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EFFECTIVENESS OF PUBLIC HEALTH SPENDING ON ECONOMIC GROWTH IN NIGERIA: IMPLICATIONS FOR HUMAN RESOURCE MANAGEMENT

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Abstract

The study investigated the effectiveness of public health expenditure on Nigeria's economic growth from 2000 to 2023 using ordinary least square method and Johansen cointegration test with the moderating role of institutional quality and governance quality. The model incorporated key indicators namely government domestic health expenditure, control of corruption, education expenditure, inflation, political stability, personal remittances and the rule of law to examine both the long-run and the magnitude of public health spending's effect on gross domestic product. The findings reveal a positive and statistically significant relationship between public health expenditure and economic growth. Again, government quality captured through control of corruption significantly strengthens the effectiveness of health spending in promoting economic growth while education expenditures and personal remittances show positive but insignificant effects, inflation and political stability exhibit mixed results. The Johansen co-integration test affirms the existence of a long-run equilibrium relationship among the variables. The Granger causality however indicates no short-run causal relationship between public health expenditure and GDP suggesting that the economic benefits of health investment materialize gradually overtime. Overall, the study underscores the importance of sustained health sector investment and strong institutional frameworks as key drivers of economic performance in Nigeria. It recommends increased public health funding, strengthened governance, improved health infrastructure and enhanced incentives for health professionals to maximize the development impact of public health spending in Nigeria.

BACKGROUND TO THE STUDY

Human capital, particularly health, is a critical driver of productivity, technological advancement, and economic growth. Recognizing this, the Nigerian government has implemented several health policies and programs such as the Primary Health Care (PHC) system, the National Health Insurance Scheme (NHIS), and the National Strategic Health Development Plan (NSHDP) aimed at improving access, quality, and equity in

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healthcare delivery. Over the years, public health expenditure in Nigeria has increased significantly, reflecting the government's commitment to strengthening the health sector.

Despite these efforts, Nigeria continues to experience poor health outcomes, including low life expectancy and high infant and maternal mortality rates, compared to other African countries negating human resource development. This suggests that increased health spending has not translated into meaningful improvements in healthcare delivery or population health. At the same time, the Nigerian economy faces challenges such as low productivity, weak human capital development, and slow economic growth.

This disconnect between rising public health expenditure and poor health and economic outcomes raises concerns about **the** efficiency and effectiveness of government spending in the health sector. It highlights the need for rigorous empirical investigation to understand whether public health spending contributes significantly to economic growth in Nigeria, and to identify issues such as resource misallocation, poor governance, and weak implementation that may hinder its impact.

REVIEW OF RELATED LITERATURE

Health as human capital affects growth directly through its effect on labor productivity and economic burden of illness. The indirect effect of health on economic growth can be represented in a two-period utility maximization problem. While the direct effect enters the production function as a labour augmenting factor. Ogundipe and Lawal (2018) utilized cointegration techniques to show that health sector funding has a long-term positive impact on GDP. Despite their robust long-run analysis, the study does not examine the efficiency of spending or how institutional quality may mediate the health-growth relationship. Ahamed (2021) conducted a panel regression across developing countries and concluded that health investment boosts economic growth. While this cross-country evidence is valuable, it does not account for Nigeria-specific challenges such as budget execution inefficiencies or regional disparities in health access.

Ramadan and Abed (1991) tested the health expenditure led growth hypothesis, through investigating the casual relationship between health expenditure and economic growth in Egypt for the period 1980 – 2010. Using vector error correction mechanism (VECM) the study revealed a unidirectional causality running from economic growth to health expenditure in the short-run and from health expenditure to economic growth in the long run. Musa, and Ismail (2023) investigate the impact of government expenditure on Nigeria's economic growth rate from 1970 to 2020 is analyzed. OLS was used to estimate the connection between the variables over the long run. The findings show a positive link between the log Gross Domestic Products (LGDP's) log and its initial lag, which is statistically significant. The result reveals a positive association between the (LGDP) and the log of recurrent government expenditure (RGE), as well as between the (LGDP) and the log of the first leg of recurrent government expenditure (RGE). A positive link exists between the (LGDP) and the log of capital government expenditure (CGE), but a negative relationship exists between the (LGDP) and the log of the first (CGE). The link between

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the (LGDP) and the domestic debt of the federal government (LFGDD) is inverse, while the relationship between the logs of the first lag of the domestic debt of the federal government (LFGDD) is positive. The R2 determination coefficient is 0.698968. The outcome demonstrates that explanatory factors account for 70% of the variation in the (LGDP). The model is acceptable since the F-statistic 3595.905 with a probability of 0.000000 is significant at 1%. The long-term trend of the explanatory variables, which has increased since the year 1985, is linked to GDP. The outcome presented above also depicts the predicted short-run relationship. Therefore, it is recommended that government expenditure be examined and bolstered to have a positive impact on Nigeria's growth rates.

Yahaya (2024) investigates the nexus between economic growth, health, and education expenditure in Nigeria, using time series data for the period of 28 years (1990-2018). The study adopts the use of the Philips-Peron test for unit root, the ARDL bound test procedure to co-integration, and the OLS method to estimate the relationship between the parameters used in the study. The findings revealed that all variables are stationary at first difference I(1), the result of the ARDL Bound test indicates that a long-run relationship exists between economic growth, health, and education expenditure, and both education and health expenditures are good determinants of growth as revealed by the regression result. The study concludes that recurrent expenditures on health and education are required for economic growth and development, which thus affects the standard of living and life expectancy which goes a long way in contributing to aggregate output. Therefore, the study calls for the urgent need for policymakers to ensure budgetary allocations on education and health are given preeminence. The results from the work conform to the a-prior expectation and also the methodology used for analysis is not suitable for the work.

Olayiwola, Bakare-Aremu, and Abiodun (2021) investigate the impact of public health expenditure on economic growth in Nigeria. OLS methodology was employed to analyze the time series data sourced from the CBN statistical bulletin in the course of the study ranging from 1995-2015. The regression analysis result establishes that there is bidirectional causality between government expenditure on health and economic growth in Nigeria. Health expenditure has a positive and significant effect on economic growth in Nigeria with a coefficient of determination of 98%. Recommendation was made that recognition of the fact that an increase in government expenditure enhances the growth of the economy. This necessitates that there should be an increase in funding for the health sectors; more so concerted efforts should still be committed to funding crucial projects that will culminate to evident outcomes in the health sectors. Also, the government would need to establish new partnerships with the stakeholders in private businesses in the sector where its relevance is gradually declining) to mobilize the necessary resources to stimulate efficiency. International organizations should also be contacted for development assistance in conformity with their commitment to African countries. The methodology is too simplistic for the study and the results conform to a prior expectation. Sinha, and Mbulawa (2023) examine the relationship between

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government expenditure on health and economic growth in Botswana. The study set out to test the existence of cointegration and specification of the deterministic components with special reference to the Pantula Principle which helps to overcome the shortfall of the method by Johansen, which may lead to spurious results by omitting the presence of deterministic components in the analysis.

Chukwuemeka, Chike, and Eze (2023), examine the impact of health government expenditure on under-five child mortality in Nigeria for a period of 1986 to 2022. The empirical results show that government health expenditure has a positive and significant impact on under-five child mortality because probability value of 0.0016 which is less than 0.05;

Awogbemi (2022) explores the impact of health expenditure on Nigeria's economic growth for the period between 2000 and 2021 using Error Correction Model Estimates (ECM). The empirical results did not find support for increasing health expenditure as it negatively affects economic growth in Nigeria both in the short-run and the long-run. The study of A'yun, and Irwandi (2022) analyzes the effect of government health expenditure on economic growth in ASEAN-9 countries. The results find that health expenditure as a percentage of GDP has a positive effect on economic growth, while out-of-pocket expenditure of the population has a negative significant effect on economic growth. Griffith (2020) assess the impact of health expenditure on economic growth in Kenya. The results revealed that the coefficient of healthcare expenditure was positive and insignificant at a 5 percent level implying that growth rate could increase.

Ojo (2024) examine Nigeria's health expenditure, education, and economic growth, spanning from 1995 to 2019 using principal component analysis (PCA. And the finding shows that there is a positive relationship between health and education expenditure and economic growth. Ivankova et al., (2022) investigated the relationship between health expenditure, treatable mortality, and economic productivity in Organization for Economic Co-operation and Development (OECD) countries. The results of the regression analysis reveal negative relationships between health expenditure and treatable respiratory mortality in countries with a tax-based health system for male and female working-age populations, as well as in countries with an insurance-based health system for male population. This means that higher health expenditure was associated with lower treatable respiratory mortality. Also, lower treatable mortality was associated with higher GDP, especially in the male-productive population from countries with an insurance-based health system.

Yerima et al. (2022) assess the impact of government expenditure on economic growth in Nigeria using time series data from 1986-2020 using Structural Vector Auto-regression (SVAR) model and the pair-wise causality test were adopted. The study observed that government expenditure on health and education had an insignificant impact on economic growth. The result also shows that public debt has an insignificant impact on economic growth. Olayiwola, Adedokun and Olusanya (2020) examine the impact of health financing on economic growth in Nigeria using the Auto-regressive Distributed Lag Model

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(ARDL) estimation technique. The results show that the previous year productive activities have a growth effect on economic growth both in the short-run and the long-run. The current domestic government general health expenditure has a negative growth effect on economic growth while the previous year's domestic general government expenditure on health improves economic growth. Ebhotemhen & Hezekiah (2021) carried out an empirical investigation on the impact of public health expenditure on the Nigeria Health Sector Performance beginning from 1995 to 2020 by employing Autoregressive Distributed Lag. The results of the Error Correction Mechanism (ECM) accentuated the connection between Public Healthcare Expenditure and Health Sector Performance in Nigeria through the establishment of a stable long-term equilibrium relationship among the variables employed in the model. Olayiwola, Bakare-Aremu, and Abiodun (2021) employed the ARDL bounds testing and Wagner's Law framework to investigate the linkage between public health expenditure and GDP. Their findings indicate a long-run relationship but no bidirectional causality, suggesting that while health spending influences economic growth, the reverse may not hold.

Eze and Amedu (2025) shifted focus from GDP to life expectancy, examining how unemployment and health spending jointly influence this outcome. Their ARDL-based findings underscore that both variables significantly shape life expectancy trends. This study is valuable for redirecting attention toward human development indicators rather than purely economic growth. George-Anokwuru (2023) explored a novel angle by analyzing how health worker migration influences infant mortality, using ARDL. Their findings underscore the brain drain's negative implications on health outcomes, but the study lacks depth in quantifying government response mechanisms such as training, subsidies or retention programs. Umoh (2025) offered a valuable innovation by separating capital and recurrent health spending. Their ARDL analysis showed that capital health spending boosts GDP per capita, while recurrent spending depresses it. This differentiation is critical, yet the exclusion of health outcomes such as mortality or morbidity limits the study to purely economic measures, neglecting the health development trade-off.

Olayiwola, Adedokun, and Olusanya (2020) utilized ECM and cointegration techniques to examine health expenditure's impact on mortality and life expectancy, revealing long-run improvements in outcomes while Eboh, Aduku, and Onwughalu (2020) employed the Ordinary Least Squares (OLS) method to investigate the effect of recurrent health expenditure on child mortality in Nigeria. Their findings revealed a significant inverse relationship, underscoring the role of consistent funding in improving health outcomes. However, the study did not examine the link between health spending and broader economic performance indicators such as GDP, nor did it address capital expenditure, which limits its relevance to economic growth debates.

In a more dynamic framework, Nwokocha et al. (2025) used VECM to demonstrate that increased public health spending significantly contributes to human capital development and GDP growth in Nigeria. While their method accounts for both short-run and long-run

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dynamics, it fails to disaggregate health spending into preventive and curative components, limiting the granularity of policy recommendations. Similarly, Osobase, and Bakare-Aremu (2019) employed the Toda-Yamamoto causality technique to establish a one-way causal relationship from health spending to GDP growth. While causality testing is a step forward from correlation analysis, the assumption of temporal stability may not hold in the face of Nigeria's economic volatility and health sector reforms. Nwokoye, (2017) combined descriptive statistics with regression analysis and found that public health expenditure on human capital significantly promotes economic growth. Yet, their methodology lacked rigorous econometric testing for structural breaks or endogeneity, which may weaken the reliability of the findings.

These studies reviewed showed the failure to integrate institutional quality, governance structures, and accountability mechanisms into their analysis of how health expenditure translates into growth. Without this, the effectiveness of health spending cannot be fully understood in the Nigerian context where corruption, mismanagement, and weak public sector governance are prevalent. This gap highlights the need for a more robust and comprehensive study that not only establishes the link between public health spending and economic growth but also accounts for the mediating roles of institutional quality, and human capital development.

METHODS AND DISCUSSION

Health Capital Theory is the theoretical framework guiding this study because it treats health as a kind of capital, where people invest in to improve their productivity and income leading to a country's overall growth. The model is thus specified:

$$GDPG = \beta_0 + \beta_1 DGGHE_t + \beta_2 CoC_t + \beta_3 EEXP_t + \beta_4 INFR_t + \beta_5 POLS_t + \beta_6 PREM_t + \beta_7 RoL_t + \varepsilon_t \quad \ldots\ldots (1)$$

Where: GDPG = GDP growth (annual %), DGGHE = Domestic general government health expenditure (% of GDP), CoC = Control of Corruption, EEXP = Education expenditure (% of GNP), INF = Inflation, GDP deflator (annual %), POPL = Political Stability and Absence of Violence/Terrorism: Estimate, PREM = Personal remittances, received (% of GDP), RoL = Rule of Law: Estimate, ε_t = Error term.

The causality model

$$\mathbf{GDPG_{i,t} = \alpha_i + \sum_{i=1}^{p} \phi_i \, GDPG_{i,t-k} + \sum_{i=1}^{p} \beta_i \, DGGHE_{i,t-k} + \varepsilon_{i,t}} \quad \textbf{----------(2)}$$

$$\mathbf{DGGHE_{i,t} = \mu_i + \sum_{i=1}^{p} \theta_i \, DGGHE_{i,t-k} + \sum_{i=1}^{p} \delta_i \, GDPG_{i,t-k} + \nu_{i,t}} \quad \textbf{----------(3)}$$

Where:

GDPG and DGGHE remain as earlier defined,

α_i, μ_i, β_i and δ_i are the coefficient parameters of causali

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Descriptive Statistics of the Study:

Table 1: Descriptive Statistics Table

	GDPG	DGGHE	COC	EEXP	INFR	POLS	PREM	ROL	DGGHE_COC
Mean	5.050559	0.645606	-1.17141	0.7025	11.55046	-1.87752	4.478192	-1.10647	-0.76595
Median	5.612804	0.55719	-1.12248	0.583	10.10376	-1.90686	4.647764	-1.06822	-0.62025
Maximum	15.32916	1.202034	-0.90095	1.365	23.86438	-1.45533	8.333829	-0.84204	-0.47157
Minimum	-1.79425	0.445932	-1.50207	0.319	0.686099	-2.21112	1.014733	-1.51251	-1.66286
Std. Dev.	3.63026	0.214665	0.146652	0.343659	6.352681	0.195679	1.887618	0.198377	0.315133
Skewness	0.430121	1.344961	-0.68428	0.574912	0.571234	0.411939	-0.26221	-0.66006	-1.51599
Kurtosis	4.287476	3.785287	2.792079	1.911074	2.512784	2.396929	2.581183	2.491417	4.261859
Jarque-Bera	2.397611	7.852359	1.916173	2.507857	1.542614	1.042469	0.450431	2.001382	10.78519
Probability	0.301554	0.019719	0.383626	0.285381	0.462408	0.593787	0.798344	0.367625	0.00455
Sum	121.2134	15.49455	-28.1138	16.86	277.2112	-45.0605	107.4766	-26.5554	-18.3829
Sum Sq. Dev.	303.112	1.059867	0.494656	2.716336	928.2008	0.880673	81.95133	0.905133	2.284096
Observations	24	24	24	24	24	24	24	24	24

Source: Researcher's construct from E-Views 13.0 estimation output

Table 1 summarizes the descriptive statistics for 24 annual observations. GDP growth averages 5.05% but shows considerable volatility, reflecting periods of expansion and recession. Government health expenditure remains low at about 0.65% of GDP with moderate variation, indicating limited and uneven health funding. Governance indicators control of corruption, rule of law, and political stability consistently record negative values, highlighting persistent institutional weaknesses. Education expenditure is also low and inconsistent, while inflation is highly volatile, suggesting macroeconomic instability. Personal remittances contribute significantly to the economy but fluctuate over time. The interaction between health expenditure and corruption control shows wide variation, emphasizing the uneven combined effects of policy and governance. Overall, the statistics depict an environment of economic volatility, weak institutions, and low public investment in social sectors, providing context for analyzing the relationship between health expenditure, governance, and economic growth in Nigeria.

Pre-Estimation Test Results

Unit Root Test Results

H_0: The Variables are non-Stationary (Unit Root)

H_1: The Variables Are Stationary (No Unit Root)

Decision Rule:

Reject the null Hypothesis if the ADF t-statistic in absolute terms is greater than the ADF 5% critical value or the p-value is less than or equal to 0.05 level of significance.

Table 2: Augmented Dickey-Fuller Test Results

Variables	ADF @ Levels		ADF @ First Difference		Order of Integration
	ADF Statistics	5% Critical Value	ADF Statistics	5% Critical Value	
GDPG	2.395216	3.752946	6.720061	3.004861	I(1)
DGGHE	1.848372	2.998064	3.132865	3.012363	I(1)

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CoC	1.590996	2.998064	4.465484	3.004861	I(1)
EEXP	0.020241	3.622033	4.784584	3.632896	I(1)
INF	1.299316	3.020686	5.387400	3.020686	I(1)
POLS	2.625459	2.998064			I(0)
PREM	2.306225	2.998064	4.616550	3.004861	I(1)
RoL	4.229083	3.644963			I(0)
DGGHE*CoC	1.723579	2.998064	3.139886	3.012363	I(1)

Source: Researcher's construct from E-Views 13.0 estimation output

From the Table 2, there is a mixture of the order of integration of the ADF t-statistic (in absolute terms) of all the variables. Seven of the variables are integrated of order one, while the other two are integrated of order zero. This mixture of the order of integration will lead us to perform a cointegration test to ascertain if there is a long run relationship between the variables.

4.2.2 Cointegration Test Results

Table 4.3: Johansen Cointegration Test Result

Table 3: Johansen Cointegration Test Result

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.** Critical Value
None *	0.98777166	361.5012127	197.3708726	6.13E-10
At most 1 *	0.969716696	260.2092345	159.5296978	7.60E-12
At most 2 *	0.844543158	179.7745838	125.6154331	8.78E-07
At most 3 *	0.808929706	136.9626798	95.75366142	6.46E-06
At most 4 *	0.767805442	98.89506045	69.81888752	5.24E-05
At most 5 *	0.714257372	65.31092859	47.85612716	0.000524464
At most 6 *	0.56502591	36.49966174	29.79707334	0.007274634
At most 7 *	0.375874223	17.35287903	15.49471288	0.025962305
At most 8 *	0.246532683	6.51060164	3.841465498	0.010720609
Hypothesized		**Max-Eigen**	**0.05**	**Prob.****
No. of CE(s)	**Eigenvalue**	**Statistic**	**Critical Value**	**Critical Value**
None *	0.98777166	101.2919783	58.43353809	3.97E-08
At most 1 *	0.969716696	80.43465069	52.36260958	1.29E-05
At most 2	0.844543158	42.81190393	46.23141975	0.111292241
At most 3	0.808929706	38.06761938	40.07757358	0.082770888
At most 4	0.767805442	33.58413186	33.87686662	0.054137054
At most 5 *	0.714257372	28.81126685	27.58433779	0.034665352
At most 6	0.56502591	19.14678271	21.1316163	0.092658467
At most 7	0.375874223	10.84227739	14.26460015	0.162271963
At most 8 *	0.246532683	6.51060164	3.841465498	0.010720609

Source: Researcher's construct from E-Views 13.0 estimation output.

Trace Test:

The results of the trace statistic reveal that the null hypothesis of no cointegration is rejected at all hypothesized ranks. For the levels "None," "At most 1," "At most 2," through

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"At most 8," the trace statistics exceed their respective 5% critical values, with all p-values statistically significant. This outcome indicates the presence of nine (9) co-integrating relationships among the variables, suggesting a strong degree of long-run association.

Maximum–Eigenvalue Test:

The maximum–eigenvalue statistics reject the null hypotheses of "None" and "At most 1" at the 5% level, indicating at least two cointegrating vectors. However, the remaining hypotheses are not rejected consistently, except for marginal significance at "At most 5" and "At most 8." Therefore, the max–eigenvalue criterion confirms the existence of two (2) cointegrating equations at the 5% significance level.

Decision and Implication:

Although the trace test indicates multiple cointegrating relationships, the study relies on the more robust maximum eigenvalue test, which identifies at least two long-run cointegrating relationships among the variables. This confirms the presence of cointegration and justifies the use of a Vector Error Correction Model (VECM), capturing both long-run equilibrium and short-run dynamics.

Presentation of the Regression Result

Table 4: OLS Regression Result

Dependent Variable: GDPG

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DGGHE	84.66696459	32.74204738	2.585878751	0.020671679
COC	-33.01101521	14.33489802	-2.302842697	0.036025783
EEXP	1.494440397	2.944938963	0.507460567	0.619210977
INFR	0.060820165	0.091347918	0.665807899	0.515642999
POLS	-8.016765181	3.661245537	-2.189627846	0.044772519
PREM	-1.131583712	0.631013654	-1.793279282	0.093111188
ROL	-15.97877003	5.345806664	-2.989028791	0.0091754
DGGHE_COC	67.27114371	25.00231197	2.690596925	0.016771961
C	-66.17055693	20.26682865	-3.264968489	0.00522068
R-squared	0.774694589	Mean dependent var		5.05055933
Adjusted R-squared	0.654531703	S.D. dependent var		3.630259549
S.E. of regression	2.133741361	Akaike info criterion		4.63362733
Sum squared resid	68.29278293	Schwarz criterion		5.075397516
Log likelihood	-46.60352796	Hannan-Quinn criter.		4.750829085
F-statistic	6.447037156	Durbin-Watson stat		2.042776115
Prob(F-statistic)	0.00101937			

Source: Researcher's construct from E-Views 13.0 estimation output

Evaluation of Regression Results

I. Domestic Government Health Expenditure (DGGHE): The coefficient of DGGHE (84.67) indicates a strong positive effect on economic growth, implying that increased

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government health expenditure significantly enhances productivity, human capital, and overall economic performance, consistent with economic theory.

II. Control of Corruption (CoC): The coefficient for CoC (–33.01) shows a negative but economically significant effect on GDP growth. While improved corruption control reduces distortions, the negative sign may reflect short-run adjustment costs, where anti-corruption measures disrupt informal activities and existing economic networks, a pattern often observed in developing economies undergoing institutional reforms.

III. Government Expenditure on Education (EEXP): EEXP has a coefficient of 1.49, indicating a positive but modest effect on GDP growth. While consistent with theory, the small magnitude suggests that education spending in Nigeria may yield limited short-term returns due to inefficiencies, poor quality, or long gestation periods.

IV. Inflation (INFR): It shows a very small positive effect on GDP growth (0.06), suggesting minimal influence and likely reflecting mild inflation associated with economic activity rather than productive expansion.

V. **Political stability (POLS):** It has a negative coefficient (–8.02), indicating that improvements may temporarily reduce growth due to structural constraints or transitional adjustments.

VI. Personal remittances (PREM): It also negatively affects growth (–1.13), possibly because they are largely used for consumption rather than investment.

VII. Rule of law (RoL): It exhibits a strong negative impact (–15.98), likely reflecting short-run adjustment costs of institutional reforms.

VIII. Interaction Term (DGGHE_COC): In contrast, the interaction term between health expenditure and corruption control (DGGHE_COC) is strongly positive (67.27), indicating that effective governance significantly enhances the growth impact of health spending.

IX. The Constant Term: The constant term (–66.17) reflects underlying structural weaknesses in the absence of key economic and institutional factors.

Evaluation Based on Statistical Criteria (First Order Test Results)

Students t-Test

H_0: $\beta_i = 0$ (The individual variables are not significant)

H_1: $\beta_i \neq 0$ (The individual variables are significant)

For i = (1, 2, …, k)

Decision Rule: Reject H_0 if the P-value of the parameter is less than 0.05 and conclude that the true population parameter is not 0, otherwise, fail to reject.

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Table 5: t-Test Results for Statistical Significance of the Variables

Variables	P-Value	Decision	Conclusion
DGGHE (Domestic Health Expenditure)	0.0207	Reject H_0	Statistically Significant
CoC (Control of Corruption)	0.0360	Reject H_0	Statistically Significant
EEXP (Education Expenditure)	0.6192	Fail to reject H_0	Not Statistically Significant
INFR (Inflation Rate)	0.5156	Fail to reject H_0	Not Statistically Significant
POLS (Political Stability)	0.0448	Reject H_0	Statistically Significant
PREM (Personal Remittances)	0.0931	Fail to reject H_0	Not Statistically Significant
RoL (Rule of Law)	0.0092	Reject H_0	Statistically Significant
DGGHE_COC (Interaction Term)	0.0168	Reject H_0	Statistically Significant

Source: Researcher's construct from E-Views estimation output

Table 5 presents the statistical significance of each explanatory variable based on the student's t-test. The results show that DGGHE, CoC, POLS, RoL, and DGGHE_COC have p-values less than 0.05, indicating that they significantly influence GDP growth in Nigeria during the study period.

Conversely, EEXP, INFR, and PREM do not exhibit statistical significance, implying that their individual effects on economic growth are weak or not distinguishable from zero within the sample period.

The F-Test

The underlying hypothesis for the F-test are as stated below:

H_0: $\beta1=\beta2=\beta3=\beta4=0$ (the overall model is insignificant)

H_1: $\beta1\neq\beta2\neq\beta3\neq\beta4\neq0$ (the overall model is significant).

At $\alpha = 5\%$ with k-1(numerator) and n-k (denominator) degree of freedom,

Where; n = number of observations,

k = number of parameters.

Decision Rule:

Reject H_0 if the probability value of the F-Stat is less than 0.05, otherwise do not reject. Since the probability value of the F-Stat is 0.0010193700 which is less than 0.05 we reject H_0 and conclude that the variables in the model are jointly statistically significant. This implies that all the dependent variables have a joint significant impact on GDP growth.

Multiple Coefficient of Determination (R^2)

The R^2 value of 0.7747 indicates that about 77.47% of the variations in GDP growth are explained by the model's explanatory variables, reflecting strong explanatory power. Key variables such as health expenditure, corruption control, political stability, rule of law, and their interaction contribute significantly to this variation. However, the remaining 22.53% is influenced by factors not included in the model, such as external shocks, policy changes, and global economic conditions.

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Adjusted Multiple Coefficient of Determination (Adjusted R^2)

The adjusted R^2 of 0.6545 shows that about 65.45% of the variation in GDP growth is explained after accounting for the number of predictors, indicating solid model reliability. The gap from the R^2 (0.7747) suggests that some variables, such as education expenditure, inflation, and remittances, contribute less to explanatory power. Overall, the model remains robust, though future studies could improve it by including additional relevant variables.

Econometric Criteria (2nd order tests)

Normality Test

The hypothesis of this test can formally be stated as:

H_0: Error term is normally distributed

H_1: Error term is not normally distributed

Decision Rule: Reject H_0 if the p-value of JB-Stat. is < 0.05 at 5% level of significance. We fail to reject if otherwise.

The Jarque–Bera statistic (JB = 0.215359, p = 0.897915) shows that the p-value exceeds the 5% significance level. Hence, this study fails to reject the null hypotheses (H_0). Therefore, the null hypothesis of normal distribution of residuals cannot be rejected, indicating that the model residuals are normally distributed.

Autocorrelation Test

H_0: There is no autocorrelation

H_1: There is autocorrelation

Decision Rule: Reject H_0 if the P-value of Chi-square of the observed R-square is < 0.05 at 5% level of significance and conclude that there is no autocorrelation in the model, otherwise we fail to reject H_0.

Table 6: Autocorrelation Test Result

Breusch-Godfrey Serial Correlation LM Test:			
Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	0.039229	Prob. F(2,26)	0.9616
Obs*R-squared	0.143977	Prob. Chi-Square(2)	0.9305

Source: Researcher's construct from E-Views 13.0 estimation output

Table 6 above indicates that the probability values associated with both the F-statistic (0.9616) and the Obs*R-squared statistic (0.9305) are greater than the 5% significance level. This implies a none rejection of the null hypothesis of no serial correlation. Consequently, the model is found to not suffer from significant serial correlation up to the second lag.

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Heteroscedasticity Test

H_0: There is homoscedasticity (no heteroscedasticity)

H_1: There is heteroscedasticity

Decision Rule: Reject H_0 if the P-value of Chi-square is < 0.05 at 5% level of significance and conclude that there is presence of heteroscedasticity otherwise we fail to reject H_0.

Table 7: Heteroscedasticity Test Result

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
Null hypothesis: Homoskedasticity			
F-statistic	0.732365	Prob. F (6,28)	0.6627
Obs*R-squared	6.741196	Prob. Chi-Square (6)	0.5648
Scaled explained SS	2.613620	Prob. Chi-Square (6)	0.9562

Source: Researcher's construct from E-Views estimation output

Since all probability values exceed 5%, the null hypothesis of homoskedasticity is not rejected, indicating constant error variance. This confirms the absence of heteroskedasticity, ensuring reliable coefficients and valid standard errors, thereby strengthening the robustness of the model.

Multicollinearity Test

Table 8: Correlation Matrix

	GDPG	DGGHE	COC	EEXP	INFR	POLS	PREM	ROL	DGGHE_COC
GDPG	1								
DGGHE	0.315579	1							
COC	-0.52937	-0.32094	1						
EEXP	0.68183	0.591024	-0.64217	1					
INFR	0.341269	0.472718	-0.38646	0.54175	1				
POLS	0.183301	0.457959	-0.54016	0.60109	0.41592	1			
PREM	-0.29893	-0.03094	0.783043	-0.40691	-0.11531	-0.52629	1		
ROL	-0.76177	-0.55375	0.746098	-0.82568	-0.40293	-0.44176	0.47459	1	
DGGHE_COC	-0.41198	-0.95155	0.585956	-0.69068	-0.50753	-0.55182	0.298892	0.706687	1

Source: Researcher's construct from E-Views estimation output

A correlation analysis was conducted to test for multicollinearity, with coefficients above 0.8 indicating potential problems (Gujarati, 2004). The results show generally weak to moderate correlations among the variables, suggesting no serious multicollinearity. Although strong correlations exist between ROL and GDPG, and between the interaction term and DGGHE, the latter is expected due to its construction and does not undermine the model's validity.

Moderate correlations also appear between:

PREM and COC (0.7830)

ROL and COC (0.7461)

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EEXP and ROL (–0.8257)

EEXP and GDPG (0.6818)

DGGHE and EEXP (0.5910)

All correlations fall below the 0.80 threshold, indicating no serious multicollinearity. Variables like inflation, political stability, and GDP growth show only weak to moderate correlations, confirming that coefficient estimates remain reliable. Mild correlations are expected in economic data, so the model can be interpreted confidently.

Specification Test

H_0: There is no specification bias or error

H_1: There is specification bias or error.

Decision Rule: Reject H_0 if p-value of F-statistics is < 0.05 at 5% level of significance and conclude that the model has specification bias or error. Otherwise, we fail to reject and conclude that the models have no specification bias or error.

Table 9: Ramsey Reset Test Result

	Value	df	Probability
t-statistic	1.424544	14	0.1762
F-statistic	2.029326	(1, 14)	0.1762

Source: Researcher's construct from E-Views 13.0 estimation output

With t- and F-statistic probabilities above 0.05, the null of correct functional form is not rejected, indicating no evidence of misspecification. The Ramsey RESET test confirms that the model appropriately captures the relationship between dependent and independent variables, supporting the reliability of the coefficients.

Causality Test Result

H_0: There is no causal relationship

H_1: There is causal relationship

Decision Rule:

Reject H_0 (no causality) if *Prob. < 0.05* → **Causality exists**

Fail to reject H_0 if *Prob. > 0.05* → **No causality**

The results are presented below.

Table 10: Granger Causality Test Result

Null Hypothesis:	Obs	F-Statistic	Prob.
DGGHE does not Granger Cause GDPG	22	1.43234	0.2661
GDPG does not Granger Cause FDI	22	0.33185	0.1341

Source: Researcher's construct from E-Views 13.0 estimation output

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Table 10 presents the results of the Pairwise Granger Causality Test conducted to determine the direction of causality between government health expenditure (DGGHE) and GDP growth (GDPG) within the study period using a lag length of two years. The test examines whether past values of one variable help to explain or predict the current values of another variable.

Interpretation of Results:

The Granger causality tests show no evidence of a causal relationship between government health expenditure (DGGHE) and GDP growth (GDPG). Neither DGGHE predicts GDPG (F = 1.4323, p = 0.2661) nor GDPG predicts DGGHE (F = 2.2669, p = 0.1341), indicating that over 2000–2023, changes in health spending and economic growth in Nigeria evolve independently in the short run.

Evaluation of Research Hypothesis

This section evaluates the formulated hypothesis of the study using the regression and Granger causality results presented in the previous sections. The hypotheses are tested at the 5% significance level, with the decision rule: reject H_0 if p-value < 0.05; otherwise, fail to reject H_0.

Hypothesis One:

H_{01}: Public health expenditure (DGGHE) has no significant effect on economic growth (GDPG) in Nigeria.

H_{11}: Public health expenditure has a significant effect on economic growth in Nigeria.

The results show that DGGHE is statistically significant (p = 0.0207), indicating that public health expenditure positively affects economic growth in Nigeria. A 1% increase in government health spending is associated with an estimated 84.67% rise in GDP growth, reflecting the productivity and human capital benefits of health investment.

Summarily, the regression analysis (OLS) shows that public health expenditure (DGGHE) has a positive and statistically significant effect on economic growth, suggesting that increased government investment in health contributes to higher GDP growth.

Policy Recommendations

To maximize the developmental impact of health spending and foster sustainable economic growth, the study recommends based on the finding the necessity of increasing public health spending to meet African Union benchmark for member states of 15% budgetary health allocation. This will ensure adequate provision of health infrastructure that will facilitate improved access to healthcare services, better population health and enhanced productive through enhancement of human resources. There is also need to integrate health and human capital development. Coordinated strategies that combine health, education, and workforce development should be implemented. Improving healthcare services will reduce morbidity, enhance labour productivity and complement educational investments to strengthen human capital formation.

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