a mean, median, maximum and minimum of 161.31, 130.76, 645,19, 8.04 values of the Nigeria currency against foreign currencies. The real gross domestic product in Nigeria

(RGDPN) with value of 45229.7, 42044.78,76684.94, 21462.73 billion for mean, median, maximum and minimum respectively.

while the kurtosis of 1.5, 1.39 for life expectancy (LEN), real gross domestic product (RGDPN) respectively suggesting a platykurtic distribution as inflation rate (IRN), Interest Rate (ITN), unemployment rate (URN), exchange rate (ERN) showed leptokurtic distribution with values of 6.85, 4.7, 4.4, 5.2 respectively which indicate that a distribution will tend towards a high value. The probability values for the jarue-bera for inflation rate (IRN), Interest Rate (ITN), unemployment rate (URN), exchange rate (ERN) are less than the level of significant which is 5 percent while life expectancy (LEN) and real gross domestic product in Nigeria (RGDPN) are have probability vales that are greater than 5 percent which shows that the data does not significantly deviate from normal distribution.

Table 3: Correlation Analysis

Correlation Probability	LEN	IRN	ITN	URN	ERN	RGDPN
LEN	1.000000					

IRN	-0.389043	1.000000				
	0.0230	-----				
ITN	-0.641679	0.277542	1.000000			
	0.0000	0.1120	-----			
URN	0.361331	0.051729	-0.327185	1.000000		
	0.0358	0.7714	0.0589	-----		
ERN	0.858997	-0.216785	-0.621046	0.393278	1.000000	
	0.0000	0.2181	0.0001	0.0214	-----	
RGDPN	0.983886	-0.346489	-0.637281	0.424324	0.849171	1.0000
	0.0000	0.0447	0.0001	0.0124	0.0000	-----

Source: Author's Computation, using E-Views 9 (2025)

From the Table 3 shows correlation result on this paper as life expectancy (LEN) in Nigeria and Inflation Rate (IRN) in Nigeria shows a significant negative correlation in Nigeria with correlation co-efficient value of -0.389043 and probability value of 0.0230. On the other hand, life expectancy (LEN) in Nigeria shows a significant negative correlation with Interest Rate (ITN) with correlation co-efficient value of -0.641679 and probability valie of 0.0000 which less than 5% level of significant. While life expectancy (LEN) and Unemployment Rate (URN) shows a significant positive correlation with co-efficient value of 0.361331 and probability value of 0.0358 which is less than the 5% level of significant, Likewise, life expectancy (LEN) and exchange rate (ERN) with shows a significant positive correlation with value of 0.858997 and probability value of 0.983886. In the same vein, life expectancy (LEN) and real gross domestic product in Nigeria (RGDPN) shows a significant positive correlation with value 0.983886 and probability value of 0.0000 which less than 5% level of significant

Stationary Tests (Unit Root Tests)
This part of the paper looked at the unit root of each of the variable using the augmented dickey-fuller (ADF) test to ascertain stationarity of the data at 5% level of significance.

Table 4: Unit Root Test Result

Variable	Augmented Dickey-Fuller (ADF) Test		
	ADF	Critical Value	Status
LEN	-7.745967	-2.957110	1(1)
IRN	-4.645122	-2.957110	1(1)
ITN	-3.648961	-2.954021	1(0)
URN	-4.388979	-3.557759	1(1)
ERN	-4.388979	-3.557759	1(1)
RGDPN	-2.976618	-2.957110	1(1)

significant level is 5% level

Source: Researcher's Computation Using EViews-9 (2025)

Table 4 shows that the stationary test of the variables in which life expectancy (LEN), Inflation Rate (IRN), Exchange Rate, Unemployment Rate (URN), real gross domestic product in Nigeria (RGDPN) were not stationary at levels until when differences at first differenced 1(1) while Interest Rate (ITN) was stationary at level 1(0) which are all in 5% level of significant.

Co-integration of ARDL-Bounds Test
This section shows the ARDL co-integration bounds test of the variables used in this paper.

Table 5: ARDL-Bound Testing

Null Hypothesis: No long-run relationships exist		
Test Statistic	Value	K
F-statistic	16.17085	5
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

Source: Researcher's Computation Using EViews-9 (2025)

Table 5 of the ARDL bound test shows that at 5 per cent level of significant that the F statistics 16.17 is greater than the lower critical bound 1(0) value of 2.62 and upper critical bound 1(1) value of 3.79 signifying that the over-all model has a long run impact.

Auto regressive Distributed Lag (ARDL) Regression Results
This part of the paper shows the shortrun, longrun impact ARDL regression analysis, the error correction and the model fit.

Table 6: Autoregressive Distributed Lag (ARDL) Model Results
Dependent Variable: LE

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEN(-1))	0.455709	0.248972	1.830365	0.1046
D(IRN)	-0.000792	0.010086	-0.078549	0.9393
D(IRN(-1))	0.009696	0.008824	1.098815	0.3038
D(IRN(-2))	0.029682	0.010513	2.823441	0.0224
D(ITN)	-0.071389	0.037470	-1.905233	0.0932
D(ITN(-1))	0.123092	0.054146	2.273351	0.0526
D(ITN(-2))	0.095949	0.042365	2.264827	0.0533
D(URN)	1.236471	0.522595	2.366021	0.0455
D(URN(-1))	-2.606504	1.351716	-1.928292	0.0900
D(URN(-2))	2.429875	0.962474	2.524613	0.0356
D(ERN)	-0.011745	0.006416	-1.830709	0.1045
D(ERN(-1))	-0.015578	0.006543	-2.380804	0.0445
D(ERN(-2))	-0.007756	0.005378	-1.442337	0.1872
D(RGDPN)	0.000293	0.000112	2.616071	0.0308
D(RGDPN(-1))	-0.000343	0.000163	-2.106762	0.0682
D(RGDPN(-2))	0.000316	0.000116	2.723981	0.0261
CointEq(-1)	-2.501708	0.492032	-5.084437	0.0009
R-squared	0.999940			
Adjusted R-squared	0.998254			
F-statistic	593.0699			
Prob(F-statistic)	0.032463			
Durbin-Watson stat	3.051011			
Long Run Coefficients (LE)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
IRN	-0.009312	0.004712	-1.976135	0.0835
ITN	-0.174483	0.037359	-4.670421	0.0016
URN	-0.232842	0.181189	-1.285079	0.2347
ERN	0.008349	0.001218	6.853609	0.0001
RGDPN	0.000076	0.000006	13.428958	0.0000
C	49.018204	1.099481	44.583057	0.0000

Source: Researcher's Computation Using EViews-9 (2025)

From the longrun result from Table 6 which shows that IRN and URN has an insignificant and negative impact on life expectancy in Nigeria implying that a unit decrease of inflation rate and unemployment will respectively lead to 0.0093 and 0.23 increase of life expectancy. While ITN has a significant (0.0016) and negative impact on life expectancy. On the other hand, ERN has a significant and positive impact on life expectancy with value of 0.008349 and probability of 0.0001. Real gross domestic product likewise showed a significant and positive impact on life expectancy in Nigeria

The R-squared of 0.999940 signify that 99.9 % of the independent variable explains the changes in life expectancy while about 0.1 does not explain. Also, the probability value of 0.032463 for the F statistics is less than 5% implying that all the model is statistically significant.

Therefore, the hypothesis that H_{01}: inflation rate has no significant impact on life expectancy in Nigeria is accepted as the probability 0.0835 is insignificant while H_{02} which start that there is no statistically significant impact of interest rate on Nigerian's life expectancy is rejected as the probability 0.0016 is significant. In contrast H_{03} that state there is no statistically significant impact of Unemployment rate on Nigerian's life expectancy. is accepted as the probability 0.2347 is insignificant. H_{04}: there is no statistically significant impact of Exchange rate on Nigerian's life expectancy is rejected as the probability 0.0001 is significant and similarly the hypothesis H_{05} which state that there is no statistical impact of Gross domestic product growth on Nigerian's life expectancy is rejected as the probability 0.0000 is significant.

Post-Estimation Checks (ARDL Diagnostic Test)
The ARDL result as in table are hereby validated in this section

Table 8: Results of ARDL Diagnostic Checks

Tests		Outcomes	
		Coefficient	Probability
Breusch-Godfrey-Serial-Correlation Test	F-stat.	4.290007	0.0697
Heteroscedasticity-Breusch-Pagan-Godfrey Test	F-stat.	0.423451	0.9471
Normality Test	Jarque-Bera	4.342832	0.114016

Source: Author's Computation Using EViews-9 (2025)

Breush-godfrey serial correlation test result F-stat. in table 8 with coefficient of 4.290007 and probability value of 0,0697 which is less than 5 % level of significant signifying the absence of serial correlation. While the F-stat. of 0.423451 for heteroscedasticity-breusch pagan Godfrey test while the probability test is 0.9471 implying that there is absence of heteroschedasticity withn the model, The normality test result shows that the residuals are normally distributed.

Discussion of Findings
This paper examines the impact of macroeconomic using proxies like inflation rate, interest Rate, unemployment rate, exchange Rate, real gross domestic rate on life expectancy in Nigeria from 1990 to 2023. The paper found that inflation rate has an insignificant negative impact on life expectancy which suggests that inflation rate fluctuations do not have a statistically significant impact on life expectancy in Nigeria. However, negative coefficient implies higher inflation may slightly reduce life expectancy due to increased costs of healthcare, food, and other essentials., this aligns with the priori expectation of a negative impact on life expectancy in Nigeria, likewise the study of Barkat *et al.* (2024) that higher food prices tend to shorten life expectancy and also other studies by Cavusoglu and Gimba (2021); Bao *et al.* (2022); Atia *et al.* (2022) aligns with the result. Also, interest rate showed significant negative impact on life expectancy in Nigeria possibly due to increased borrowing costs for businesses and individuals, which can limit investment in healthcare infrastructure and personal healthcare

spending which is supported by Olaitan *et al*. (2020) who found out that interest rate and bank rate has indirect and insignificant effect on health and economic growth in Nigeria.

Unemployment showed an insignificant and negative impact on life expectancy in Nigeria. This suggests that although joblessness can reduce access to healthcare and quality of life, other factors may mitigate its direct influence on mortality as supported by Atia *et al.* (2022); Miftahu (2021); Orji *et al*. (2020); Sede and Ohemeng (2015) and contrasted by Umaru *et al*. (2023) that unemployment has significant and positive influences on life expectancy in Nigeria. The exchange rate showed a positive and significant impact on life expectancy in Nigeria possibly due to increased foreign investment, improved medical imports which align with the studies of Olaitan *et al*. (2020); Sede and Ohemeng (2015); Wasurum & Leera (2023). Real gross domestic product showed a significant positive impact on life expectancy in Nigeria which align with the studies of Sart *et al.* (2024); Etienne (2017); Felice et al. (2016); Aigheyisi (2021) while Chang (2023) was against the findings that GDP growth can have a negative impact on life expectancy if it is accompanied by increased environmental pollution or income inequality

Conclusion and Recommendations
This paper investigated with the help of ARDL methodology on the impact of Inflation Rate, Interest rate, Unemployment Rate, exchange rate and real gross domestic product variables respectively on life expectancy in Nigeria as the impact have mixed outcomes of macroeconomic variables on life expectancy in Nigeria. While inflation rate, interest rate, unemployment has a positive impact, exchange rate and real gross domestic product have positive impact on life expectancy. This shows that policies are effectively targeted to areas that can foster long-term improvements in life expectancy. Therefore, this paper recommends that:
1. while inflation rate has an insignificant negative impact on life expectancy, Central Bank of Nigeria should implement policies to control inflation.
2. Also, interest rate showed significant negative impact on life expectancy in Nigeria, the Central Bank of Nigeria should implement policies to moderate interest rate hereby encouraging investments in health infrastructure improving life expectancy.
3. Unemployment showed an insignificant and negative impact on life expectancy in Nigeria, through the National Directorate of Employment which should role out policies for enabling business environment, reduce unemployment and equip the unemployed to improve their skills
4. Exchange rate showed a positive and significant impact on life expectancy in Nigeria, the Central Bank of Nigeria should implement policies to maintain stable and favourable exchange rates to reduce the cost of imparted medical supplies.
5. Real gross domestic product showed a significant positive impact on life expectancy in Nigeria; Therefore, the Ministry of Finance and National Planning Commission should pursue policies that stimulate sustainable economic growth which is linked with better life expectancy.

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