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Macroeconomic Stability and Life Expectancy in Nigeria: A Dynamic Modelling Approach

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Abstract
Macroeconomic stability and health status are crucial in developing nations, as they impact citizens' purchasing power, consumption patterns, and income disparity. Inflation, unemployment, money supply, interest rates, and exchange rates can affect health, leading to economic stress and mental imbalance. In Nigeria, studies show a decrease in health status due to macroeconomic imbalances, deteriorating labour productivity, and healthcare accessibility. However, to juxtapose these threats, the study tests the hypothesis that macroeconomic stability does not have a significant effect on health status in Nigeria. It is on this that the study piques Nigeria's health status from 1990-2021, focusing on macroeconomic stability and health outcomes using life expectancy, inflation, interest rates, exchange rates, and unemployment rates, sourcing its data from the 2022 World Development Indicators. The study showed that there exists a long-run equilibrium condition between macroeconomic stability and health status was maintained which enacts the appropriate choice of the Autoregressive Distributed Lag, with a response mechanism for short-run equilibrium of 9.2%. The study found that macroeconomic stability in Nigeria is not significantly impacted by inflation, interest, exchange rates, or unemployment rates. However, increased unemployment and depreciated exchange rates significantly impact health outcomes. The study suggests enhancing macroeconomic stability in Nigeria by lowering interest rates, facilitating trade to attract investors, and expanding the labour force for stable economic liberation.
Keywords: Dynamic Model, Life Expectancy, Macroeconomic Stability
JEL Classification Codes: C61, I14, J13

1. Introduction

Macroeconomic stability and health status have attracted great concern by health economist in most developing nations due to the peculiarity as a result of their macroeconomic imbalance. Extant literature suggests that macroeconomic instability factors for equal differences in health status. Macroeconomic fluctuation in the economy determines the pull and push force of its citizens. In other words, the unequivocal trend of a nation's health status

is determined by the intersection of its macroeconomic indices (Afjal, 2023). To a large extent, these macroeconomic indices determine monetary, and household purchasing power, the need to hold money, and the path of consumption patterns (Chen, Kumara, & Sivakumar, 2021). Specifically, the repercussions of the up and fall of these macroeconomic indices directly affect the health status through the need to beat up the income disparity in the economy (Bloom, Kuhn, & Prettner, 2022; Kahouli, 2020).

Moreover, clamoring for the need for such an economy to stabilize, calls for a multifaceted effect on the health status of Nigerians. However, the impact of macroeconomic stability like inflation rate, unemployment rate, money supply, interest rate, and exchange rates are what directly determines the strength of one's nation's economy if these economic indices are grossly affected it calls for more human efforts to maintain its purchasing power. As such, volatility in inflation is the most concerned macroeconomic stability considered because it unsympathetically measures the allocative efficiency by increasing unemployment and deteriorating economic growth due to the need in beating up the macroeconomic trends and ensuring that the macroeconomic evils (like inflation rate, unemployment rate, money supply, interest rate, and exchange rates) do not bite the citizens and the economy at large. As such, if this then dis-stabilizes the economy, there exists a macroeconomic (in)stability and also resulting to decrease in economic productivity and growth in the long-run.

Specifically, with inflation rate as an indicator of macroeconomic instability presents an unanticipated change in the price and causes systematic economic stress on employers, employees, and unemployed citizens thereby resulting in distinct differences in the core and food price of commodities with a precautionary increase in the savings of the citizens. With these threats, the health status of the citizens is tampered with. However, any eroding and persistent increase in inflation rates pulls for a decrease in access to medical services and a push factor of more labor (Ali & Asfaw, 2023). With the need for more labour in the economy, such individual is posed and prone to health status deficiency. In the same vein, Nigeria faced financial economic shocks with penetrated an imbalance in the macroeconomic stability of such nation (Arowosaiye, 2022). These shocks arose from the seeming threat of exchange rates, interest rates, and money supply. These rates when stable influence the health status. A depreciation in the exchange rate and an increase in interest rates lead to an increased cost of imported medical supplies and also limit the accessibility to healthcare facilities (Mustafa, Veysel, & Kirca, 2022).

Also, upon the foregoing, high interest rates limit the stabilization of macroeconomic indicators thereby resulting in to increase in unemployment rates and income disparity which in the long and short run affects the health status of an individual (Ali & Bibi, 2017). Unemployment rate volatility is a

significant risk to macroeconomic stability, leading to increased mental imbalance, stress, and loss of healthcare insurance. This issue is prevalent in developing economies like Nigeria, where health status is a function of government expenditure rather than macroeconomic stability. Increased labor productivity due to macroeconomic instability poses a significant threat to health status and healthcare accessibility, highlighting the need for a revisiting of macroeconomic indicators to stabilize health status.

The study of Abubakar, Mustapha, and Mallum (2023) in Nigeria who reviewed the impact of macroeconomic variables on life expectancy showed that the choice of variable for the dependent variable of life expectancy was not appropriately selected having used the real gross domestic product as a proxy variable, and also examining the shortcoming of Sede and Ohemeng (2015) who investigated the socio-economic determinants of life expectancy in Nigeria between the period of 1980-2011. The study who acknowledged the endogeneity issues with variables also using Vector Autoregressive (VAR) and Vector Error Correction Model (VECM) frameworks, but it also admits to potential bias due to unobserved influences influencing independent variables and life expectancy.

Therefore, to juxtapose the shortcomings of these previous studies and macroeconomic threats, this present study tests the hypothesis that, macroeconomic stability does not have a significant effect on health status in Nigeria. As such, this makes the present study to become necessary to be visited and given demanding an outstanding recommendation in harmonizing the macroeconomic instability and health status in Nigeria between 1990 and 2021. Then, this study will be of benefit to academicians, macroeconomic policymakers, and governments. The basis of their benefit to these stakeholders are prone to articulately and efficiently proffering solutions to how these hunting macroeconomic variables affects the life expectancy of Nigerians. The study is divided into four other sections, namely review of related literature, methodology, results and discussion, and conclusion and recommendations.

2. Literature Review

2.1 Theoretical Review

2.1.1 Social Determinants of Health Theory

The social determinants of health theory (SDHT) is an economic and non-medical factors that influences the health status of an individual. The SDHT focuses on the link between the linear and non-linear relationship of socio-economic and health outcomes. Despite the essential nature of the theory, there is no clear or single definition of theory. However, according to Krieger (2001), SDHT refers to the special feature of the society that potentially informs the individuals of their health outcomes. Unlike the report

of the Commission on Social Determinants of Health (CSDH) in 2008 which revealed that the theory of social determinants of health focuses on economic and social relationships such as transportation, education, housing, food supply, and healthcare accessibility effectively determines the quality of one's life. This foregoing creates a linkage in the expression of how macroeconomic instability inflicts health outcomes which summits the bedrock of the study.

2.1.2 Health Production Function

This specific theory meters the relationship between the flows of inputs and flows of output over a specific period of time. The flows of input tell the demand for health and the flows of output tells the health status or outcome of an individual over a period of time. Basically, the production of health is the maximum output that can be produced from a given basket of input. The influence of variables such as healthcare spending, education, lifestyle decisions, cleanliness on health status is explained by the health production function (HPF). In order to proper manage resources, enhance healthcare delivery, government must have macroeconomic stability with the aim of funding public healthcare investments and infrastructures. Thus, this theory explains the processes of health over time in an economy.

2.1.3 Malthusian Population Theory

However, the study is hinged on the Malthus Population theory which was developed in the 18th Century with a critical focus on the relationship or causality between population growth and economic resources with much concentration on food disparity and supply. However, as propounded by Thomas Robert Malthus (1766-1803), the theory previews at a microscale the linkages between macroeconomic variables and sustainability of health status through life expectancy (Malthus, 1803). I the view of the theory, it was revealed that that there exists a linear production function of resources (food supply as a function of health status, income inequality, and poverty) and population.

2.2 Empirical Review

Abubakar *et al.* (2023) examined the impact of macroeconomic variables on life expectancy in Nigeria spanning from 1991 and 2021 through the use of the Error Correction Model (ECM) which corrects the long-run relationship in the ARDL model back to its stability in the short-run. Upon their findings, their study revealed that the inflation rate hurts life expectancy while unemployment does not. Upon the empirical review of previous studies in the scope of the study, it is revealed that there exists a significant economic connection between macroeconomic stability and Nigeria's health status. Health status in previous studies is majorly peroxided through life expectancy,

and to such end, macroeconomic stability by macroeconomic theorists in both developed and developing nations is measured by four important indicators, namely, the gross domestic product, interest, inflation, and unemployment rates respectively, and amongst others. However, in determining the major macroeconomic cause of household and nation's health outcomes, the need for interest rate indices cannot be overemphasized. Therefore, there is a need to specifically investigate the continued effects of macroeconomic stability on health status in Nigeria.

Unlike Guo, Hafeez, Wang, Kaium, Bilal, and Zahan (2023) who investigated whether there is a non-linear relationship between economic uncertainty and human health in China. This study was carried out in China in order to compare with the Nigerian economy. Thus, using the Baker, Bloom, and Davis' economic uncertainty theory, the study employed both the linear and non-linear Quantile Autoregressive Distributed Lag (QARDL) models to assess the long-term impacts on newborn mortality and death rates. Then, it was revealed that there exist a positive association between economic uncertainty and greater infant mortality rates, with negative correlations occurring at higher quantiles. To this end, the study then recommends that implementing suitable measures to manage economic uncertainty can enhance human health in China.

Adesete, Dauda, and Okirie (2022) examined the effect of public health spending, macroeconomic uncertainty, and health outcome in Nigeria between 1981 and 2020. Through the use of ARDL and the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) to matrix the macroeconomic uncertainty in the study using the inflation rate. Based on the foregoing, their study revealed that public health expenditure and macroeconomic uncertainty do not significantly affect health outcome both in the short- and the long-run. However, their study revealed that public health expenditures are the major determinants of health outcomes rather than macroeconomic uncertainty.

Likewise, Ohioze, Charles, Ojo, Osoase, and Musa (2022) investigated the macroeconomic variable uncertainty and health outcome in Nigeria using the ARDL and Granger Casualty test between 1980 and 2019. The investigation revealed that exchange rates, among other macroeconomic uncertainty variables have a substantial effect on health outcome in Nigeria. Adegoke, Mbonigaba, and George (2022) examined the combined effect of health expenditure and other macroeconomic factors on indices of health outcome between 1995 to 2020 in Nigeria through the use of ARDL. Therefore, based on their investigation, their study revealed that there exists a significant negative relationship between macroeconomic factors and indices of health outcome in Nigeria basically through household consumption, gross fixed capital, and total health expenditure. However, unemployment is an

indicator of macroeconomic stability and has a positive significant relationship with health outcome.

Ujuju and Vincent (2020) investigated the effect of macroeconomic variables on human capital development in Nigeria with specialty on life expectancy between the periods of 1986 and 2018. The study employed the use of ARDL and revealed that macroeconomic variables have a significant and long-run effect on life expectancy in Nigeria while public health spending does not. The study further asserts that money supply causes a major threat on life expectancy while inflation, exchange, interest rates and does not affect in the short-run. This finding supports the interplay of naira redesigning in 2022. Thus, the study recommends that the government through the Ministry of Finance should ensure relevant monetary policy instruments that maintains the circulation of currency and that they should put in place to ensure an increasing expenditure on health to sustain a stable life expectancy.

In the same vein, Kelani, Onochie, and Odumosu (2019) investigated the variables of macroeconomic instability policy and health status in Nigeria between 1981 and 2017. In their study, it was revealed that there exists a long-run relationship between variables of macroeconomic instability and health status in Nigeria and that public capital health expenditures, domestic debt, and financial deepening have a significant impact on health status in Nigeria while inflation does not. Also, in the view to investigate the economic stability towards the attainment of health security in Nigeria by 2050 piques the study of Lawanason, Folawewo, and Olakojo (2019). The Nigerian economy, sponsored with revenue from the oil industry, experienced 6.4% annual growth between 2006 and 2015, but high poverty and unemployment arose due to inadequate healthcare finance. This study summits and recommends that it is essential to incorporate health security into Nigeria's economic stability strategy and promoting inclusive growth by 2050 through significantly ensuring the stability of the Nigerian economy to provide the necessary support at the national flowing to the state and local household levels. With this, there will be some positive macroeconomic policies can improve health status, with a life expectancy over 60 years.

2.3 Theoretical Framework

Several studies have tried to link different theories that best captures the nexus between macroeconomic stability and health status but most of these theories do not holistically capture the connection. Among these theories are the Social Determinants of Health (SDH) theory, the Health Production Function (HPF) theory, and the Malthusian Population Theory (MAPT) as discussed in section 2.1. To this end, these theories capture the comprehensive dynamism of the prevailing macroeconomic variables on health outcomes. Furthermore, since the MAPT predicted that there exists a linear production

function of resources (food supply as a function of health status, income inequality, and poverty), then, a sustained increase in population growth will lead to a decrease in well-being because macroeconomic stability variables (consumer price index, unemployment, money supply, interest rates, and exchange rates) will inflict the health status of the citizens. This is in support of Hansen and Lonstrup (2013), and Abubakar et al. (2023). Thus, as this study thinly establishes the interdependency of the variables, it however, basically expresses a broader dynamism on the impact of macroeconomic variables on life expectancy. Therefore, through this expression it can be transformed and highlighted in equation (1) as:

$$HS_{it} = f(RS_{it}, Pop_{it}, MS_{it}) \quad 1$$

Where: HS is a vector for disparities of food supply which affects health status (life expectancy), RS is a vector for resource scarcity as a result of an increase in the consumer price index, Pop is a vector for the progressive increase in population growth while MS are vector for other macroeconomic variables that measures the stability of an economy.

3. Methodology

3.1 Data and Model Specification

To determine and investigate the effect of macroeconomic stability on health status in Nigeria, the study used the secondary annual time series data from 1990 to 2021. The data used are total life expectancy at birth (%), inflation rate (consumer price, annual %), real interest rate (annual %), the logged exchange rate (current LCU %), broad money growth (annual %), and unemployment rate (% of the total labour force). These data were all sourced from the World Bank (2022). As such, expressively, equation (1) can be transformed and adopted from Abubakar et al. (2023) also modified from Ujuju and Vincent (2020) in equation (2),

$$HS_t = f(INF_t, INT_t, LEXR_t, MM_t, UNE_t) \quad 2$$

Equation (2) where HS_t is the dependent variable peroxided with total life expectancy rate at birth while the independent variables as INF_t is the inflation rate, INT_t is interest rate, $LEXR_t$ is logged of exchange rate, MM_t is the broad money supply, and UNE_t is the unemployment rate. Equation 3 is aimed to test the hypothesis of the study by introducing coefficients and constant parameters namely γ_0 to γ_5, and white noise as μ_t.

$$HS_t = \gamma_0 + \gamma_1 INF_t + \gamma_2 INT_t + \gamma_3 LEXR_t + \gamma_4 MM_{2t} + \gamma_5 UNE_t + \mu_t \quad 3$$

A priori expectation of the coefficients in Equation 3 are:

$\gamma_1 < 0$: An increase in the inflation rate will lead to a decrease in life expectancy.

$\gamma_2 < 0$: An increase in interest rate will lead to a decrease in life expectancy.

$\gamma_3 < 0$: An increase in the logged exchange rate will lead to a decrease in life expectancy.

$\gamma_4 < 0$: An increase in the rate of broad money supply will lead to a decrease in life expectancy.
$\gamma_5 < 0$: An increase in the unemployment rate will lead to a decrease in life expectancy.

3.2 Estimation Technique

On the assumption that the variables are likely to be of different orders of integration, the ARDL modeling approach was employed because the unit root test were stationary at levels; I(0), and stationary at first differenced; I(1) to investigate the effect of macroeconomic stability and health status in Nigeria. The ARDL approach was developed by Pesaran, Shin, and Smith (2001) for testing the presence of a co-integrating relationship and it has peculiar advantages over other symmetric co-integration tests. Firstly, the ARDL approach can be applied to variables of a different order of co-integration (Pesaran & Shin, 1995); secondly, the ARDL approach applies to small or finite sample sizes (Pesaran *et al.*, 2001); thirdly, the short and long-run parameters are estimated concurrently and fourthly, the approach can accommodate structural breaks in time series data (Ahmad & Aworinde, 2015). To this end, the ARDL Bound test specification is estimated in Equation (4) as:

$$\Delta Y_t = \alpha_0 + \sum_{i=1}^{p} \beta_i \, \Delta Y_{t-i} + \sum_{j=1}^{q} \delta_j \Delta X_{1t-j} + \sum_{k=1}^{q} \lambda_k \Delta X_{2t-k} + \rho_0 Y_{t-1} + \rho_1 X_{1t-1} + \rho_2 X_{2t-1} + \mu_t \quad (4)$$

Where Y_t is a vector of dependent variable, X_t is a vector of independent variables and α, β, δ, λ, and ρ are parameters to be estimated. Therefore, the bounds test involves performing an F-test of the hypothesis specified against its alternate of which a rejection of the null hypothesis connotes that there is a long-run relationship among the variables is estimated as,

H_1: $\theta_1 \neq \theta_2 \neq \theta_3 \neq \theta_4 \neq \theta_5$

Given the variables of this study, therefore, the ARDL bounds test model is:

$$\Delta LEXP_t = \gamma_0 + \sum_{i=1}^{m} \lambda_1 \, \Delta LEXP_{t-i} + \sum_{i=1}^{n_1} \lambda_2 \Delta INF_{t-1} + \sum_{i=1}^{n_2} \lambda_3 \, \Delta INT_{t-1} + \sum_{i=1}^{n_3} \lambda_4 \, \Delta LEXR_{t-1} + \sum_{i=1}^{n_4} \lambda_5 \, \Delta MM2_{t-1} + \sum_{i=1}^{n_5} \lambda_6 \, \Delta UNE_{t-1} + \beta_1 LEXP_{t-1} + \beta_2 INF_{t-1} + \beta_3 INT_{t-1} + \beta_4 LEXR_{t-1} + \beta_5 MM2_{t-1} + \beta_6 UNE_{t-1} + \mu_t \quad (5)$$

In Equation (5), parameter γ is the constant coefficient, while λ's and β's explain the vector of short-run and long-run coefficients respectively. However, where all the variables are of the same order of integration, other appropriate estimation techniques will be used. For example, the Ordinary Least Squares (OLS) estimation will be adopted if all are I(0) series, VAR will be used if all series are stationary at first difference, and the specified ARDL in Equation (5) will be used when all the series are of mixed order that is, I(0) and I(1) and if all series are I(1) (Shrestha & Bhatta, 2018). As such, suppose there exists a long-run co-integration from the Equation 5, then, to correct this back to short-run using the Error Correction Term (ECT) as specified in Equation (6).

$$\Delta LEXP_t = \gamma_0 + \sum_{i=1}^{m} \lambda_1 \Delta LEXP_{t-i} + \sum_{i=1}^{n_1} \lambda_2 \Delta INF_{t-1} + \sum_{i=1}^{n_2} \lambda_3 \Delta INT_{t-1} + \sum_{i=1}^{n_3} \lambda_4 \Delta LEXR_{t-1} + \sum_{i=1}^{n_4} \lambda_5 \Delta MM2_{t-1} + \sum_{i=1}^{n_5} \lambda_6 \Delta UNE_{t-1} + \varphi ECT_t + \mu_t \quad (6)$$

4. Results and Discussion

This section captures the results and discussion of finding of the study through the pre-estimation and post-estimation techniques. The pre-estimation technique reviews the empirical analysis of results through the descriptive statistics, correlation, optimal lag length criteria, the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root test, and co-integration test, while the post-estimation revamps the ARDL short- or long-run estimation results based on the unit root test, the Jarque-Bera histogram, serial autocorrelation test, heteroscedasticity test, Ramsey's RESET functionality test, the CUSUM and CUSUM Square test.

Therefore, Figure 1 briefly depicts the year-on-year trends of the macroeconomic stability and life expectancy in Nigeria between 1990 and 2021. The Figure showed that unemployment and the logged of exchange rates swings in a same direction while rates of money supply and inflation moves in the same direction between 1990 and 1997. This Figure also showed that inflation and money supply swung above the average life expectancy of a Nigeria at 50-60 years. From this figure is then means that money supply and inflation rate (that is, price of consumable goods) threatens the average life expectancy of Nigerians.

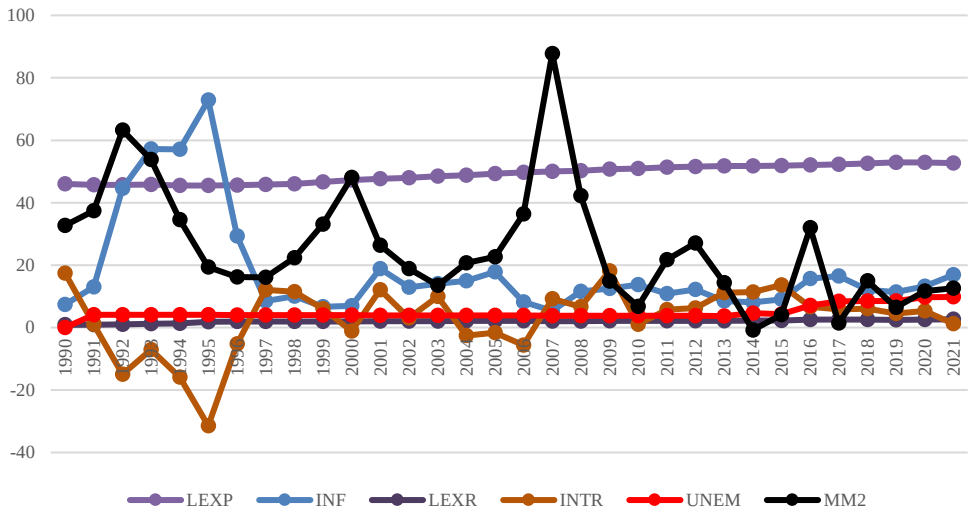

Figure 1: Year-on-Year Trends of Macroeconomic Stability and Life Expectancy in Nigeria
Source: Authors' Compilation, 2022.

Table 1: **Descriptive Statistics of the Variables**

Variable(s)	$LEXP_t$	INF_t	INT_t	EXP_t	$LMM2_t$	UNE_t
Mean	49.14534	18.06084	3.137848	150.3275	1.258413	4.719156
Maximum	52.91000	72.83550	18.18000	435.0000	1.943303	9.788000
Minimum	45.48700	5.388008	-31.45257	7.390000	-0.100088	0.000000
Skewness	-0.089687	2.170086	-1.370559	1.046455	-1.398564	1.100943
Kurtosis	1.444934	6.633360	5.428488	3.186524	5.283740	4.193921
Jarque-Bera	3.267205	42.71787	17.88170	5.886752	17.38585	8.364997
Probability	0.195225	0.000000	0.000131	0.052688	0.000168	0.015260
Observations	32	32	32	32	32	32

Source: Authors' Computation from E-Views Output.

To this end, Table 1 reveals the summary statistics of the variables. Thus, the summary statistics results showed that the mean value of all the series lies between the minimum and maximum range. The results further showed that life expectancy, interest rate, and exchange rate were negatively skewed while all the series were leptokurtic except life expectancy which was platykurtic. The probability of the Jarque-Bera statistics showed that the variables in the model were all significant except life expectancy.

Also, since all the series are significant except life expectancy, the implication is that, the life expectancy of Nigerians is affected by some

variation and outliners as a result of macroeconomic instability in the captured period. The implication is that life expectancy in Nigeria having a higher probability value than the Jarque-Bera statistics showed that there exists an acceptance of the normal distribution while other independent variables leads to a rejection of null hypothesis of a normal distribution.

Table 2: **Correlation Matrix Results**

Variable(s)	$LEXP_t$	INF_t	INT_t	$LEXP_t$	$MM2_t$	UNE_t
$LEXP_t$	1.000					
INF_t	-0.479*	1.000				
	[-2.995]					
INT_t	0.410*	-0.826*	1.000			
	[2.465]	[-8.053]				
$LEXP_t$	0.815*	-0.406**	0.290***	1.000		
	[7.663]	[2.433]	[1.661]			
$MM2_t$	-0.418**	0.185	-0.235	-0.513*	1.000	
	[-2.525]	[1.032]	[-1.326]	[-3.281]		
UNE_t	0.607*	-0.040	-0.028	0.647*	-0.340**	1.000
	[4.190]	[-0.222]	[-0.158]	[4.649]	[-1.982]	

*[] is t-Statistics while asterisks (*), **, *** are, and 1%, 5%, and 10% significance level respectively.*

Source: Authors' Computation from E-Views Output.

In the same vein, Table 2 revealed the correlation between matric results showing that the results showed that inflation and money supply were negatively related to life expectancy and significant at 1% and 5% respectively. On the other hand, interest rate, exchange rate, and unemployment rate were positively related and all series were significant at a 1% significant level. The implication is that interest rate, exchange rate, and unemployment rate were indicators of macroeconomic stability which strongly affected life expectancy in Nigeria by 41%, 81.5%, and 60.7% respectively between the period of 1990 to 2021. Thus, having identified the relationship between macroeconomic stability and health status, there is a need to determine the stationarity direction of the series to determine the appropriate use of econometric techniques by the model.

Table 3: **Optimal Lag Length Criteria**

Lag	LogL	LR	FPE	AIC	SIC	HQC
0	-453.2876	NA	799752.9	30.61917	30.89941	30.70882
1	-260.0974	296.2249	23.69133	20.13983	22.10151*	20.76739
2	-213.5259	52.78114*	16.05010*	19.43506*	23.07817	20.60052*

*Asterisks * indicates the appropriate selection of the lag length criteria.*

Source: Authors' Computation from E-Views Output.

Table 3 revealed the optimal lag length criteria, which presents the choice of appropriate lag length and criteria to select to determine the direction of the unit root test. Table 3 revealed that in determining the unit root test, the Akaike Information Criterion (AIC) is the lowest among the other criteria; Schwarz Information Criterion (SIC), Hannan-Quinn Information Criterion (HQC) at lagged two maximum lag is the best optimal lag length criteria to select in analyzing the unit root tests. This is solely done for the ADF unit root test.

Table 4: ADF Unit Root Test at Intercept

Variable(s)	ADF at Levels	ADF at First Difference	Stationary Decision	Stationary Remarks
$LEXP_t$	-2.999(-2.964)**	-	I(0)	Stationary
INF_t	-2.619(-2.963)***	-4.511(-2.963)*	I(1)	Stationary
INT_t	-3.344(-2.960)**	-	I(0)	Stationary
$LEXP_t$	-2.489(-2.960)	-4.621(-2.963)*	I(1)	Stationary
$MM2_t$	-3.051(-2.960)**	-	I(0)	Stationary
UNE_t	-1.146(-2.960)	-7.917(-2.963)**	I(1)	Stationary

*() is test critical value at 5% while *, **, *** are, and 1%, 5%, and 10% probability level respectively.*

Source: Authors' Computation from E-Views Output.

Table 4 revealed that the ADF unit root test at the intercept test equation shows all the series in the model to be of mixed order of stationarity, that is, at I(0) and I(1). The ADF unit root test results show that life expectancy, interest rate, and broad money supply are all stationary at levels. In contrast, inflation rate, exchange rates, and unemployment rate are stationary at forest differenced.

Table 5: PP Unit Root Test at Intercept

Variable(s)	PP at Levels	PP at First Difference	Stationary Decision	Stationary Remarks
$LEXP_t$	-0.135(-2.960)*	-2.959(-2.963)**	I(1)	Stationary
INF_t	-2.387(-2.960)	-4.498(-2.963)*	I(1)	Stationary
INT_t	-3.344(-2.960)**	-	I(0)	Stationary
$LEXP_t$	-2.619(-2.960)*	-4.621(-2.963)*	I(1)	Stationary
$MM2_t$	-2.832(-2.960)*	-11.267(-2.963)*	I(1)	Stationary
UNE_t	-1.143(-2.960)	-7.262(-2.963)*	I(1)	Stationary

*() is test critical value at 5% while *, **, *** are, and 1%, 5%, and 10% probability level respectively.*

Source: Authors' Computation from E-Views Output.

On the contrary but relatively in common, Table 5 also revealed the PP unit root at intercept of which the series also revealed to be of mixed stationarity. PP unit root test in Table 5 showed that life expectancy, inflation rate, exchange rate, broad money supply, and unemployment rate are stationary at levels while the interest rate is stationary at levels. Therefore, based on the ADF and PP unit test results, it is revealed that as developed by Pesaran and Pesaran (1997), and Shrestha and Bhatta (2018), the appropriate choice of econometric technique is the ARDL.

Table 6: ARDL Bounds Test Results

K	ARDL Specification	Significance level	I(0)	I(1)	F-Statistics
5	1, 1, 2, 2, 1, 1	10%	2.08	3	26.87
		5%	2.39	3.38	
		1%	3.06	4.15	

Source: Authors' Computation from E-Views Output.

As such, the ARDL bound test results will be conducted for the co-integration test in Table 6, which revealed an automatic model selection at 1, 1, 2, 2, 1, and 1, and that there exists long-run equilibrium showing that the F-Statistics at 26.87 is greater than the upper and lower bound values at 2.39 and 3.38 respectively under the 5% significance level.

Table 7: ARDL Long-run Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
$LEXP_{t-1}$	0.907813	0.019505	46.54203	0.0000
INF_t	-0.000637	0.007252	-0.087893	0.9311
INF_{t-1}	0.007143	0.005610	1.273173	0.2211
$INTR_t$	0.000229	0.004779	0.047866	0.9624
$INTR_{t-1}$	-0.004176	0.004958	-0.842165	0.4121
INF_{t-2}	0.015526	0.003439	4.514225	0.0004
$LEXR_t$	-0.532616	0.472218	-1.127903	0.2760
$LEXR_{t-1}$	0.060761	0.527594	0.115166	0.9097
$LEXR_{t-2}$	1.190213	0.440288	2.703261	0.0157
$MM2_t$	-9.41E-05	0.002159	-0.043571	0.9658
$MM2_{t-1}$	0.002445	0.001831	1.335313	0.2005
$UNEM_t$	0.039951	0.054305	0.735674	0.4726
$UNEM_{t-1}$	-0.097206	0.061156	-1.589474	0.1315
Constant	3.450960	0.705404	4.892177	0.0002
Adjusted R-squared	0.998054	F-statistic		1145.096
D-W stat.	2.178009	Prob. (F-statistic)		0.000000

Source: Authors' Computation from E-Views Output.

Table 8: ECM Short-run Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
$D(INF_t)$	-0.000637	0.002718	-0.234496	0.8176
$D(INTR_t)$	0.000229	0.002538	0.090122	0.9293
$D(INTR_{t-1})$	-0.015526	0.002416	-6.426100	0.0000
$D(LEXR_t)$	-0.532616	0.189012	-2.817890	0.0124
$D(LEXR_{t-1})$	-1.190213	0.234842	-5.068150	0.0001
$D(MM2_t)$	-9.41E-05	0.001099	-0.085611	0.9328
$D(UNEM_t)$	0.039951	0.032448	1.231229	0.2360
ECT_{t-1}	-0.092187	0.005732	-16.08200	0.0000
Adjusted R-squared	0.786674	D-W stat.		2.178009

Source: Authors' Computation from E-Views Output.

Likewise, the logged of exchange rate has a significant and positive impact on health status while the unemployment rate and broad money supply positively impact health status but remain insignificant. Thus, this result is supported with that of Ohioze *et al.* (2022), and Abubakar *et al.* (2023). This insignificant impact connotes an asymmetric result on the Nigerian health status between 1990 to 2021. As such, these insignificant impact by the unemployment rate, inflation, and broad money supply spurs an explorative explanation that the interest rate at which individuals borrow money causatively affects health status to financial deepening which supports that of Kelani *et al.* (2019). The results in Table 7 then revealed that in any case and

with *ceteris paribus*, unemployment rate, inflation, and broad money supply barely and variably impacts health status in Nigeria unlike interest rate.

Table 8 also revealed that in the short run, the ECT does not only show a negative sign but that it also passed the 1% significance level. The result showed that the coefficient estimates about 9.2% of adjustment in the disequilibrium of the long-run co-integration results within one year of correction. The implication of this 9.2% adjustment is that, at the moment and recent year of the scope of study, the result implies a slower rate of bettering the healthcare access and investment. Also, this result shows that the macroeconomic variables are moving towards the long-run. Meanwhile, the results further outlined that there is an adequate response mechanism to restore the short-run equilibrium. till discovered that the coefficient of determination for the model is adjusted for degree of freedom by 78.6% implying that a total of 78.6% variation in health status could be attributed to the explanatory variables of macroeconomic stability in Nigeria between 1990 and 2021.

Table 9: Pairwise Granger Causality Test Results

Null hypothesis: $LEXP_t$ → $INF_t, INTR_t, LEXP_t, MM2_t, UNEM_t$	**F-Statistic**	**Prob.**	**Causality Direction**
$INF_t \rightarrow LEXP_t$	2.55934	0.0975	Uni-directional
$LEXP_t \rightarrow INF_t$	6.99563	0.0039	
$INTR_t \rightarrow LEXP_t$	4.35306	0.0239	Uni-directional
$LEXP_t \rightarrow INTR_t$	2.49338	0.1030	
$LEXR_t \rightarrow LEXP_t$	2.93479	0.0716	Uni-directional
$LEXP_t \rightarrow LEXR_t$	3.39983	0.0494	
$MM2_t \rightarrow LEXP_t$	0.35857	0.7022	No causal relationship
$LEXP_t \rightarrow MM2_t$	1.53419	0.2353	
$UNEM_t \rightarrow LEXP_t$	0.61480	0.5487	No causal relationship
$LEXP_t \rightarrow UNEM_t$	2.21046	0.1306	

Source: Authors' Computation from E-Views Output.

The aim of specifically determining the pairwise causality through the Granger test is revealed in Table 9, and shows that there exists a uni-directional causality direction between life expectancy, inflation rate, interest rate, and exchange rate in Nigeria. This is supported by a significant probability level of less than 5% when correlating each of the regressing variables on life expectancy. As such, this results are supported by the results in Table 7 and 8 respectively showing a significant impact of interest rate on life expectancy. The implication is that interest rate among other regressed macroeconomic

stability proxies has a strong and significant direct impact on life expectancy in Nigeria.

Table 10: Diagnostic Test Results

Tests	Statistics value(s)	P-value(s)
Normality test (X^2_N)	JB = 1.489595	0.474830
Breusch-Godfrey Serial Correlation LM Test	1.379372	0.2839
Breusch-Pagan-Godfrey Heteroskedasticity Test	0.983239	0.5052
Ramsey RESET Functional Test	1.248832	0.2814

Source: Authors' Computation from EViews output.

The diagnostic test is revealed in Table 10 which includes the normality test, Breusch-Godfrey serial autocorrelation, Breusch-Pagan-Godfrey heteroscedasticity test, and Ramsey's RESET functional test. These post-estimation tests passed all the 5% level of significance. The implication is that there is no misspecification in the model and that the series was not affected by its previous lagged values.

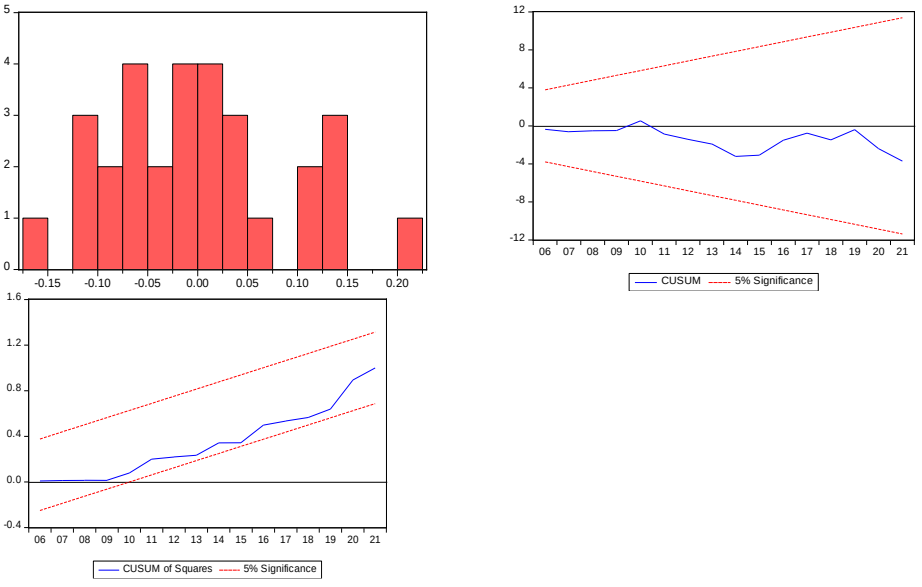

Figure 2: Histogram and Model Structural Stability Test

Source: Authors' Computation from E-Views Output.

Also, the diagnostic test results revealed that the residuals have the same variance. To uphold the foregoing, Figure 2 showed that as revealed by the cumulative sum (CUSUM) of recursive residuals and CUSUM of Squares of recursive residuals at a 5% level of significance, the parameters are stable in the model and dependable for policy implementation.

4.1 Discussion of Finding

The implication is that the long-run equilibrium condition holds between macroeconomic stability and health status in Nigeria, and this result is in support with that of Kelani *et al.* (2019). This long-run equilibrium on the scope of the study implies a disequilibrium in the model and that it needs to be corrected to make the instability in the model stable in the short run. As such, the occurrence of the disequilibrium in the model as a result of the long-run equilibrium demands an error correction term (ECT). This term determines the speed of correcting the disequilibrium in the model back to its normality in the short run. The estimates of the long-run and short-run results.

The results revealed are fairly robust, stable and satisfactory for policy implementation. Based on the long-run results, the *a priori* expectation of inflation rate has an insignificantly negative impact on health status between the scope of the study while interest rate has a significantly positive impact on health status. This finding is to show that since interest rate has a positive impact on life expectancy, and inflation rate having a negative impact on life expectancy as well shows that there exists a macroeconomic penetration on the economic leading to an increase in unemployment and a deterioration in the investment of healthcare access and investment in the Nigerian economy. This is support with the findings of Guo *et al.* (2023) whose negative shock resulted to economic uncertainty in China thus adopting relevant economic policies that could curb the menace in such economy, while the result of Adesete *et al.* (2022) also supports the present study's findings. In the findings of Adesete *et al.* (2022), it was further revealed that macroeconomic uncertainty does not have impact on health outcome with specialty on the inflation rate of Nigeria. The implication of the negative impact of inflation on health status calls for a decreasing health status and finds a counterintuitive response in Nigeria.

5. Conclusion and Recommendations

This study examined the macroeconomic stability which includes inflation rate, interest rate, exchange rate, broad money supply and unemployment rate to determine the life expectancy of Nigerians. The result

revealed that the inflation rate, broad money supply, and unemployment rate are insignificant while interest rate and exchange rate significantly affect life expectancy in Nigeria. This result implies that since there is an increase in the unemployment rate (that is, those who are willing healthy and willing to get employed are not employed), then, the motive to sustain themselves has a causative impact on the need to borrow money to sustain livelihood while in the same vein, the exchange rate is depreciated (that is, the local currency; naira has no value). This macroeconomic instability inflicts the livelihood of the citizens and poses a great threat to their life expectancy.

Based on these findings, the study recommends that the macroeconomic stability variables should be strengthened. This is to tell that a stronger currency leads to cheaper rates and access of medical equipment that will lead to an increase in healthcare resources. Also, the result has shown that since unemployment has a positive impact, its direct influence is not felt because unemployment can affect health through some socioeconomic factors, including income, healthcare access, and psychological stress. Employment provides income and access to employer-sponsored health insurance, which contributes to better health outcomes. Policymakers may emphasize implementing employment-generating policies, such as job creation programs and skill development initiatives, to indirectly improve health outcomes through increased employment opportunities.

As such, in doing this, the interest rate should be reduced through a fixed or peg rate, and the exchange of goods and services through the borders should be opened thereby simultaneously charging and calling for more investors in the nation. This should or could be done by the Central Bank of Nigeria and Ministry of Finance. With this, the investors coming to invest in the nation will expand the labor force thereby causing more people to be employed and have more money in circulation. This will also reduce the need for Nigerians to borrow money to feed themselves rather than invest.

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