Impact of Public Health Expenditure on Life Expectancy in Nigeria

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Abstract

Health is wealth. For mankind to live the expected life standard, it requires a sustainable good healthcare condition. For this, understanding the influence of public health expenditure on life expectancy in Nigeria becomes imperative. The study therefore examines the impact of public health expenditure on life expectancy in Nigeria utilizing annual data from 1990 to 2023. Data were analyzed using Johansen Cointegration and Vector Error Correction Mechanism (VECM). The variables adopted for the study were public health expenditure (PHEX), life expectancy (LEXP), per capita income (PCIN), population growth rate (POPGR) and unemployment rate (UNEMR). The result revealed that in the long run, PHEX and PCIN have a positive relationship with LEXP, whereas POPGR and UNEMR revealed a negative relationship with LEXP. In the short run, PHEX and PCIN were statistically significant in explaining LEXP, while POPGR and UNEMR were insignificant in explaining LEXP. UNEMR revealed a negative relationship with LEXP in the short run, while all other variables revealed a positive relationship with LEXP in the short run. The speed of adjustment shown by the Error Correction Mechanism (ECM) was approximately 35 per cent. Findings from the study showed that life expectancy in Nigeria increases as public health expenditure increases. Based on the results, the study recommends the need for continual allocation of funds into the health sector as it shows a positive relationship between public health expenditure and life expectancy in Nigeria.

Keywords: Public Health Expenditure, Life Expectancy, Per capita Income, Population Growth Rate, Nigeria and Vector Error Correction Model

Introduction

Policymakers have considered development in human health status as one of the ways to improve human capital and the welfare of countries. In order to attain global higher health status, the United Nations in 2019, held a meeting in New York, which focused on the coverage of universal health (Ibrahim & Rejoice, 2022). Also, the African Union's agreement made in 2001, that the health sector of African countries should be allocated 15 per cent of the budget in order to increase the health status of individuals, is yet to be met by many African countries. To achieve an improved human health status, countries allocate funds to the health sector yearly. The United States in 2020, had the highest allocation of its budget to the health sector. It stood at about 19.7 per cent compared to the 12.8 per cent and 12.2 per cent allocation of Germany and France respectively. This puts their life expectancy at 79 years in the United States, 80 years for Germany and 82 years for France (World Development Indicators, 2022). The disparity in health allocation and resultant life expectancy may be attributed to the population size of the countries (Abdulganiyu & Tijjani, 2021).

A country's life expectancy may be affected by several factors such as population growth, per capita income and unemployment rate. Wilson and Olawale (2021) opine that, to attain higher life expectancy in a populated country, public health expenditure allocation and per capita income may have to be prioritized. This will enable citizens to have access to healthcare services at subsidized rates and also enable them to meet their financial obligations that concern health issues.

In Nigeria, fluctuating public health expenditure, unemployment rate, low per capita income and population growth may have affected the life expectancy of Nigerians. In 1990 and 1997, public health expenditure rose from ₦1.03 billion to ₦5.64 billion while life expectancy averaged 45 years within the same period. By 2004, when public health expenditure fell to ₦41.83 billion, from ₦48.87 billion allocated in 2002, life expectancy rose to 47 years. Public health expenditure rose to ₦225.38 billion in 2011 and life expectancy increased to 51 years. The years that followed (2012, 2013 and 2014) had a lower allocation in billions to the health sector (₦222.64, ₦219.29, ₦224.25 respectively) while life expectancy averaged 51 years in 2012 and 2013, then increased to 52 years in 2014. In 2015, public health expenditure increased from ₦278.78 billion to ₦547 billion in 2021, consequently, life expectancy rose from 52 years to 55 years respectively (Fatunmole, 2022). Though life expectancy has been increasing over the years, it is still one of the lowest in the world (Ibrahim & Rejoice, 2022).

Nigeria's highest allocation to the health sector reached 5.75 per cent an all-time high in 2023 (Tambe, 2022). It is below the required 15 per cent benchmark agreed by the African Union and the World Health Organization benchmark of 18 per cent (Wasiu, 2020). Nigeria may have not met the expected United Nations and African Union requirements due to challenges attributed to insecurity which has bedeviled the economy since 2012 till date. The 5.75 per cent allocation is low considering Nigeria is the seventh most populated country in the world, the unemployment rate is high (37.7 per cent) and the per capita income ($2,184), is insufficient to cater for what the government did not subsidize (Tambe, 2022). However, the increase to 5.75 per cent may be a result of health challenges facing the economy (like Monkey pox, Lassa fever and coronavirus). Nevertheless, this increase has not contributed to an increase in life expectancy (55 years) which is the third lowest in the world (Tambe, 2022).

Attempting to solve this challenge, researchers in this area have gone around circles in which scholars have had varying results on the relationship between government health expenditure and life expectancy. Oluwatoyin, Folasade and Fagbeminiyi (2015) discovered a negative relationship between the variables. Contrary to their study, Wilson and Olawale (2021) and Wasiu (2020) reveal that public health expenditure increases life expectancy. While Ogungbenle, Olawumi and Obasuyi (2013), discover that life expectancy and public health expenditure have no connection. This shows that, in recent studies, there has not been a consensus on research findings. The contending issue associated with this research is that life expectancy is still a challenge in Nigeria. It is against this backdrop that this study adds to the discussion and debate on the impact of public health expenditure on life expectancy in Nigeria. Following this introduction, the subsequent part of this paper is organized as follows: Section two discusses the conceptual, theoretical and empirical issues while section three presents the methodology adopted for the study. Section four presents the results of data analysis while major findings were summarized in section five.

Conceptual Literature

Public Health Expenditure

The concept of public health expenditure has been defined by several scholars including Admane and Sliman (2021), Omoloba (2020) and Bashir (2016). The common denominator in

all their conceptualizations is that public health expenditure are monetary government allocations to the health sector to improve, maintain and restore the health status of citizens within a given period.

For the sake of this study, public health expenditure will be defined as all government spending on health to develop human health status and increase the life expectancy of the population. The definition is deemed suitable because it includes the major variables (public health expenditure and life expectancy) in the study.

Life Expectancy

Several scholars have conceptualized life expectancy. This can be traced to Clarkson (2022), Cameron, Contreras and Cornwell (2019) and Stout (2018) who agree that life expectancy is the mean age that people in a given environment will be at the time of death given their diet, heredity, profession, physical disorder and genetic ability to survive diseases.

This study defines life expectancy as the number of years an individual will survive in an environment given the population size, health services provided by the government and the individual's ability to afford a healthy lifestyle based on his income. The study considers this definition appropriate because it highlights some variables (population growth, per capita income and public health expenditure) considered in the study.

Per capita income

Per capita income has been conceptualized by Wilson and Olawale (2021) and Orekoya (2022) as the average income earned by each person in a specific area. It is determined by dividing total income of the area by the population in the area

This study defines per capita income as the average income earned by each individual in a specific population or group, typically calculated on an annual basis. It aids in measuring the well-being and standard of living of the population.

Unemployment Rate

Some studies like Elijah (2021), David (2018) and Jajere (2016) view unemployment rate as the ratio of individuals who are within the work force and are actively looking for employment but are unable to find gainful employment.

This study defines unemployment rate as the percentage of economically active population who are unemployed due to inadequate resources in the economy and poor health status of the citizens, despite the prevailing wage rate.

Population Growth Rate

Population growth rate was conceptualized by Tieguhong and Piabuo (2017) and Emile (2016), as the percentage or degree at which the population of a specific area or country is rising or falling over time.

This study defines population growth rate as the rate of increase in the number of people in an economy, attributed to higher life expectancy, increased birth rate and lower death rate.

Theoretical Literature

Grossman's Theory of Health Demand

This theory is propounded by Grossman (1972). The theory states that health capital is a good which can be consumed or invested in. Health capital can be inherited and if not developed, depreciates. Health is consumed because it increases the quality of work and leisure while health can be increased by investing in health facilities, education and food. The theory

explains that health is treated as a capital stock for people to produce more health capital by investing in health. The relationship between health consumption and health investment explains the connection among health-related outcomes and decisions which affect the life expectancy of the population. Life expectancy improves over time as a result of individual decisions. These decisions are affected by the cost of healthcare services.

The theory recognizes that individuals aim at maximizing utility subject to constraint. Individuals' demand for healthcare services is constrained by the price of healthcare services and per capita income. Prices of healthcare services are determined by the government and private sector. Many government-owned healthcare facilities provide healthcare services as a public good at subsidized rates. The subsidy attracts many individuals who have low per capita income and cannot afford the prices of healthcare services provided by the private sector. Investment by the government in the health sector is vital for longevity of the population as many individuals patronize government-owned health facilities (Ibrahim & Rejoice, 2022). The theory is adopted because of its relevance to this study in the sense that, it explains government investment in health and health-related outcomes (life expectancy).

Empirical literature

Jude *et al* (2023) analyzed the determinants and drivers of life expectancy in some countries in North Africa (Algeria, Egypt, Morocco, Sudan and Tunisia) from 1985 to 2018. The study employed Panel Fixed Effect Least Square Dummy Variable Regression model. The result of the study showed that total fertility rate and government final consumption expenditure revealed a negative relationship with life expectancy while carbon emission per capita, per capita gross national income and population growth rate had a positive relationship with life expectancy in North Africa.

Focusing on 45 countries from different sub-regions, Abdulganiyu and Tijjani (2021) studied how life expectancy is affected by health expenditure from 2000-2015. Fixed effects estimation method and two-stage least squares were employed as techniques of analysis. The study revealed that in West Africa when the Fixed Effect Method was applied, health expenditure and life expectancy had a positive relationship but an inverse relationship exists between life expectancy and spending on health in Southern and Central Africa, while in Northern and Eastern parts of Africa, health expenditure did not affect life expectancy. When the two-stage least square technique was applied the result revealed that it is only in Central Africa that fluctuations in life expectancy can be attributed to spending on health. There is a need for a more current study in order to capture government spending as a result of recent health crises (coronavirus) that affected many countries' life expectancy.

Employing the Error correction Mechanism, Ibrahim and Rejoice (2022) analyzed government health spending on indicators of health in Nigeria spanning 1985-2019. The result showed that the variables employed in the study have a connection in the long run and life expectancy is positively and significantly impacted by government spending on health.

Health performance in Nigeria and government spending on health, was analyzed by Wilson and Olawale (2021) from 1981 to 2020. The study utilized Autoregressive Distributed Lag (ARDL) model Findings from the research showed a direct link between life expectancy and government spending on health. Further analysis based on the individual test showed that per capita income, number of physicians and literacy rate contribute negatively to life expectancy while the urban population contribute positively to life expectancy. The result of the study tallies with the recent findings of Ibrahim and Rejoice (2022).

Applying ARDL model, Wasiu (2020) studied the link connecting government health financing and outcomes of health in Nigeria from 1985 to 2018. The study found that government health

financing significantly and positively affects life expectancy. Other findings showed that though the urban population is significant it has a negative relationship with life expectancy while corruption and life expectancy have a positive relationship though the effect is not significant.

From 1979 to 2012, Oluwatoyin, Folasade and Fagbeminiyi (2015) utilized Johansen Co-integration and Vector Error Correction Model (VECM) technique to examine the effect of health spending by government on outcome of health in Nigeria. The study revealed that government health expenditure is significant in explaining life expectancy though the relationship is negative. The result of the study did not conform to the result of recent studies conducted by Ibrahim and Rejoice (2022).

The connection between the growth of an economy, government expenditure on health and human longevity in Nigeria, was studied by Ogungbenle, Olawumi and Obasuyi (2013) from 1977 to 2008. The study employed the Vector Autoregressive (VAR) model and discovered that life expectancy in Nigeria has no connection to government allocation to the health sector. The result of the study did not agree with the result of recent studies conducted by Wilson and Olawale (2021).

Contradicting results of previous studies have necessitated the need to conduct a study on the impact of public health expenditure on life expectancy. Also, this research differs from previous studies because it included population growth and unemployment rate as control variables based on the premise that Nigeria is the most populated country in Africa yet has one of the lowest life expectancies and effects of unemployment may have impacted life expectancy negatively.

Methodology

Model Specification

Theoretical Framework

The theoretical background of this research is adopted from Grossman (1972) who developed a function on health production. The production function is specified as:

$H_t = F(X_t)$ ----------(1)

Where H measures the output of individuals' health at period t while X is a vector of individuals' input at period t to the health production function F. Grossman's model focused on health production at a micro level. In order to study health production at a macro level without losing the theoretical grounds, the components of X are compressed into:

$LEX_t = F(PHEX_t, \Theta_t)$ ----------(2)

Where LEX represents life expectancy, PHEX is public health expenditure and Θ represents controlling variables.

The study adopted the work of Omoloba (2020) the model is specified as

$HO_t = \beta_0 + \beta_1 HEXP_t + \beta_2 URBP_t + \beta_3 PCI_t + \mu_t)$ ----------(3)

Where HO represented health outcome, HEXP represented health expenditure URBP represented urban population and PCI represented per capita income. The study however adopted the model below with modifications. The study included population growth and unemployment in other to determine if the population size of Nigeria and the high unemployment rate has been detrimental to the life expectancy rate of Nigerians.

$LEXP_t = \beta_0 + \beta_1 PHEX_t + \beta_2 PCIN_t + \beta_3 POPGR_t + \beta_4 UNEMR_t + \mu_t$ ……. (4)

Where: β_0 is the intercept of the relationship in the model, β_1- β_2 are the coefficients of each of the independent variables, LEXP is life expectancy, PHEX is public health expenditure, PCIN is per capita income, POPGR is population growth rate and UNEMR is unemployment rate. The variables with large figures are further transformed into log form to aid in linearizing relationships between variables, making it easier to apply linear techniques. Therefore, the model is specified as:

$LEXP_t = \beta_0 + \beta_1 LogPHEX_t + \beta_2 LogPCIN_t + \beta_3 POPGR_t + \beta_4 UNEMR_t + \mu_t$ ……. (5)

Some of the variables in the model were dropped because they do not suit the objective of this study while life expectancy, public health expenditure, population growth and unemployment rate were incorporated into the study.

Types and Methods of Data Collection

Annual time series secondary data was utilized in the study. The variables on which data was collected from the World Bank (2023) are life expectancy (LEXP), per capita income (PCIN), population growth rate (POPGR) and unemployment rate (UNEMR), while public health expenditure (PHEX) data was collected from Central Bank Statistical Bulletin (2023). Data on the variables covered the period 1990 to 2023. The choice of 1990 was on the basis that in 1990, the Nigerian Demographic and Health Survey (NDHS) took statistics on various health indicators. The period 2023 was chosen to enable the study to include current issues in the health sector in Nigeria.

Estimation Procedure

Cointegration

The technique adopted in this study is the Johansen cointegration test. The co-integration equation is shown below:

$Y_t = A_t Y_{t-1} + \ldots\ldots\ldots\ldots + A_p Y_{t-1} + B_\gamma + e_t$ …… 6

Where Y_t is a dimensional vector of the non-stationary I (1) variable, γ is γ – the dimensional vector of the deterministic variable and e_t is the stochastic error residual.

Vector Error Correction Mechanism

Vector Error Correction Mechanism (VECM) is a special application of Vector Autoregressive Models (VAR). The specification of VECM involves the introduction of error correction terms into the VAR model. VECM methodology is utilized if the variables in the system have a long-run relationship, that is they are cointegrated. Every VAR model can be specified in the form of VECM by differencing the variables and introducing error correction terms. However, VECM is used only in the presence of cointegration (Viren, 2022). Generally, the "unrestricted" Error Correction Model equation is given below:

$\Delta \ln Y_t = \alpha_{0y} + \sum_i^n \alpha_{yi} \Delta \ln Y_{t-i} + \sum_i^n \alpha_{yi} \Delta \ln Y_{it-i} + \beta_1 \ln X_{it-1} + \beta_2 \ln X_{it-1} + \lambda ECT_{t-1} + \mu_i$ ……. (7)

Where, Δ is the first difference operator, α is the short-term dynamic coefficients of the model, β is the long run coefficients of the model, λ is speed of adjustment with negative sign, ECT is the error correction term and μ_i is the error term of the model.

Pre-estimation Diagnostic

Stationarity Test

The study applied the Augmented Dickey Fuller (ADF) test to determine the time series stochastic characteristics. The ADF equations are shown below:

$\Delta\mu_i = \beta\mu_{i-1} + \beta\sum_{i=1}^{3}\Delta\mu i - 1 + e_{1i}$ 8

$\Delta\mu_i = \beta_0 + \beta_1\mu_{i-1} + \beta\sum_{i=1}^{3}\Delta\mu i - 1 + e_{2i}$ 9

$\Delta\mu_i = \gamma_0 + \gamma_1 t + \gamma\mu_{i-1} + \beta\sum_{i=1}^{3}\Delta\mu i - 1 + e_{3i}$ 10

Where; $\mu_{i,j}$= (LEXP, PHEX, PCIN, POPGR, UNEMR) representing the variables utilized for the unit root test.

Result of the Findings

Table 1: Summary Statistics

	LEXP	LogPHEX	LogPCIN	POPGR	UNEMR
Mean	48.85	3.901	7.038	2.632	4.989
Median	48.00	4.409	7.409	2.610	4.000
Maximum	55.00	6.718	8.071	2.800	10.00
Minimum	45.00	-0.371	5.598	2.410	3.500
Std. Dev.	3.529	2.000	0.787	0.108	2.099
Skewness	0.370	-0.668	-0.271	-0.174	1.541
Kurtosis	1.664	2.317	1.501	1.994	3.628
Jarque-Bera	3.207	3.091	3.489	1.558	13.61
Probability	0.201	0.213	0.175	0.459	0.001
Observations	33	33	33	33	33

Source: Researchers computation using E-views 9

Table 1 shows the summary of statistics for the time series secondary data utilized in the study. All the variables (LogPHEX, LogPCIN, POPGR and UNEMR) except LEXP have small mean values, signifying a fairly robust distribution. Also, the respective standard deviations for the LOGPCIN and POPGR, are very small, indicating that the estimated values of the variables are as close as possible to their true values. Additionally, the Kurtosis of the distribution for all the variables, except UNEMR is leptokurtic because they all have kurtosis less than 3. Similarly, the Skewness measures suggest that only LEXP and UNEMR, are positively skewed while the probability values of the Jarque-Bera reveal that all the variables are normally distributed except UNEMR which is not normally distributed.

Table 2: Test for Stationarity

Variables	ADF Levels	ADF 1st Difference	Remarks
LEXP	-2.611	-8.476	**1(1)**
LogPHEX	-2.367	-8.490	**1(1)**
LogPCIN	-1.682	-4.205	**1(1)**
POPGR	-0.389	-4.145	**1(1)**
UNEMR	-0.358	-5.337	**1(1)**
ADF Critical Values at 5% = 3.562			

****Signifies stationary at 5%***

Source: Researchers computation using E-views 9

Data in Table 2 reveal the result of the Augmented Dickey-Fuller (ADF) unit root test of stationarity. Trend and intercept were included in conducting the test because they are statistically significant. Results of the test reveal that at levels all the variables of the study are not stationary because their critical values at a 5 per cent level of significance are higher than the calculated values in absolute terms. However, when the variables were differenced once, they became stationary, signifying that they are integrated of order one 1(1). Therefore, the model is not spurious and as such, the interpretation of the result will not be misleading.

Table 3: Order of Lag Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-103.0833	NA	0.000735	6.973118	7.204407	7.048513
1	60.97705	264.6135	9.56e-08	-1.998519	-0.610790*	-1.546154
2	97.19840	46.73723*	5.31e-08*	-2.722477*	-0.178307	-1.893141*

Indicates lag order selected by the criterion

Source: Researchers computation using E-views 9

Based on the lag selection criteria given in Table 3, lag 2 was selected for the estimation of the VAR model. The selected lag was based on the Akaike information criterion (AIC) test statistics because it is better to have an over-fitted model than an under-fitted model. The model with the lowest value of information criteria was chosen to ensure that the error term is not mis-specified.

Table 4: Johansen Cointegration Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.** Critical Value
None *	0.665958	102.9351	69.81889	0.0000
At most 1 *	0.521744	56.88260	47.85613	0.0057
At most 2	0.346821	25.90306	29.79707	0.1316
At most 3	0.167917	8.015122	15.49471	0.4638
At most 4	0.006989	0.294562	3.841465	0.5873

Trace test indicates 2 cointegrating equation(s) at the 0.05 level
*** denotes rejection of the hypothesis at the 0.05 level**

Source: Researchers computation using E-views 9

Table 5: Johansen Cointegration Test (Max-eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.** Critical Value
None *	0.665958	46.05250	33.87687	0.0011
At most 1 *	0.521744	30.97954	27.58434	0.0176
At most 2	0.346821	17.88794	21.13162	0.1341
At most 3	0.167917	7.720560	14.26460	0.4078
At most 4	0.006989	0.294562	3.841465	0.5873

Max-eigenvalue test indicates 2 cointegrating equation(s) at the 0.05 level
*** denotes rejection of the hypothesis at the 0.05 level**

Source: Researchers computation using E-views 9

The null hypothesis of no cointegration was rejected in Tables 4 and 5, suggesting that at least two co-integrating relationships exist among all variables at 5 per cent level of significance. The outcome agrees with that of Ibrahim and Rejoice (2022).

Table 6: Normalized Equation Result

Variables	Coefficient	Std.Error	t-statistics
LogPHEX(-1)	-2.979	0.299	9.970
LogPCIN(-1)	-1.332	0.443	-3.003
POPGR(-1)	3.582	1.749	2.048
UNEMR(-1)	0.369	0.113	3.281

Source: Researchers computation using E-views 9

In Table 6 above, the signs of the coefficients, of the normalized equation from Johansen unrestricted co-integration test are interpreted in reverse form. The result revealed that in the long run, public health expenditure and per capita income are positively related to life expectancy while population growth rate and unemployment rate are negatively related to life expectancy.

Table 7: Vector Error Correction Model (VECM) Result

Variables	Coefficient	Std.Error	t-statistics	P-value
Constant	0.282	0.142	1.986	0.049
ECT_{t-1}	-0.353	0.153	-2.311	0.023
D(LEXP(-1))	-0.213	0.185	-1.151	0.252
D(LogPHEX(-1))	0.529	0.221	2.395	0.023
D(LogPCIN(-1))	0.855	0.046	18.64	0.000
D(POPGR(-1))	5.055	3.679	1.374	0.172
D(UNEMR(-1))	-0.066	-0.165	0.400	0.689

Source: Researchers computation using E-views 9

Data in Table 7 reveal the VECM result. The value of the ECM was negative and statistically significant at 5 per cent in line with econometric specifications. The estimate of the error correction term is -0.353026 suggesting that the speed of adjustment is approximately 35 per cent. This implication is that the divergence between life expectancy and the selected independent variables can be corrected at the rate of 35 per cent in the previous year. The result shows that public health expenditure (LogPHEX) has a positive and significant impact on life expectancy (LEXP) in Nigeria throughout the study period. One per cent increase in PHEX increases LEXP by approximately 0.53 per cent. LEXP is inelastic to changes in LogPHEX because the elasticity is less than 1. The positive relationship between LEXP and LogPHEX in Nigeria is perhaps consistent with economic theory. Given that Nigeria allocates funds to the health sector annually to cater for the health needs of the citizens. Injecting funds into the health sector will translate to higher life expectancy. This finding agrees with Wilson and Olawale (2021), that an increase in public health expenditure increased life expectancy which is in line with a priori expectation that public health expenditure increase is beneficial to the life expectancy of Nigerians.

Consequently, per capita income (LogPCIN) has a positive and significant impact on LEXP. The result shows that a one per cent rise in LogPCIN increases LEXP by about 0.86 per cent. LEXP is also inelastic to changes in LogPCIN because the elasticity is less than 1. This conforms to a priori expectations. This is because as per capita income of individuals increase,

they tend to invest more in their health requirements which aids in achieving a higher life expectancy. The result disagrees with the findings of Wilson and Olawale (2021).

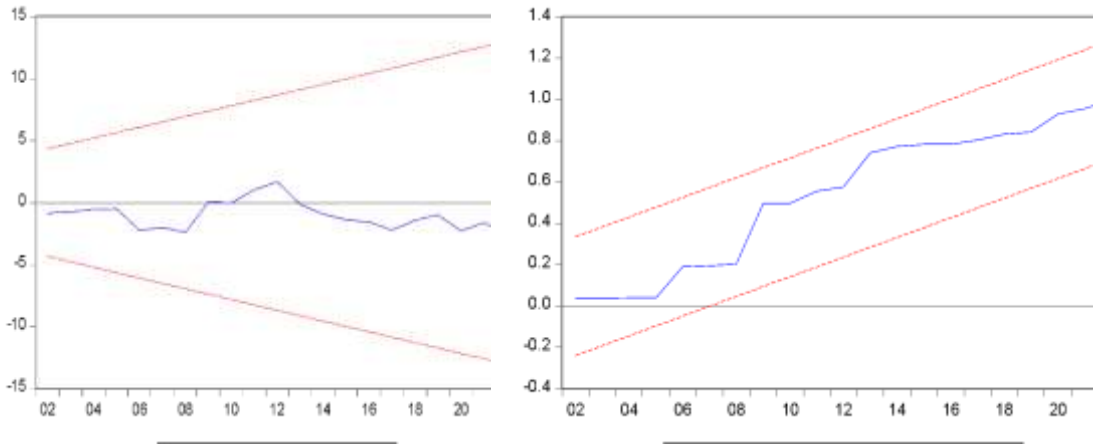
Also, a unit change in POPGR leads to 5.055 change in life expectancy, though the result is statistically insignificant, it conforms to the a priori expectation. An increase in population growth rate may have an immediate positive impact on life expectancy. This is because an increase in population may cause the government to increase annual allocation to the health sector thereby raising the life expectancy of citizens. The positive relationship between population growth rate and life expectancy in Nigeria during the period of study agrees with the findings of Wilson and Olawale (2021).

Similarly, a percentage increase in UNEMR increases LEXP by approximately -0.07 per cent. This conforms to a priori expectations because, higher rate of unemployment leads to a lack of wages or salaries. This affects the health of citizens as many are unable to cater for their health requirements.

Table 8: Diagnostic Test Results

Test	Result	Probability
Heteroscedasticity Test	188.3925	0.1024
Normality Test	9.357997	0.4985
Serial Autocorrelation LM test	0.950702	0.4050

Source: E-views 9 output



Figures 1 and 2: CUSUM and CUSUM of Squares plot of Stability

Source: E-views 9 output

Table 8 shows the post-estimation statistics. The serial correlation LM test has a probability value of 0.9143 which is greater than 0.05. this suggests that the null hypothesis of the absence of autocorrelation in the model cannot be rejected. Similarly, the probability value for the test of heteroscedasticity is 0.1024 implying that the null hypothesis of absence of heteroscedasticity in the model cannot be rejected. Furthermore, Jarque-Bera's probability value is 0.4985, implying that the null hypothesis that the error terms of the data used in the study are normally distributed cannot be rejected. The result passed the test of stability because the CUSUM plot reported in Figure 1 does not cross the 5% critical lines. Therefore, it could be concluded that the estimated parameters for the study are stable for the period under study.

Conclusion

This study analyzed the impact of public health expenditure on life expectancy in Nigeria from 1990 to 2023. The outcome of the study shows that all the variables are stationary at first

difference. Johansen Cointegration test revealed that two of the equations were cointegrated. The Vector Error Correction Model was utilized to determine the impact of public health expenditure on life expectancy in Nigeria. The variables employed in the study were, public health expenditure (PHEX), life expectancy (LEXP), per capita income (PCIN), population growth rate (POPGR) and unemployment rate (UNEMR). The normalized long run equation revealed that only PHEX and PCIN had a positive impact on LEXP. The short run result showed that all the variables had a positive relationship with LEXP except UNEMR that showed a negative relationship with LEXP. Also, PHEX and PCIN were statistically significant in explaining LEXP while POPGR and UNEMR were statistically insignificant. The result also revealed that the speed of adjustment is approximately 35 per cent. The study therefore concludes that public health expenditure impacts life expectancy in Nigeria.

Recommendations

Based on the findings, the study recommends the need for continual allocation of funds to the health sector as it is evidently clear that there is a positive relationship between public health expenditure and life expectancy in Nigeria. This implies that higher investment in healthcare can lead to better health outcomes and longer life expectancy. Consequently, the government should increase allocation to the health sector to enable it meet the needs of the increasing population. Furthermore, the government should focus on growing the economy by promoting entrepreneurship and investment in order to reduce the problem of unemployment and increase per capita income because it will affect life expectancy positively.

References

Admane, M. & Sliman, S. (2021). The impact of health expenditure on the economic growth of Algeria. *International Journal of Economics and Finance. 13*(2), 25-34.

Abdulganiyu, S. & Tijjani, M. (2021). Health expenditure and life expectancy in Africa: A panel study. *South Asian Journal of Social Studies and Economics, 9*(4), 1-9.

Bashir, Y.M. (2016). An assessment of the impact of government expenditure on infrastructures: Evidence from Nigerian health sector Performance. *European Journal of Business and Management,* 14(8), 8-14.

Cameron, L., Contreras, S.D., & Cornwell, K. (2.019). Understanding the determinants of maternal mortality: An observational study using the Indonesian Population Census. *PLoS ONE* 1 4 (6): e0217386.https://doi.orglI0.1371Ijournal.pone .0217386.

Clarkson, S. (2022, 16 June). *Which countries have the best healthcare in the world?* William Russell. http://www.william-russell.com/blog/cuntriesworlds-best-healthcare-systems

David, J. (2018). Infant mortality and public health expenditure in Nigeria: empirical explanation of the nexus. *Timisoara journal of economics and business*, 11 (2), 149-164. https://www.researchgate.net/publication/333786613

Elijah, E.K. (2021). Impact of inflation and unemployment on Nigeria's economic growth. *Journal of economics and finance, 5*(1), 119-125.

Emile, T. (2016). The impact of health on productivity: Empirical evidence and policy implications. *Journal Human Resource, 31*(1), 84-89

Fatunmole, M. (2022, 7 April). *Nigeria has spent 72 per cent of its health sector budgets to pay salaries and run offices in the past 11 years*. Icir. https://www.icirnigeria.org./72-of-nigerias-health-budget-spent-on-salaries-running-officies-in-11-years/

Grossman, M. (1972). On the concept of health capital and demand for health. *Journal of political economy*, 80, 223-255.

Ibrahim, T.M. & Rejoice, D.N. (2022). The impact of public health expenditure on health indicators in Nigeria. *Journal of Economics and Allied Research, 7*(1), 25-34.

Jajere, H.B. (2016) Impact of Unemployment on Economic Growth in Nigeria 1980 – 2010. *Pyrex Journal of Business and Finance Management Research*, 2 (10) 180-195. http://www.pyrexjournals.org/pjbfmr ISSN: 2985-8860

Jude, O.I., Orji, A., Ayela, A.E., Ogbuabor, J.E., Orji, O.I.A. & Nevo, C.H. (2023). Analysis of the determinants and drivers of life expectancy in North Africa. *Journal of Xi'an Shiyou University, Natural Science Edition,*19(2), 253-278.

Oluwatoyin, M.A., Folasade, A.B., & Fagbeminiyi, F.F. (2015). Public health expenditure and health outcomes in Nigeria. *International Journal of Financial Economics*, *4*(1), 45-56.

Ogungbenle, S., Olawumi, O.R., & Obasuyi, F.O.T. (2013). Life expectancy, public health spending and economic growth in Nigeria: a vector autoregressive (VAR) model. *European Scientific Journal*, 9(19), 210-235.

Omoloba, D. (2020). The relationship between health expenditure and health outcomes in Nigeria (1980-2018). *KASU Journal of Economics and Development Studies (KJEDS),8*(1), 319-355.

Orekoya, O.S. (2022). Income inequality, health expenditure and outcomes in Nigeria. *AJSD*, 7 (2), 115-139. https://www.researchgate.net/publication/358275417.

Stout, N. (2018, 21 March). *Increasing life expectancy in Nigeria.* The Borgen Project. https://borgenproject.org/increasing-life-expectancy-in-nigeria/

Tieguhong, J.C., & Piabuo, S.M. (2017). Healthy expenditures and economic growth - a review of the literature and an analysis among the economics communities for Central African state (CEMAC) and selected African countries. *Health Economic Reviews*, 23(7), 1186-1173. Retrieved from https://www.ncbi.nlm.nih.gov/pm/articles/PMC5462666/pdf/13561_2017_159.pdf

Tambe, N.A. (2022, 12 October). *2023 Budget: Health gets highest allocation ever but fails to meet AU commitment*. Premium Times. https://www.premiumtimesng.com/news/headlines/559213-2023-budget-health-gets-highest-allocation-ever-but-fails-to-meet-au-commitmen.html?tztc=1

Viren, S.R. (2022, 4 May). *Vector Error Correction (VECM) and VAR: Theory*. Spur Economics. https://spureeconomics.com/vector-error-correction-vecm-theory.

Wasiu, B. (2020). Public health financing and health outcomes in Nigeria. *BizEcons Quarterly, 13*(2), 23-47.

Wilson, E., & Olawale, H. (2021). Impact of public health expenditure on Nigerian health sector performance: an empirical investigation. *Gusau International Journal of Management Science 4*(2), 86-100.

World Development Indicators (2022). Washington, D.C: The World Bank.