Research Article

Health Outcome and Economic Growth: The Case of Malaria in Nigeria

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This inquiry delved into the intricate interplay between health outcomes and economic growth, with a specific focus on the impact of malaria in Nigeria. This research endeavours to delve into the profound intricacies inherent in the interconnection between health outcomes and economic growth. The multifaceted exploration entails a meticulous scrutiny of pivotal determinants, encompassing the intricate tapestry of current health expenditure, gross capital formation, the prevalence of malaria in Nigeria, secondary school enrolment (spanning post-primary and secondary education), and the discerning trajectory of real gross domestic product, serving as an illuminating proxy for the profound dynamics governing economic growth. Econometric analysis is employed to investigate the study using an autoregressive distributed lagged model (ARDL). The findings show that current health expenditure has an inverse relationship with economic growth in Nigeria. Meanwhile, gross capital formation and secondary school enrolment, parameters used, showed a positive influence on economic growth in Nigeria. Thus, the policy proffered is that the federal government should invest deliberately in the health sector. There may be a need to double government expenditure in the health sector with a view to making the people have access to a quality healthcare system at a very cheap and affordable rate and also making social services such as education free from the primary to secondary level.

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I. Introduction

A prevailing consensus suggests that the trajectory of economic growth inherently holds the capacity to fundamentally elevate health standards. This intricate relationship unfolds through the amplification of food accessibility, the augmentation of earnings, thereby rendering health expenditures more within reach, and the simultaneous surge in demand for superior health services. In essence, the symbiotic interplay between economic prosperity and health advancement resonates on a profound level (Ogunjimi and Adebayo, 2019). The prospect of heightened economic growth concurrently implies the potential for increased public revenue, affording the opportunity for augmented investments in health infrastructure. This introspection naturally raises the pivotal question of reverse causality: does an enhancement in health outcomes correspondingly propel heightened economic growth? Should this reciprocal relationship exist, the subsequent analysis necessitates a meticulous examination of the nuanced significance of health's contribution within the broader context of other empirically acknowledged determinants steering economic growth. Hence, it is plausible that causality operates bidirectionally, albeit challenging to quantify and estimate accurately. Nonetheless, it is discernible that an escalating discourse surrounds the prevailing uncertainty regarding the dominant direction of influence. A decisive resolution or informed input into this discourse holds substantial policy implications. For instance, empirical evidence indicating that economic growth mitigates infant mortality could catalyse the imperative for instituting growth-centric policy reorganizations (Taofik and Ditep, 2022; Ajao, et al. 2021). On the other hand, should it be determined that enhancing the health of the population contributes to economic growth, a notable realization emerges — the public emphasis on strategies focused on improving health position is deemed to be inadequately acknowledged. Consequently, policies aimed at health improvement would become essential components of intervention measures designed to stimulate growth. Noteworthy is the observation that numerous works on economic growth in Nigeria have predominantly linked growth to macroeconomic nitty-gritties, frequently neglecting the crucial human capital facet, inclusive of both education and health, in their analytical frameworks.

Nigeria Health Care Sector

Healthcare services in Nigeria are delivered through a collaborative effort between the cloistered and open sectors. The cloistered sector encompasses non-governmental organizations, private non-profit providers, community organizations, as well as religious and traditional healthcare providers. According to Adegoroye et al. (2021) and Ogunyemi et al. (2022), Government entities assume the responsibility of

offering care within the public sector, organized across three levels: primary, secondary, and tertiary. Services at the community level encompass both preventive and curative measures, accessible at the community's doorstep. Fundamental and reference support is extended, with a cadre of health workers, including nurses, health workers, community health educators (CHEWs), and environmental workers, actively involved in service provision. Facilities at this level include health centres, pharmacies, and medical facilities. At the secondary level, a general hospital assumes a pivotal role, delivering medical, laboratory, and specialized medical services, encompassing areas such as surgery, obstetrics, and paediatrics. Key mid-level health professionals contributing to this level include doctors, nurses, midwives, laboratory technicians, and pharmacists.

An exemplary illustration of such healthcare facilities is a general hospital. In the United States, tertiary care stands as the pinnacle of healthcare, comprising specialty and teaching hospitals. Similarly, federal medical centres (FMCs) in Nigeria epitomize this highest level of care, equipped with state-of-the-art technology to deliver specialized healthcare services and serve as hubs for knowledge creation. Regrettably, Nigeria's health indicators are notably lower compared to other developing countries within the same category. As of 2011, life expectancy was estimated at 52 years, with a crude death rate of 14%. Alarmingly, 124 out of every 1,000 new-borns fail to survive to age 5. Furthermore, only 39.56% of men and 42.25% of women make it to the age of 65. The country is grappling with a significant burden of HIV, with approximately 3 million adults (aged 15 to 49) living with the virus. The estimated prevalence of HIV/AIDS in Nigeria is 3.7. Despite having a health workforce comparable to Egypt and South Africa, only 39% of births involve skilled medical personnel. Notably, the expenditure patterns indicate a relatively modest allocation to healthcare in Nigeria. In 1997, healthcare spending constituted 4.6% of the gross domestic product (GDP), a figure that increased to 6.6% in 2005 before decreasing to 5.8% in 2009. The total actual expenditure for the years 1997, 2001, 2005, and 2009 amounted to 134,522, 256,283, 972,921, and 1,596,573 million naira, correspondingly. This financial trend underscores the country's limited commitment to enhancing medical facilities and equipment. Examining total healthcare expenditures (THE), available data reveal a significant reliance on out-of-pocket costs. In 2011, public spending on healthcare constituted 36.7% of total healthcare spending, while monopoly costs represented a substantial 60.4% of the overall costs. This financial landscape emphasizes the need for strategic interventions to address funding challenges and enhance the accessibility and quality of healthcare services in Nigeria.

II. Literature Review

Conceptual and Theoretical Review

Health financing, as defined by Oyefabi et al. (2014), is the strategic mobilization of funds for health services. It encompasses the provision of financial resources for government initiatives aimed at safeguarding public health, including the delivery of medical and associated services with the goal of sustaining good health. The allocation of resources to healthcare within a country serves as a tangible reflection of the societal valuation of health in comparison to other commodities and services. The configuration of health financing contributes a pivotal part in shaping the dynamics and conduct of numerous stakeholders, influencing the overall quality of health outcomes. As emphasized by Metiboba (2012), understanding the nature of health financing is integral to comprehending the intricate interplay among stakeholders and contributes significantly to shaping the landscape of healthcare quality.

Theoretical Review

The Law of Wagner/ Increasing State Activities' Theory

Adolf in 1883 articulated the "law of progressive expansion of governmental activity," positing that government support tends to expand over the long term in tandem with economic growth. This hypothesis, known as Wagner's Law, asserts that the relative importance of public services increases over time. Wagner identified three principal reasons supporting the anticipated growth of social movements. Firstly, as nations develop, the complexities of authorized relationships and message intensify with population density and urbanization, necessitating governments to establish a regulatory framework to navigate the intricate web of relationships between economic entities. Secondly, rising incomes prompt heightened societal demands for increased education, entertainment, equitable income distribution, and more extensive public services. Lastly, the technological requirements of industrial society necessitate a greater investment in complex infrastructure, a realm where government intervention becomes imperative to bridge the gap.

Empirical testing of Wagner's Law across various countries has yielded diverse results. Advocates of Wagner's Law, such as Musgrave and Musgrave (1988), contend that the portion of the municipal sector in the countrywide economy will invariably expand as progressive countries undergo industrialization.

The Keynesian Theory

Keynes delved into the correlation between government spending and economic growth, characterizing government spending as an exogenous factor wielded as a policy tool to invigorate economic expansion. According to the Keynesian perspective, government spending can apply a favourable influence on economic growth. The theory posits that heightened government consumption can foster increased employment, productivity, and investment by triggering a multiplier effect on aggregate demand. Consequently, the escalation of government spending elevates aggregate demand, inducing a higher output as a consequence of the spending multiplier.

Musgrave and Rostow's Improvement Theory

Economic scholars and historians assert that the upswing in individual public spending is intricately linked to the principles governing economic growth and social development. In the developmental trajectory, a distinct phase, Step 3, emerges. This phase is marked by crucial investments in education and essential expenditures, often deemed as indirect social costs. To adequately support these necessary expenses, where government expenditures constitute a significant portion of the total products, a period of pronounced growth ensues. During this phase, there is a confluence of heightened individual consumption and increased public investments, fostering a surge in demand for products necessitating additional public investments. Notably, this heightened societal demand, exemplified by trends such as increased car ownership and urbanization, contributes to a pronounced growth trajectory. The escalating demand for skilled labour in affluent societies underscores the evolving role of education as an investment asset for the broader society. Simultaneously, population migration dynamics give rise to the development of urban slums, among other factors. These multifaceted influences collectively contribute to an augmentation of government spending as a percentage of Gross Domestic Product (GDP).

Empirical Review

Health financing models are intricately connected to the delivery of healthcare services, and various funding approaches exist worldwide, including in Nigeria. These sources encompass tax-based financing by the public sector, contributions from households, funding from the private sector (often donor-supported), and the utilization of health insurance. Additionally, out-of-pocket payments for healthcare play a role in the financing landscape. External funding for health initiatives involves grants and loans from donor organizations such as the World Bank, WHO, and the European Union, as noted by Olayiwola

et al. (2017). Tax-based health financing relies on public revenues generated through taxation across all levels and sectors. Publicly funded healthcare predominantly operates as an income-based function. Importantly, a robust positive correlation exists between the tax-adjusted proportion of healthcare spending and the overall progressivity of healthcare, highlighting the significance of this funding mechanism in shaping equitable healthcare access and delivery.

Two methodologies are commonly employed to gauge the influence of health on economic growth. The first involves estimating health impacts through microeconomic studies and subsequently extrapolating these findings to quantify impacts at the aggregate level. The second approach entails directly estimating aggregate relationships applying macroeconomic data. Studies exploring the interconnection between health and economic outcomes typically scrutinize two overarching categories of measures at the individual or country level: inputs to health and inputs to health outcomes. Health inputs encompass the physical factors influencing an individual's health, including aspects such as nutrition, exposure to pathogens, and access to healthcare services at different life stages (e.g., childhood and adulthood). Conversely, health outcomes constitute characteristics determined by an individual's health and genetic predisposition, exemplified by life expectancy, height, work capacity, and cognitive function. Crucially, two pivotal dimensions of human capital, namely education and health, emerge as focal points in understanding and assessing the intricate interplay between health and economic growth, as articulated by Weil (2007).

However, one significant portion of the literature in health microeconomics and economic outcomes centers on exploring the impact of diverse health exposures on health outcomes, human capital characteristics dependent upon health outcomes, and earnings. The majority of these studies rely on micro-level data, concentrating on households and their members. Examples of such studies comprise the work of Berman and Deolalikar (1988) and Strauss and Thomas (1998). These investigations often focus on specific groups of dependent variables. For instance, a study by Alderman et al. (2006) delved into the enduring effects of nutrition on children, employing a range of natural and artificial experiments that induced extrinsic dietary changes. The findings indicated that improved nutrition correlates with enhanced school performance, encompassing factors such as Intelligence Quotient (IQ), height, and salary.

Furthermore, Thomas et al. (2004) identified a positive correlation between adult nutrition and labour force participation as well as wages. Another strand of literature has sought to elucidate how changes in Nigeria's health level lead to earnings variation by focusing on health outcomes instead of health initial

plans, using aggregate analysis rather than micro-level evaluations. Scholars such as Barro (1996), Bhargava et al. (2001), Bloom et al. (2000), Bloom in Malaney (1998), and Bloom et al. (1999) have conducted studies focusing on the regression of Total Factor Productivity (TFP) on GDP per capita, GDP growth, or specific health outcome measures, while accounting for standard controls.

Quantitative outcomes from these studies indicate that a 5-year increase in life expectancy generates incremental effects ranging from 0.006 (Sacks and Warner, 1997) to 0.58 (Barro and Lee, 1994). Scheffler (2004) asserts that health should be perceived not merely as an outcome (e.g., life expectancy) but also as an input, specifically in terms of healthcare costs. Moreover, Scheffler highlights that the elasticity of healthcare costs to GDP surpasses 1, implying that a 10% increase in GDP leads to a proportionally higher increase in healthcare costs. This observation aligns with the evident trend that developed countries allocate a greater portion of their resources to healthcare compared to developing nations, as demonstrated by Ogundipe et al. (2011). In a regression analysis, Oni (2014) concludes that total investment, total health disbursement, and labour output serve as significant bases of economic growth in Nigeria. Notably, public health outflow exhibits a substantial relationship with growth and development across all countries. Grimard and Harling (2004), employing panel data exploration of 91 countries through the Solow growth theory and Tuberculosis (TB) occurrence report data from 1981 to 2000, found that nations with lesser TB burdens experienced faster growth compared to those with higher burdens, demonstrating that a 10% increase in TB cases corresponds to a permanent impact on low growth ranging from 0.2% to 0.4%.

Nwaobi (2004) observed that the healthcare sector in Nigeria is characterized by underdevelopment, contributing to a gradual deterioration in the quality of life for the average citizen, as an increasing number of individuals find themselves below the critical poverty line. He contends that this situation persists due to the absence of essential administrative, institutional, and structural changes within the health sector, which are imperative for fostering rapid and sustainable growth capable of elevating the standard of living to a minimum acceptable level.

The industry and technology base supporting the healthcare sector are notably weak, and there is a dearth of meaningful linkages with other industries. Key factors contributing to this state of affairs include weak and inconsistent health policies, mismanagement of the health sector, and inadequate linkages. Importantly, Nwaobi emphasizes that increases in public expenditure and per capita output in Nigeria do not necessarily translate into commensurate improvements in public health and health

results. Investment in security has the capacity to stimulate peace and hence boost foreign direct investment, which can boost economic growth (Akinuli, et al. 2023; Ajao, et al. 2021, Adeyeye, et al. 2016).

Ogundipe and Lawal (2011) resolved that there is a critical need to focus on enhancing the quality and nature of healthcare services. This necessitates improvements in service delivery across all segments of the healthcare sector. The authors argue that judicious allocation of resources, channelled strategically, can yield immediate and substantial impacts on the overall effectiveness of healthcare expenditures.

III. Methodology

Research Design

This study inherently explores the nexus between health outcomes and economic growth in Nigeria. The analysis incorporates several variables, with real gross domestic product (serving as a proxy for economic growth) as the dependent variable. The explanatory variables encompass current health expenditure, incidence of malaria, gross capital formation, and secondary school enrolment.

Data and Variables Sources

This study trusts on secondary data got from the Central Bank of Nigeria (CBN) and World Bank (WB) Statistical Bulletin straddling multiple subjects from 1985 to 2021. Thus, the reliability and cogency of this research are contingent upon the accuracy and genuineness of the intermittent reports disseminated through the CBN and the yearly reports of the WB.

Model Specification

The model for this study is delineated as follows:

$$RGDP = f(CHE, IOM, SES, GCF) \tag{i}$$

Equation 1 is explicitly expressed as:

In explicit form, the short-run equation for the ARDL model is given by:

$$\begin{aligned} \Delta RGDP_t =& \propto_{01} + \sum_{i=1}^{P} \propto_{1i} \Delta RGDP_{t-1} + \sum_{i=1}^{q} \propto_{2i} \Delta CHE_{t-1} + \sum_{i=1}^{q} \propto_{3i} \Delta IOM_{t-1} \\ &+ \sum_{i=1}^{q} \propto_{4i} \Delta GCFR_{t-i} + \sum_{i=1}^{q} \propto_{5i} \Delta SES_{t-i} + \mathrm{e}_{1t} \end{aligned} \tag{ii}$$

ARDL Long run model specification (in case there long-run relationship among the variables)

$$\begin{aligned}\Delta RGDP_t =& \propto_{01} + \sum_{i=1}^{P} \propto_{1i} \Delta RGDP_{t-1} + \sum_{i=1}^{q} \propto_{2i} \Delta \text{ CHE }_{t-1} + \sum_{i=1}^{q} \propto_{3i} \Delta IOM_{t-1} \\ &+ \sum_{i=1}^{q} \propto_{4i} \Delta GCFR_{t-i} + \sum_{i=1}^{q} \propto_{5i} \Delta SES_{t-i} + \lambda ECM_{t-1} \\ &+ \mathrm{e}_{1t}\end{aligned} \tag{iii}$$

Where:

- RGDP = Real Gross Domestic Product
- CHE = Current Health Expenditure
- IOM = Incidence on Malaria
- GCF = Gross Capital Formation
- SES = School Enrolment Secondary

And also,

- α_0 = constant/intercept
- α_1 = co-efficient of current health expenditure
- α_2 = co-efficient of incidence on malaria
- α_3 = co-efficient of gross capital formation
- α_4 = co-efficient of school enrolment secondary
- $\mathrm{e}1t$= error term/stochastic disturbance

$$\lambda = \left(1 - \sum_{i=1}^{p} \delta i\right) \Leftrightarrow$$

this represents the speed of adjustment parameter with a negative sign

- ECM = (RGDP $_{t-1}$ - θ_{xt}), the error correlation term is the extracted residuals from the regression of the long-run equation

A priori **expectation**

$\alpha_1, \alpha_2, \alpha_3, \alpha_4 > 0$

IV. Analysis and Interpretation of Data

Descriptive Statistics

Descriptive statistics provide an overview of the characteristics of variables utilized in this study, offering insights into the adequacy of these variables.

	CHE	GCF	IOM	RGDP	SES
Mean	2.179729	31.61758	211.2397	4.630541	33.93006
Median	3.090694	29.38680	297.4619	4.210000	31.86770
Maximum	5.053609	54.95059	418.0386	14.60000	56.20540
Minimum	0.009658	14.90391	0.000000	-1.920000	23.55180
Std. Dev.	1.787026	12.63252	181.0317	3.859328	9.303816
Skewness	-0.159216	0.233863	-0.248835	0.418512	0.532672
Kurtosis	1.326323	1.826332	1.226636	2.685449	1.967540
Jarque-Bera	4.474829	2.460907	5.230095	1.232642	3.393100
Probability	0.106734	0.292160	0.073164	0.539927	0.183315
Sum	80.64999	1169.851	7815.870	171.3300	1255.412
Sum Sq. Dev.	114.9646	5744.902	1179810.	536.1990	3116.196
Observations	37	37	37	37	37

Table 1. Descriptive Statistics

***Source**: E-View 10 output, 2024*

Table 1 presents the descriptive statistics for the variables postulated in the specified model of this study. The descriptive statistics offer insights into the adequacy of the employed variables. The means of the parameters for current health expenditure (CHE), gross capital formation (GCF), incidence of malaria (IOM), real gross domestic product (RGDP), and secondary school enrolment (SES) are 2.1797, 31.61758, 211.2397, 4.630541, and 33.93006, respectively. Correspondingly, the standard deviations for these parameters are 1.7870, 12.6325, 181.0317, 3.8593, and 9.3038, respectively.

Additionally, the Jarque-Bera test results are examined. The Jarque-Bera test serves as a statistical assessment to ascertain whether a series follows a normal distribution. The decision rule for the Jarque-Bera statistics dictates rejecting the null hypothesis when its probability is less than 5%, and vice versa.

In this context, the probabilities for Jarque-Bera indicate that the null hypotheses for CHE, GCF, IOM, RGDP, and SES cannot be rejected, as their probabilities exceed 5%. It is pertinent to note that there are 37 observations in this study.

Results of Correlation Coefficient

The analysis of the relationship between parameters in this study utilized the correlation coefficient, and the fallouts are presented in Table 2 below.

Correlation Probability	CHE	GCF	IOM	RGDP	SES	
CHE	1.000000					

GCF	-0.83**	1.000000				
	0.0000	-----				
IOM	0.94**	-0.80**	1.000000			
	0.0000	0.0000	-----			
RGDP	0.278427	-0.111399	0.38*	1.000000		
	0.0952	0.5116	0.0171	-----		
SES	0.72**	-0.81**	0.63**	-0.028413	1.000000	
	0.0000	0.0000	0.0000	0.8674	-----	

Table 2. Correlation Coefficient Results

Source: *E-view 10.0 Output, 2024 Note: ** /or *portrays coefficients are significant at the 1% /or 5% significance*

Table 2 presents the correlation coefficients with statistical significance for the model posited in this study, utilizing the Pearson correlation. It is noteworthy that the independent variables are intentionally maintained with low correlation to mitigate potential challenges associated with multicollinearity, as

emphasized by Willis and Perlack (1978). Multicollinearity, as elucidated by Yoo et al. (2014), heightens the risk of variance in estimated coefficients, leading to increased sensitivity to adjustments in the postulated model.

The analysis indicates an impressive correlation coefficient, with no evidence of multicollinearity among the variables. Each variable exhibits a weak correlation with the independent variable, and the fallouts are statistically significant, except for SES, which demonstrates a very weak and negative correlation. It is essential to interpret these correlation coefficients as indicative of either weak or strong positive/negative correlations.

Unit Root Test

Non-stationary data may suggest the presence of spurious regression, rendering the results invalid and potentially misrepresentative. Consequently, ensuring the stationarity of data is imperative. In pursuit of this, the ADF unit root test (which is known as the Augmented Dickey-Fuller) is used to analyze the stationarity of the variables. The verdict principle is that the ADF test statistic value must surpass the Mackinnon critical value at a 5% significance level and at absolute value. The swift of the unit root test carried out on the variables at the level is presented in Table 3 below.

Variables	ADF Test Statistic Value	Mackinnon Critical Value at 5%	Prob.	Remark
CHE	-1.9186	-3.5403	0.6242	Non-Stationary
GCF	-0.1964	-3.5403	0.9907	Non-Stationary
IOM	-1.5547	-3.5403	0.7909	Non-Stationary
SES	-2.5497	-3.5403	0.3041	Non-Stationary
RGDP	-3.2992	-3.5403	0.0826	Non-Stationary

Table 3. Unit Root Test

***Sources**: Author's analysis using EViews 11 (2024)*

Table 3 presents the results of the unit root test at the level for the variables proposed in this study. From the computation, it can be deduced that none of the variables exhibits stationarity at the level, given that the ADF test statistic values are below the Mackinnon critical values at a 5% significance level. Consequently, the evaluation of stationarity is extended to the first and second differences.

Table 4 provides the order of integration, as indicated in the remarks column. It is crucial to emphasize that the data series must exhibit stationarity; otherwise, the results of the whole analysis may yield undependable and erratic results.

Variables	PP Test Statistic Value	Mackinnon critical Value at 5%	Prob.	Remark
CHE	-6.7336	-3.5442	0.0000	$I_{(1)}$
GCF	-6.4201	-3.5442	0.0000	$I_{(1)}$
IOM	-5.8574	-3.5442	0.0001	$I_{(1)}$
SES	-6.8309	-3.5442	0.0000	$I_{(1)}$
RGDP	-7.9580	-3.5442	0.0000	$I_{(1)}$

Table 4. Unit Root Test Displaying First/Second Difference

Sources: Author's analysis using E-views 11 (2024)

Table 4 illustrates that each coefficient in the model achieves stationarity after the first difference, denoted by I(1) in the remarks column, signifying an integrated order of one. The stationarity of variables at the difference level suggests that the variables are not co-integrated at the same order. Additionally, the ADF statistics values were derived using trend and intercept as the gradient.

Optimal Lag Selection

It is imperative to determine the optimal lag selection in that it is crucial for estimating the Autoregressive Distributed Lag (ARDL) model. It helps know to what extent to lag the dependent variables and the independent variables when using ARDL for estimation. The optimal lag length is

obtained by using the Vector Autoregressive (VAR) model. The specified lag lengths for the variables are presented in Table 5 below.

Dependent Variables	Lag Length Criteria
RGDP	1

Table 5. Appropriate Lag Length when RGDP (Proxy Economic Growth) is a Dependent Variable

***Sources**: Author's analysis using E-view 11 (2024)*

From Table 5, the appropriate lag length to be selected using Vector Auto-Regressive (VAR) lag order of selection criteria is 1 (one) (**see appendix 2**).

Co-integration Test using ARDL Bound Approach

The outcome of the unit root test guided the decision to employ the ARDL bound co-integration approach in this study. Subsequently, in Table 6, a bound co-integration test was conducted.

	Model 1	
Bound significance	**I(0)**	**I(1)**
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06
F-Statistics	7.044093	
D.F	4	

Table 6. F-Bound Test

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***Sources**: Author's analysis using E-view 11 (2024)*

Decision Rule: at 5% Significance value

If F-Statistics (BT) < Lower Limit Bound ↔No Long-run relationship exist

If Lower Limit < F-Statistics (BT) > Upper Limit ↔ Long-run relationship exist

If F-Statistics (BT) > Upper Limit (I_1) ↔ Long-run relationship exist

- In instances where the Bounds Test (BT) falls below the lower limit, it is advisable to endorse the null hypothesis positing the absence of a long-term relationship
- In cases where the Bounds Test (BT) exceeds the lower limit yet falls below the upper limit, it is recommended to reject the null hypothesis asserting the absence of a long-run relationship.
- In scenarios where the Bounds Test (BT) surpasses the upper limit, it is advisable to reject the null hypothesis positing the absence of a long-run relationship

NB: The selection of a reasonable level of significance is contingent upon the researcher's margin of confidence. In this instance, a 5% level of significance is chosen as a margin of safety or confidence.

As depicted in Table 6, the bound co-integration test results affirm the presence of a long-run relationship among the variables. The model's F-Statistics test outcome of 7.00093 surpasses the Upper Limit Bound I(1) at a 1% level of significance. This signifies that the variables are mutually co-integrated at the same level, upholding the presence of a long-run relationship. Consequently, both short-run and long-run appraisals are assessed in the subsequent analysis.

Presentation of Auto-Regressive Distributed Lag (ARDL) Model Results

Dependent Variable: RGDP (Proxy for economic growth)							
Short-Run Estimation				**Long-Run Estimation**			
Variable	**Coefficient**	**t-Statistic**	**Prob**	**Variable**	**Coefficient**	**t-Statistic**	**Prob**
RGDP(-1)	0.160997	1.063840	0.2984	Δ(IOM)	0.025448**	2.391089	0.0254
IOM	0.025448**	2.391089	0.0254	Δ (IOM(-1))	-0.017778**	-2.183895	0.0394
IOM(-1)	-0.005153	-0.563571	0.5785	Δ (CHE)	-1.742920	-1.597133	0.1239
IOM(-2)	0.017778**	2.183895	0.0394	Δ (GCF)	0.000404	0.002748	0.9978
CHE	-1.742920	-1.597133	0.1239	Δ (GCF(-1))	0.307691	1.705458	0.1016
GCF	0.000404	0.002748	0.9978	Δ (GCF(-2))	-0.427326*	-2.999724	0.0064
GCF(-1)	0.188116	0.922921	0.3656	Δ (SES)	0.094142	0.743141	0.4649
GCF(-2)	-0.307691	-1.705458	0.1016	ECM(-1)	-0.839003*	-5.543973	0.0000
GCF(-3)	0.427326*	2.999724	0.0064				
SES	0.094142	0.743141	0.4649				
C	-13.35165	-1.735176	0.0961				

Table 7. ARDL Long-Run and Short-Run Results

Sources: Author's Analysis (2024) **implies significant at 1%, **implies significant at 5%*

Post Diagnostic Test Results		Statistical Properties	
B-G Serial Correlation LM (F-Statistics)	0.800966	Prob(F-statistcis)	0.000383
B-G Serial Correlation LM Prob F (1, 28)	0.4621	Durbin Watson Statistics	1.5205
Heteroskedasticity Test (F-statistics)	1.769762	Akaike Info Criterion	
Heteroskedasticity Test Prob F (2, 21)	0.1244	Model Selection	1
		R-Squared	0.703003
		Adj R-squared	0.573874
		F-statistics	5.444185
		ARDL Best Model	(1, 2, 0, 3, 0)

Table 8. Statistical Properties and Post Diagnostic Results

Sources: Author's Analysis (2024)

Interpretation of Results and Discussion of Findings

From Tables 7 & 8 above, the results of the Auto-Regressive Distributed Lag – ARDL model's short-run and long-run appraisals are expounded in turns below:

In the short run, the Real Gross Domestic Product (RGDP) exhibits a positive relationship with its lagged values, although the result lacks statistical significance, indicated by a probability value of 0.2984. Regarding the Incidence of Malaria (IOM), in the short run, it positively influences economic growth in the current period. However, when lagged by one year (IOM-1), the influence becomes negative, and when lagged by two years (IOM-2), it shifts to positive. The result is statistically significant when lagged by two periods. In the long run, the incidence of malaria demonstrates a direct influence on economic growth in the current period but transforms into an indirect influence when lagged by one period. The results are statistically significant, with p-values of 0.0254 and 0.0394 in the current and lagged periods, respectively. This discovery aligns with the work of Kareem et al. (2017) and Yahaya et al. (2023).

In the short run, Current Health Expenditure (CHE) exhibits a negative effect on economic growth. The coefficient value of 1.742920 suggests that a 1% increase in CHE will result in a 174.2920% burst in

economic growth within the review period. In the long run, the nature of the relationship with RGDP remains negative, contrary to the *a priori* expectation of a positive relationship. This result differs from the findings of Saheed and Samuel (2021), where current expenditure was observed to have a positive influence on economic growth.

Conversely, in the short run, Gross Capital Formation (GCF) demonstrates a positive influence on economic growth (proxied by RGDP) within the review period. Similarly, in the long run, GCF continues to exhibit a positive effect on economic growth, aligning with the *a priori* expectation of an affirmative relationship. This study's findings are consistent with the works of Onisanwa (2014), Popoola et al. (2015), as well as Kareem *et al*. (2017).

School Enrolment Secondary (SES) exerts a positive effect on economic growth within the review period. In the long run, SES continues to exhibit a positive effect on economic growth, aligning with the *a priori* expectation of a positive relationship. This discovery is in line with the work of Musibau (2010) and Ogunjimi and Adebayo (2018).

Furthermore, the error correction mechanism (ECM) bears the appropriate negative sign. This is essential as ECM(-1) must indicate a negative sign to fulfil the condition of being able to correct the previous errors in the subsequent period. The speed of adjustment, denoted by -0.839003, suggests that errors from the preceding period could be corrected in the succeeding period to the extent of 83.9003%. The coefficient of the ECM is statistically significant, with a probability value of 0.0000, indicating significance at the one per cent level.

The Post Diagnostic Results

Table 8 provides the post-diagnostics test outcomes for the model projected in this study. The coefficient of determination, R-Squared, is 0.703003, indicating that the independent variables can explain up to 70.30% of the variation in economic growth (proxied for RGDP). The remaining 29.70% deviancy is expressed by the error term. This outcome is reinforced by the adjusted R-squared of 57.38%.

The F-statistics result of 5.444185 with a probability distribution of 0.000383 signifies the overall statistical significance of the regression analysis. Thus, it can be asserted that health outcomes have a significant influence on economic growth in Nigeria within the review period.

The chosen lagged criterion model, determined to be 1, is based on the vector autoregressive (VAR) model.

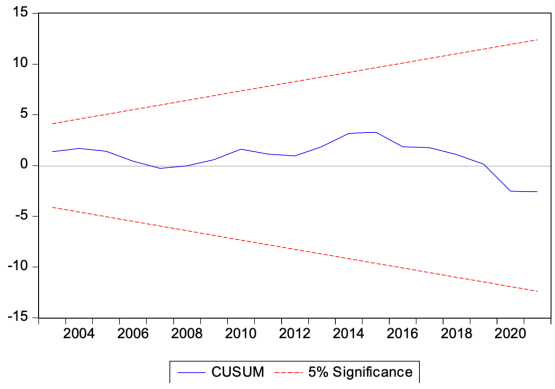
The Durbin Watson (DW) statistic, yielding a result of 1.52, implies that the regression analysis is indicative of minimal serial autocorrelation issues. The Durbin Watson statistical test also gauges the "goodness of fit" of the model, indicating that the stated model is appropriately aligned with the presence of the accurate and satisfactory parameters.

The Breusch-Godfrey Serial Correlation LM Test is employed to evaluate the presence of serial correlation. The null hypothesis, indicating the absence of a serial correlation problem, is not rejected, as the probability exceeds the 5% threshold. The F-statistics for the Breusch-Godfrey serial correlation test, specifically 0.800966, with a corresponding probability value of 0.4621, indicates that the overall analysis may not be afflicted by a serial correlation issue.

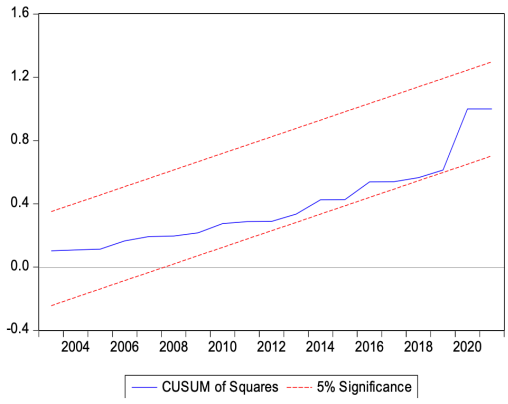
Stability Test

The stability test involves a visual assessment to determine whether the regression analysis remains relatively stable and adheres to an acceptable range at a 5% significance level. Illustrated in Graph 1 and Graph 2 below are the results of the stability test utilizing cusum and cusum square methods at a 5% significance level.

Graph 4.1



Graph 4.2



Graph 4.1 and 4.2.

Graph 4.1 and 4.2 present the results of the cusum and cusum of squared stability tests. These findings indicate that both the cusum test and cusum of squares fall within the acceptable region at a 5% significance level, affirming the stability of the analysis. In summary, the comprehensive results have

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furnished substantial evidence to confirm that health outcomes have a significant effect on economic growth within the investigated period.

V. Conclusion and Recommendations

It is imperative to draw policy recommendations from the findings in this study.

Gross capital formation, which could imply investment in human capital development and infrastructure, should be prioritized by the government as it has a positive influence on economic growth. Health personnel should be trained and allowed to measure up to world standards. Hence, the government should endeavour to invest in health personnel in terms of good welfare packages and prompt payment of all allowances so as to avoid a mass exodus of health workers out of the country.

Incidence of malaria has a multiplier effect on economic growth; hence, the government should try to put paid to occurrence of this case as it has a mixed effect on economic growth.

School enrolment at the secondary level, which implies the amount of population that can afford post-primary and secondary education, must be attended to by the government, as this has a positive influence on economic growth in Nigeria. The government should ensure free education from the primary to the secondary level, and where possible, some post-secondary education, most especially in health-related fields, should be made free by the government.

Current expenditure should be directed to boost health systems development. The government should invest in quality health services and provide adequate infrastructure for multiple good reasons. Firstly, the government should know that adequate health infrastructure has a positive influence on social health and hence on economic growth. Secondly, productive input in public services and human capital boosts labour performance and thus stimulates higher economic growth and revenue. Thirdly, the health sector has the inherent capacity to be a ready-made market for health services and products; however, guidelines are still required to make sure that all and sundry have access to top-notch health facilities in Nigeria.

In Nigeria, for instance, private health expenditure surpasses public sector expenditure on health. The private current expenditures are mostly entirely out-of-pocket, and private insurance (for instance, the National Health Insurance Scheme) contributes only a negligible role. Several studies have pointed out that out-of-pocket receipts are an inefficient and inequitable means of generating funds for health services. The peculiar health issues in Nigeria need a kind of health infrastructure to be attended to as a

public good; however, the private sector can contribute vital roles. Where necessary, the private and public sectors can collaborate to provide health services, and it is a welcome occurrence as it happens globally.

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Appendix

Appendix 1

OBS	RGDP	CHE	IOM	SES	GCF
1985	8.52	0.09659	0	29.33096	46.39088
1986	1.9	0.009658	0	27.22324	54.95059
1987	0.17	0.020711	0	27.20931	49.98771
1988	6.23	0.15952	0	25.73112	43.64422
1989	6.66	0.151729	0	24.25362	52.8869
1990	11.63	0.105787	0	24.72132	53.13669
1991	-0.55	0.113622	0	24.75121	48.40572
1992	2.19	0.017136	0	24.80231	43.77939
1993	1.57	0.35515	0	24.85123	44.48886
1994	0.26	0.149318	0	24.95122	42.08362
1995	1.87	0.114193	0	25.01221	37.23967
1996	4.05	0.078863	0	25.10299	36.62556
1997	2.89	0.092857	0	25.30213	38.47746
1998	2.5	0.118813	0	25.40232	40.61495
1999	0.52	0.355616	0	23.5518	38.34181
2000	5.52	3.197384	418.0386	24.60941	34.10954
2001	6.67	2.1874	407.7619	27.03358	30.92589
2002	14.6	2.4964	392.9392	29.61322	27.58251
2003	9.5	5.053609	391.6551	32.03311	29.3868
2004	10.44	4.633683	401.1537	34.99748	27.11797
2005	7.01	4.465919	407.7855	34.95775	26.18959

OBS	RGDP	CHE	IOM	SES	GCF
2006	6.73	4.25775	410.9614	34.45698	27.86599
2007	7.32	3.909973	412.435	31.8677	21.24461
2008	7.2	3.695816	413.0925	35.38618	19.897
2009	8.35	3.580197	400.1758	39.2328	22.04954
2010	9.54	3.296533	373.2587	44.21823	17.5621
2011	5.31	3.320779	350.5024	45.55653	16.36056
2012	4.21	3.359843	328.0538	47.18077	14.95883
2013	5.49	3.420693	308.1847	56.2054	14.90391
2014	6.22	3.48404	297.3433	45.62404	15.8027
2015	2.79	3.58195	292.5424	46.782	15.4901
2016	-1.58	3.647737	293.9236	42.00254	15.36674
2017	0.82	3.753365	297.4619	42.75682	15.47433
2018	1.91	3.090694	299.0206	43.51114	19.81377
2019	2.27	3.02666	300.4425	44.27758	25.41589
2020	-1.92	3.5	313.7581	45.05866	27.49712
2021	2.52	3.75	305.3795	45.85347	33.781

***Source**: Central Bank of Nigeria and World Bank Statistical Bulletin (2022)*

Appendix 2

VAR Lag Order Selection Criteria
Endogenous variables: RGDP
Exogenous variables: C CHE GCF SES IOM
Date: 01/09/23 Time: 07:58
Sample: 1985 2021
Included observations: 34

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-86.36645	NA	12.66406	5.374497	5.598962	5.451046
1	-82.39460	6.541877*	10.64978*	5.199682*	5.469040*	5.291541*
2	-81.75072	1.022635	10.89958	5.220630	5.534881	5.327799
3	-81.72653	0.036999	11.57837	5.278031	5.637175	5.400509

* indicates lag order selected by the criterion
LR: Sequential modified LR test statistic (each test at 5% level)
FPE: Final Prediction Error
AIC: Akaike Information Criterion
SC: Schwarz Information Criterion
HQ: Hannan-Quinn Information Criterion

Appendix 3: Bound Test

ARDL Bounds Test
Date: 01/09/23 Time: 08:03
Sample: 1988 2021
Included observations: 34
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	7.044093	4

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

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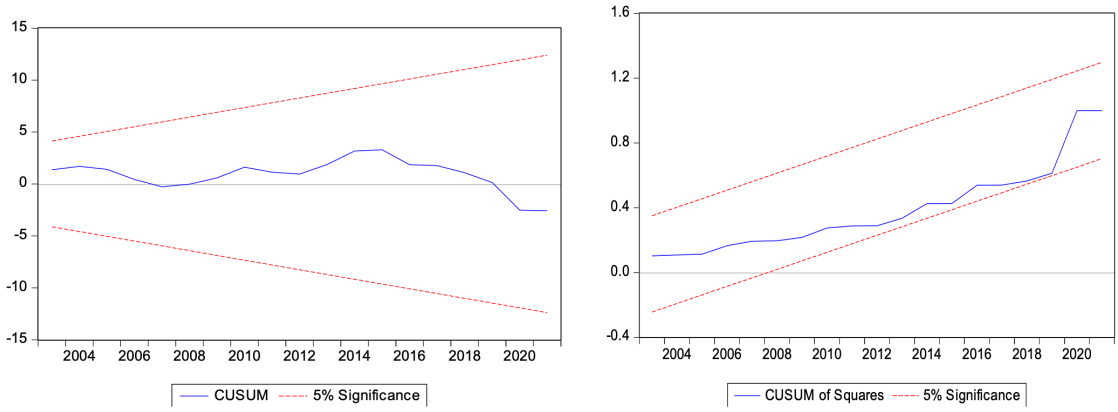

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