Effects of Environmental Quality and Health Care Development on Economic Growth Nigeria

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Abstract

This study examined the effect of environmental quality and health care development on economic growth in Nigeria. The annual time series data was collected from world development indicator and Central bank of Nigeria respectively, covering 39 years span from 1986 to 2024 were used. The expost factor research design was used for this work. The study employed the econometric estimation technique of Autoregressive Distribution Lag (ARDL) model was used for the analysis, adopting annual data method of analysis. Aside that, a lot of tests were conducted such as co-integration test, bound test, long- run and short- run test etc. This implies that a unit increase in current health expenditure (CHEXPTR), Immunization (IMZTN), labour force (LFCE), ratio of gross domestic product – labour force (GDPLFCE), Human immune virus (HIV) will lead to increase of about 0.005279, 0.000696, 0.019862, 0.032686 and 0.037736, CHEXPTR, IMZTN, LFCE, GDPLFCE and HIV were statistically significant at five percent level of significant. Increase Health Expenditure: Government and policymakers should prioritize higher budgetary allocation to healthcare, ensuring resources are efficiently directed towards preventive and curative services. Strengthen Immunization Programs: Expanding immunization coverage can significantly improve public health outcomes, thereby enhancing labor productivity and economic growth.

Introduction

Economic growth depends critically on the health and productivity of a country's people. In Nigeria, persistently poor environmental quality and under-resourced health systems impose large, measurable drag on growth by reducing life expectancy and labour productivity, increasing healthcare and social-protection costs, and altering demographic dynamics such as fertility and mortality. For example, Nigeria's total fertility rate remains high at roughly 4.6 births per woman (2022), a demographic pattern that interacts with child health, female labour force participation and long-term human-capital accumulation. High child and neonatal mortality weaken human-capital formation and raise household and public spending on child survival. Nigeria's under-five mortality rate is extremely high (UN estimates put it at around 107 deaths per 1,000 live births in 2021, with wide sub national variation), which reflects gaps in primary health, nutrition, water and sanitation and undermines future productivity.

Infectious diseases such as HIV continue to shape the labour market and fiscal outlook. Official sources and recent epidemiological analyses report adult HIV prevalence in the order of ~1.4 percent (programmatic/UNAIDS figures), while some recent survey-based estimates and modeling place prevalence higher (population estimates in some studies have been reported around ~2.0–2.1 percent), either way, HIV imposes direct morbidity and mortality costs, increases absenteeism and treatment costs, and can depress household income and savings. Public and private health spending in Nigeria remains low relative to the scale of needs: current health expenditure is a small share of GDP (World Bank series shows health spending around the mid-single digits percent of GDP, historically around 3–4 percent in recent years), leaving major gaps in service coverage and financial protection that force households into out-of-pocket spending, reduce consumption, and blunt the income-boosting effects of better health.

Environmental quality, especially air pollution, unsafe water, poor sanitation and reliance on solid fuels, is a major upstream driver of ill-health. Studies and country profiles estimate that air pollution and household air pollution together account for many tens of thousands of premature deaths annually in Nigeria (State of Global Air and country analyses report figures in the tens to low hundreds of thousands for pollution-related deaths in recent years), while access to safely managed water, sanitation and hygiene services remains much below universal targets (large fractions of the population lack safely managed water and sanitation). The combined effect is higher respiratory and diarrhoeal disease, reduced school attendance, and lost worker productivity, all of which translate into lower GDP per capita than would otherwise be possible.

Mechanisms linking these facts to growth are multiple and reinforcing: (1) reduced labour supply and productivity from premature death and chronic illness; (2) lower human-capital investment when families respond to high child mortality by having more births or reducing investment per child; (3) fiscal crowding as governments and donors divert resources to treat preventable illnesses instead of investing in infrastructure and productive public goods; and (4) private income shocks from out-of-pocket health spending that depress consumption and small-business investment. In Nigeria's context, large population, regional inequality in service coverage, and dependence on labour-intensive sectors, these channels imply that better environmental management and stronger health systems are not just welfare policies but essential growth strategies.

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Statement of the Problem

Nigeria's pursuit of sustainable economic growth has been persistently undermined by poor environmental quality and an underdeveloped healthcare system that together contribute to low life expectancy, high disease burden, and reduced productivity of the labour force. Despite being Africa's largest economy by GDP, Nigeria continues to rank among the countries with the worst health and environmental indicators globally. These adverse conditions translate into significant economic losses through diminished labour output, increased public expenditure on curative rather than preventive care, and reduced human capital formation. Environmental degradation in Nigeria has reached critical levels. According to the World Bank (2023), over 70 percent of Nigeria's population is exposed to air pollution levels that exceed World Health Organization (WHO) safety limits, mainly due to industrial emissions, open waste burning, and household use of biomass fuels. The State of Global Air (2022) estimated that air pollution (ambient and household combined) caused over 114,000 premature deaths in Nigeria annually, making it one of the top environmental causes of mortality in Sub-Saharan Africa. Water pollution and poor sanitation further exacerbate the problem, about 33 percent of Nigerians lack access to safely managed drinking water, and 44 percent do not have access to basic sanitation facilities (UNICEF, 2023). These environmental challenges lead to a high incidence of respiratory infections, diarrhoeal diseases, and other environment-related illnesses that reduce the country's productive workforce.

Nigeria's health-care system, though improving, remains grossly inadequate. Health expenditure as a share of GDP stood at approximately 3.2 percent in 2022 (World Bank, 2024), well below the 15 percent Abuja Declaration target committed by African Union countries. Public health infrastructure is unevenly distributed, with rural areas suffering from limited access to hospitals, skilled medical personnel, and essential drugs. This underfunding has contributed to persistently high mortality rates and a heavy reliance on out-of-pocket payments, which account for more than 70 percent of total health spending (WHO, 2023). Such high private expenditure limits household consumption, savings, and investment, thereby constraining aggregate demand and slowing GDP growth. Mortality and fertility indicators reflect the severe impact of poor health services and environmental degradation. The under-five mortality rate in Nigeria remains one of the highest in the world at 109 deaths per 1,000 live births (UNICEF, 2023), while the maternal mortality ratio stands at 512 per 100,000 live births (World Bank, 2023), both of which are far above global averages. These high mortality rates weaken human capital accumulation by reducing the future workforce and discouraging long-term investment in education and skills.

Furthermore, the total fertility rate of 4.6 births per woman (UNDP, 2023) indicates a rapidly growing population that continues to outpace improvements in health care, infrastructure, and employment opportunities, resulting in greater pressure on limited resources and reduced per capita income. HIV/AIDS remains a major health and economic concern. According to UNAIDS (2023), Nigeria has approximately 1.9 million people living with HIV, with a national prevalence rate of about 1.3 percent among adults aged 15–49. Although prevalence has declined compared to previous decades, the epidemic continues to erode productivity, especially among the working-age population. The economic cost of HIV includes reduced labour supply, increased absenteeism, and higher healthcare costs, all of which dampen economic growth prospects. Overall, the combined effects of poor environmental quality, weak health-care systems, high mortality and fertility rates, and the persistent burden of communicable diseases such as HIV represent major structural impediments to Nigeria's economic growth. As the nation's economy increasingly depends on a healthy and skilled population to drive industrialization, innovation, and productivity, continued neglect of these critical sectors poses a severe threat to achieving the Sustainable Development Goals (SDGs), especially Goals 3 (Good Health and Well-Being), 6 (Clean Water and Sanitation), and 8

(Decent Work and Economic Growth). Without substantial improvement in environmental management and healthcare investment, Nigeria risks a vicious cycle where ill health and poor environment reduce productivity, which in turn limits economic growth and the resources available to improve public health and environmental sustainability.

Theoretical Studies

Endogenous Growth Model

According to Romer (1990), technological progress increases the growth of capital stock. This increases the level of output, which raises the proportion of output allocated to saving and investment, accelerating economic growth even further. Technological progress is the result of economic agents' investments. The output generated per hour worked rises as capital accumulation and technological change combine. People intentionally respond to market incentives to bring about technological change, so it is assumed that technological change is endogenous. Technology is also assumed to have a fixed cost because it may be used repeatedly without incurring additional costs after the initial development cost is incurred. Human capital, according Romer (1990), is a major determinant of economic progress. Since technological change exists independently of the individual, human capital is assumed to be separate from the technological component. Individuals with higher of education are more productive and have more skills. As a result of differences in human capital formation can be utilized to explain differences in labor productivity and per capita income.

The endogenous growth model assumes a constant tax rate and a constant debt-to-GDP ratio for the government. It claims that raising the public debt slows the economy's growth rate, placing future generations at a disadvantage as a result. When the public debt is reduced, the opposite is true. It boosts the economy's growth rate but harms the current generation. As a result, regardless of whether debt is increased or decreased, at least one generation will be affected. Because the model assumes that the interest rate remains intact, this is the case. To have a positive impact on debt reduction, the state has to provide an investment subsidy. People will save more, consume less, and grow more now that the private return on capital is higher (Saint-Paul, 1992). The above theory has captured the variables such as: economic growth, technology, human capital development, and interest rate.

Environmental Kuznets Theory

The Environmental Kuznets Curve (EKC) theory provides an analytical framework that explains the dynamic relationship between economic growth and environmental degradation. It is an environmental extension of the original Kuznets hypothesis proposed by Simon Kuznets (1955), which described an inverted-U-shaped relationship between income inequality and economic development. The environmental version of this hypothesis was later advanced by Grossman and Krueger (1991, 1995) in their studies on trade and the environment under the North American Free Trade Agreement (NAFTA). They observed that environmental degradation tends to increase in the early stages of economic growth, reach a turning point, and then begin to decline as income rises and societies become wealthier and more conscious of environmental sustainability.

The theory posits that at the initial stages of economic development, countries typically prioritize industrial expansion, urbanization, and resource extraction to accelerate income growth and employment creation. During this phase, environmental degradation tends to rise because of increased pollution, deforestation, fossil-fuel combustion, and waste generation. Governments and firms in developing economies usually give little attention to environmental protection due to weak institutions, limited technology, and a greater emphasis on poverty reduction and industrial output. As a result, economic growth during the early development phase comes at the cost of deteriorating air and water quality, loss of biodiversity, and heightened health risks among the population. However, as income per capita continues to increase, the economy begins to transition toward a more service-oriented and technology-driven structure. The growing middle class becomes more environmentally aware, demanding cleaner air, safer water, and stricter environmental policies. At this stage, often referred to as the turning point, the relationship between economic growth and environmental degradation begins to reverse. Governments, responding to public demand and better fiscal capacity, invest more in environmental regulation, renewable energy, waste management, and pollution-control technologies. Consequently, pollution levels begin to decline even as the economy continues to expand. This shift creates the inverted-U shape that characterizes the Environmental Kuznets Curve.

Mathematically, the relationship is expressed as:

E=α+β1Y+β2Y2+εE = \alpha + \beta_1Y + \beta_2Y^2 + \varepsilonE=α+β1Y+β2Y2+ε

Where:

EEE represents environmental degradation (e.g., CO_2 emissions, deforestation rate, or air pollution level),

YYY is income per capita or GDP per capita,

β1>0\beta_1 > 0β1>0 and β2<0\beta_2 < 0β2<0 imply the inverted-U relationship, and

ε\varepsilonε is the error term.

At low income levels, β1Y\beta_1Yβ1Y dominates, implying a positive relationship between income and degradation, while at high income levels, β2Y2\beta_2Y^2β2Y2 dominates, indicating improvement in environmental quality.

The EKC theory suggests that economic growth can ultimately be compatible with environmental improvement if societies reach and surpass the turning point. However, the income level at which this turning point occurs differs across countries, depending on factors such as institutional quality, environmental regulation, technology adoption, and social awareness. Developed economies, having already passed this threshold, often enjoy both high income and improved environmental conditions, while developing nations like Nigeria remain on the upward, environmentally damaging side of the curve. In the context of Nigeria, the EKC framework is particularly relevant because of the country's rapid industrialization, urban expansion, and dependence on natural resources. The Nigerian economy relies heavily on crude oil extraction, gas flaring, and manufacturing, all of which contribute significantly to environmental degradation. According to the World Bank (2023) and the State of Global Air (2022), Nigeria records over 114,000 annual deaths related to air pollution, while gas flaring contributes to greenhouse gas emissions that exacerbate climate change. Moreover, poor waste management, deforestation, and water contamination continue to harm public health and productivity. These environmental challenges directly affect labour productivity, health outcomes, and economic sustainability, linking the EKC concept to broader issues of health care and human capital development.

As Nigeria's income level gradually rises, the EKC theory implies that the nation could eventually achieve a transition point where economic expansion no longer results in worsening environmental conditions. This would, however, require effective governance, strong environmental institutions, and significant investment in green technology. Empirical studies (e.g., Adedayo, Ibrahim, & Yusuf, 2022; Nwosu & Ogbuabor, 2021) support the existence of an EKC-type relationship in Nigeria, showing that economic growth initially leads to higher CO_2 emissions and deforestation but later contributes to environmental improvement as the government enforces stricter environmental standards and citizens become more aware of sustainability issues. Despite its influence, the EKC theory has faced considerable criticism. Critics argue that the pattern is not universal and that some forms of environmental degradation such as biodiversity loss and groundwater depletion — may not follow an inverted-U pattern. Others note that high-income countries may simply export pollution by relocating dirty industries to developing countries, thereby creating an illusion of environmental improvement domestically. Moreover, the theory assumes that technological progress and policy reforms automatically accompany income growth, which may not be true in countries with weak governance or corruption. In many African economies, including Nigeria, the absence of strict environmental laws and enforcement capacity means that income growth continues to coincide with environmental damage, rather than reversing it.

Nevertheless, the Environmental Kuznets Curve remains a vital theoretical tool for understanding the complex interplay between economic growth, environmental quality, and public health. It provides a useful framework for policy design by highlighting the need for sustainable growth strategies that integrate economic expansion with environmental management. For Nigeria, the EKC theory underscores the importance of investing in clean energy technologies, enforcing pollution controls, promoting afforestation, and expanding access to healthcare services that mitigate the health effects of pollution. By moving toward the downward slope of the Kuznets curve, Nigeria can achieve not only sustained economic growth but also improved environmental quality and better health outcomes, essential conditions for long-term human and economic development.

Empirical Studies

Emife, Nwani, Kelani, Ozegbe and Oluleye, (2018) investigated the public health expenditures, environmental pollution and health outcomes: Evidence from Nigeria. This study used annual time-series data for Nigeria (1981-2017) and applied the ARDL technique to estimate how public health expenditure and environmental pollution (proxied by CO_2 emissions) affect health outcomes (life expectancy) in Nigeria. Key findings: higher public health expenditure has a positive and significant effect on health outcomes; increased CO_2 emissions (i.e., more pollution) have a negative and significant effect on health outcomes. This directly links an environmental quality indicator (pollution) to health outcomes in Nigeria, and also connects health-care development (via expenditure) to health. It supports your argument about how poor environmental quality undermines health care / health status, which then influences productivity and growth.

Okogor (2023) examined effects of Environmental Quality on Human Health Status in Nigeria This study examined the effect of environmental quality (including CO_2 emissions and access to improved water sources) on health status (proxied by life expectancy) in Nigeria using OLS estimation. The results showed a long-run relationship between environmental quality and health status. The suggestion revealed that the links environmental quality to health (broadly defined) in the Nigerian context. It helps substantiate the channel by which environmental degradation translates into poorer health outcomes — an important part of your problem statement and theoretical framework.

Croitoru (2020) determined *the* Cost of Air Pollution in Lagos. A World Bank city-level

economic assessment that quantifies the health and economic costs of air pollution in Lagos using concentration-response functions, population exposure, and valuation of mortality and morbidity.
the results indicated that the report estimates the health cost of air pollution in Lagos at roughly US$2.1 billion annually**,** equivalent to about 2.1% of Lagos State's GDP (estimate based on year of study). The analysis shows large productivity and welfare losses driven primarily by premature mortality and morbidity from PM2.5 exposure. This study directly translates pollution exposure into GDP-scale losses, providing a concrete channel (mortality, illness → lost labour output & welfare) that links environmental quality to economic performance. Use it to justify why improving air quality is an economic as well as a health priority.

Alege (2013) looked at environmental Quality and Economic Growth in Nigeria. Time-series econometric analysis (various cointegration/fractional cointegration approaches are used in successive versions) examining the relationship between CO_2 emissions (and other pollutants) and GDP growth for Nigeria over multi-decadal periods. The outcomes revealed that the study finds no classical EKC (inverted-U) for Nigeria; instead, the evidence points to either a U-shape or an absence of a turning point within the sample period — meaning as GDP increases, carbon emissions do not reliably decrease afterward. The author concludes that economic growth in Nigeria has not produced the environmental improvements seen in some high-income countries, reflecting weak institutions and policy. Why it's useful: Alege's work is Nigeria-specific and shows that growth so far has not delivered environmental gains; this supports policy arguments that pro-growth alone won't reduce pollution and that explicit environmental and technological policy is needed.

Falade (2023) investigated a Verification of the Environmental Kuznets Curve Hypothesis / Sectoral contributions and EKC in Nigeria Time-series analysis using ARDL bounds testing to examine the EKC hypothesis for Nigeria (including sectoral controls like manufacturing share, energy consumption, FDI). Different model specifications test whether GDP per capita has an inverted-U relation with CO_2 or other pollution measures. The paper finds mixed evidence — some specifications show EKC-like behaviour after controlling for sector composition and energy use, while others show that growth is associated with rising emissions. Overall, results suggest sectoral structure and energy intensity are crucial: if manufacturing and fossil-fuel intensive activities dominate, emissions rise with growth; if the economy shifts to services and cleaner tech, pollution can falI.Why it's useful**:** This study links environmental outcomes to GDP while highlighting policy**-**relevant mediators (sector composition, energy use). Use it to argue that Nigeria's path (and policy choices) determines whether growth will worsen or improve environmental quality and hence GDP net-effects.

Adeleye and Eboagu (2020) investigated the **e**nergy consumption, environmental degradation, and economic growth in sub-Saharan Africa: The role of institutional quality Panel data for 33 Sub-Saharan African countries (1995–2017) analyzed using Dynamic System-GMM estimation. Environmental degradation was proxied by CO_2 emissions, while GDP growth was the dependent variable. The Findings indicated that Economic growth and energy consumption significantly increase environmental degradation. Strong institutional quality reduces the negative effect of growth on the environment. For Nigeria and peers, improving governance and environmental regulation can yield sustainable growth without high emissions. This study provides cross-country African evidence, showing that Nigeria's experience aligns with the regional trend of growth–pollution conflict moderated by governance.

Research designed

This study adopts ex-post facto research (after the fact) design. This is because the events had already taken place before the investigation was carried. The choice of this method is made because the researcher has no direct control of the independent variables, and inference about the link or relationship between domestic debt and investment on economic growth in Nigeria are made without the current interaction between the dependent and independent variables (Ndiyo, 2005). The study uses the framework of Ordinary Least Square which involves testing of unit root using techniques like ADF and Philip Perron to test for the unit root and ARDL for estimation.

Model Specification

This study is based on the use of an equation with the growth rate and investment as a dependent variable and, domestic debt and investment as independent variables. The equation is anchored on an eclectic theoretical anchor because a single theory cannot the serve relationship between environmental Quality, Healthcare Development and its effect on economic growth in Nigeria. The theories adopted comprise the endogeneounes growth theory and Simon Kuznets Theory. The endogenous growth model posits that the main driver of economic growth is investment by firms in research and development and the resultant diffusion of the knowledge created from such efforts throughout the economy. The theory also identifies the quantity of capital, and by implication capital accumulation and therefore investment, as one of the determinants of economic growth in the long run.

The model of this study is stated thus:

*log*GDP = f (CHEXPTR, IMZTN, CO2, LFCE, GDPLFCE, HIV. MTR) …………………………… (1) The function representation.

*log*GDP = β0 + β1CHEXPTR + β2IMZTN + β3CO2+ β4LFCE+ β5GDPLFCE + β6HIV + β6MTR …………….. (2) The mathematical representation

*log*GDP = β0 + β1CHEXPTR+ β2IMZTN + β3CO2 + β4LFCE+ β5GDPLFCE + β6HIV + β6MTR + Ui-------- (3)

Where: GDP = Gross Domestic Product. CHEXPTR = Current Health Expenditure, IMTZN = Immunization, CO2 = Carbon Emission, LFCE = Labour force, GDPLFCE = Ratio of Gross Domestic Product – labour Force, HIV = Human immune Virus, MTR = Motality rate.

β0 = Intercept or autonomous constant. β1 = Coefficient or parameter estimate of the exchange rate β2 = Coefficient or parameter estimate of the inflation rate β3 = Coefficient or parameter estimate of the interest rate β4= Investment.

Ut = Stochastic or Error term. A-priori Expectations

Sources of data

Secondary sources of data were used as the main source of data collection for this study. The relevant data for this study were been derived from the Central Bank of Nigeria Statistical Bulletin and the Central Bank of Nigeria Annual Report and Statements of Accounts, World Development Indicator and publication of the National Bureau of Statistics. Data will be collected on annual basis from 1986 to 2o22.

3.4 Estimation Procedure

The model estimation procedure includes; descriptive statistic, unit root test, causality test technique, co-integration test, Autoregressive Distribution lag model, Error correction model and stability test.

3.4.1 Unit Root Test

Before model estimation is carried out, the unit root test is used to ascertain the stationarity property of the time series variables in the specified models. The importance of unit root test is that it enables us to avoid the problem of spurious regression output, and to know the order of integration of the time series variables in order to know the appropriate co-integration test method to employ (Gujarati & Porter, 2009). In this study, the Augmented Dickey-Fuller (1981) and Phillip Perron unit root test was utilized in determining the order of integration. The Augmented Dickey-Fuller (ADF) unit root test equation is specified as follows:

$$\Delta y_t = \omega + \delta y_{t-1} + \sum_{i=1}^{m} \theta_i \Delta y_{t-i} + \mu_t \qquad (3.8)$$

Where Δ is the first difference operator;y_t is a time series variable at current time (t); ω is the drift term; y_{t-1} is the one period lagged value of y_t; $\delta$is the coefficient of y_{t-1}; $\Delta y_{t-i}$is the lag valued of the first difference of y_t; m is the maximum lag length; δ_i is the coefficients of Δy_{t-i}; and μ_t is the white noise error term. The null hypothesis is such that the time series contains a unit root which implies that δ=0. The null hypothesis is rejected if δ is negative and statistically significant. The ADF unit root test is based on t-statistic test.

Hypothesis for unit root test:

$H_0: \delta = 0$ (Variable has unit root i.e.; time series is non-stationary)

$H_1: \delta < 0$ (Variable does not have unit root i.e.; time series is stationary)

Decision Rule:

(i) If t^*> ADF critical value in absolute terms, reject the null hypothesis

(i) If t^*< ADF critical value in absolute terms, do not reject the null hypothesis.

Note: t^* is the calculated value of the ADF unit root test value.

Similarly, using the Phillips-Perron (1988) test, the following equation is also specified as;

$$y_t = \alpha y_{t-1} + \varepsilon_t \qquad 3.9$$

Where:

y_t is the parameter to be estimated; and ε_t is the random error term.

The null hypothesis using PP test requires that if $\phi = 1$, then the series is non-stationary or has a unit root but if $\phi < 1$, then the series is stationary.

Co-integration Test

Co-integration test is used to confirm whether time series variables are individually non-stationary or linearly combined to give a long-run equilibrium relationship. In other words, a co-integration test is conducted to ascertain if time series variable under consideration are co-integrated i.e., if they have a long-run equilibrium relationship (Gujarati & Porter, 2009). If the order of integration of the time series variables are of order one (i.e., I(1)), then Johansen co-integration test is suitable; but if the order of integration is a mixture of order zero and one (i.e., I(0) and I(1)), ARDL-bounds co-integration test procedure is used. This study used ARDL tests for co-integration in the determination of the existence of any long run relationship amongst the variables.

Presentation and analysis of econometric results

The results of the unit root tests conducted using the ADF unit root method are shown that the out of the eight variables used in the study, three of them being CO2, HIV, MTR, and were stationary at level. This means that these variables have no unit root at their nominal level. The rest of the variables, that is, GDP, GDPLFCE, IMZTN, LFCE, CHEXPTR, RDDGDP, were stationary after first difference; this means these variables have unit root at their nominal levels and they require differencing for them to be stationary. The conclusion of the panel unit root test result shows mixed stationarity of the variables.

Bound test for investment equation

The result of bound test presented, indicates that, there exist a no long run relationship amongst the variables. This is because the F-statistics estimate 3.644276 of is greater than the upper bound estimate of 3.83 and the lower bound estimate of 2.69 at five percent level of significance.

Test Statistic	Value	k
F-statistic	3.644276	7

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.38	3.45
5%	2.69	3.83
2.5%	2.98	4.16
1%	3.31	4.63

Source: Author's computation, 2025

Long run result for gross domestic product (GDP) equation

From the result estimated, all the explanatory variables were consistent with a priori expectation. This implies that a unit increase in current health expenditure (CHEXPTR), Immunization (IMZTN), labour force (LFCE), ratio of gross domestic product – labour force (GDPLFCE), Human immune virus (HIV) will lead to increase of about 0.005279, 0.000696, 0.019862, 0.032686 and 0.037736, CHEXPTR, IMZTN, LFCE, GDPLFCE and HIV were statistically significant at five percent level of significant. Also, a unit increase of Carbon Emission (CO2), and mortality rate (MTR) will lead to diminish of about 0.083642 and 0.000238, were statistically insignificant at five percent level of significant.

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CHEXPTR	0.005279	0.002124	2.485675	0.0197
IMZTN	0.000696	0.000205	3.394426	0.0022
CO2	-0.083642	0.049274	-1.697504	0.1015
LFCE	0.019862	0.000750	26.489633	0.0000

GDPLFCE	0.032686	0.001019	32.070874	0.0000
HIV	0.037736	0.016702	2.259433	0.0325
MTR	-0.000238	0.000589	-0.404577	0.6891
C	5.309904	0.117395	45.231064	0.0000
@TREND	-0.003645	0.001402	-2.599815	0.0152

Short-run ARDL result for gross domestic product (GDP) equation.

The parsimonious error correction result of the investment equation based on the autoregressive distributed lag (ARDL) approach is presented, the result of the short-run dynamics showed that the error correction variable is fractional, has the expected negative coefficient and statistically significant in line with theoretical expectation as its P-value is 0.00136 its coefficient of-0.003649 indicates that about 36 percent of the systemic disequilibrium in investment variable was corrected each year. This represents a fast speed of adjustment from short run disequilibrium to long long-run equilibrium. The adjusted R-square (R^2) of 0.60 shows that about 60 percent of the variation in the dependent variable is explained by the independent variables. This indicates that the model has moderate explanatory power. The Durban-Watson value of 2.3 may be judged to mean that there is no problem serial correlation in the model.

Evaluation of the short-run coefficients shows that current health expenditure (CHEXPTR) has a positive relationship with gross domestic product. With a coefficient of 0.005, this is consistent with theoretical expectation, showing that a one percent increase in current health expenditure will lead to a rise in gross domestic product by 0.005 *ceteris paribus.* The variable is statistically significant as its probability value of 0.02 is less than 0.05 level of significance.

Immunazation (IMZTN), has a positive relationship with gross domestic product. With a coefficient of 0.000220, this is consistent with theoretical expectation, showing that a one percent increase in an immunization will lead to a rise in gross domestic product by 0.000220, ceteris paribus. The variable is statistically insignificant as its probability value of 0.3 is greater than 0.05 level of significance.

Carbon Emission (CO2), has a negative relationship with gross domestic product. With a coefficient 0.083 this is consistent with theoretical expectation, showing that a one percent increase in a carbon emission led to decrease in a gross domestic product by 0.083, all things being equal. The variable is statistically insignificant as its probability value of 0.1 is greater than 0.05 level of significance.

Labour force (LFCE), has a positive relationship with gross domestic product. With a coefficient of 0.019883 this is consistent with theoretical expectation, showing that a one percent increase in a labour force (LFCE), will lead to increase in a gross domestic product by 0.019, ceteris paribus. The variable is statistically significant as its probability value of 0.0 is less than 0.05 level of significance.

Ratio of gross domestic product to labour force (GDPLFCE), has a positive relationship with gross domestic product. With a coefficient of 0.0327, this is consistent with the a priori expectation, showing that a one percent increase in ratio of gross domestic product – labour force will lead to increase in a gross domestic product by 0.032, all things bing equal. The variable is statistically significant as its probability value of 0.03 is less than 0.05 level of significance.

Human Immune Virus (HIV), has a positive relationship with gross domestic product. With coefficient of 0.0377 this is consistent with the a priori expectation, showing that a one percent increase human immune virus will lead increase in gross domestic product by 0.0377, all things being equal. The variable is statistically significant as its probability value of 0.03 is less than 0.05 level of significance.

Mortality rate (MTR), has a negative relationship with gross domestic product. With coefficient of 0.01006 this is consistent with the a priori expectation, showing that a one percent increase of mortality rate will lead to decrease of gross domestic product in Nigeria, vice versa. The variable is statistically significant as its probability value of 0.000 is less than 0.05 level of significance.

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CHEXPTR)	0.005284	0.002185	2.418338	0.0229
D(IMZTN)	0.000220	0.000219	1.007392	0.3230
D(CO2)	-0.083730	0.050258	-1.665994	0.1077
D(LFCE)	0.019883	0.001137	17.492711	0.0000
D(GDPLFCE)	0.032720	0.001623	20.156504	0.0000
D(HIV)	0.037776	0.017347	2.177618	0.0387
D(MTR)	-0.010066	0.001624	-6.198880	0.0000
D(@TREND())	-0.003649	0.001378	-2.647947	0.0136
CointEq(-1)	-1.001050	0.047826	-20.931112	0.0000

R-squared	0.607008	Mean dependent var	0.015510
Adjusted R-squared	0.440742	S.D. dependent var	0.034437
S.E. of regression	0.025754	Akaike info criterion	-4.228399
Sum squared resid	0.017244	Schwarz criterion	-3.711266
Log likelihood	92.33958	Hannan-Quinn criter.	-4.044407
F-statistic	3.650825	Durbin-Watson stat	2.377582
Prob(F-statistic)	0.003224		

Conclusion

The results of this study reveal that health expenditure, immunization, labor force participation, the ratio of GDP to labor force, and HIV prevalence have a positive and statistically significant effect on the dependent variable, indicating that improvements in these factors are associated with better health outcomes or economic performance. In contrast, carbon emissions and mortality rate were found to negatively affect the outcome, although their effects were statistically insignificant at the 5% level.

This suggests that while environmental degradation and mortality have a negative association, the immediate influence of health and labor-related interventions is more pronounced and measurable. Overall, the findings underscore the critical role of public health investment, immunization coverage, labor force development, and effective management of HIV in promoting societal well-being and sustainable growth.

Recommendations

Based on the study findings, the following recommendations are proposed:

1. **Increase Health Expenditure**: Government and policymakers should prioritize higher budgetary allocation to healthcare, ensuring resources are efficiently directed towards preventive and curative services.
2. **Strengthen Immunization Programs**: Expanding immunization coverage can significantly improve public health outcomes, thereby enhancing labor productivity and economic growth.
3. **Enhance Labor Force Participation**: Policies that support job creation, skill development, and labor productivity should be promoted to maximize the positive impact of the labor force on growth and health outcomes.
4. **Manage HIV Effectively**: Intensifying HIV awareness, prevention, and treatment programs is crucial to mitigate its negative health and economic implications.
5. **Address Environmental Concerns**: Although carbon emissions were not statistically significant in this study, reducing environmental pollution remains critical for long-term health and sustainability. Strategies should focus on cleaner technologies and sustainable industrial practices

Policy Statement

In light of the findings, it is recommended that the government adopt a holistic policy framework that integrates health, labor, and environmental considerations. Specifically, policies should:

1. Prioritize increased and efficient health sector funding.
2. Expand national immunization campaigns and disease prevention programs.
3. Foster labor force development through skill acquisition, employment generation, and workplace health programs.
4. Implement national strategies for HIV prevention and treatment.
5. Promote environmental sustainability by reducing carbon emissions and supporting green technologies.

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