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Government recurrent health expenditure and economic growth relationship in Nigeria: A quantile regression perspective

Yunana Ishemu Zumba[1]
Joseph Abbey Aku[2]
Jane Emmanuel Hwyere[3]
Patience Elisha[4]


(✉ Corresponding Author)

[1]*McPeniel Consultancy, Logos, Nigeria.*
[1]*Email: zumba348@gmail.com*
[2,3]*University of Jos, Nigeria.*
[2]*Email: joeaku007@gmail.com*
[3]*Email: janemankilik92@gmail.com*
[4]*Modibbo Adama University, Yola, Nigeria.*
[4]*Email: patiemcewondereli481@gmail.com*

Abstract

Government health expenditure has been recognized as a key determinant of economic growth, particularly in developing economies. This study, therefore, investigates the impact of government recurrent expenditure on health on economic growth in Nigeria using annual data from 1980 to 2024. The quantile regression technique was used to perform the data analysis. To enhance the robustness of the findings, the analysis controlled for some variables, including population, foreign direct investment, and exchange rate. The results show that government recurrent expenditure on health has a positive and statistically significant impact on economic growth across different economic growth quantiles. The impact is stronger at the lower and middle than at the higher growth quantiles. Exchange rate weakening constrains economic growth minimally at the lower but strengthens economic growth significantly at the higher quantiles of economic growth. Foreign direct investment exerts a weak and unstable impact on economic growth across different growth quantiles, while population has a positive and significant impact on economic growth, with the effect greater during low and moderate than during high economic performance. The findings are robust to robustness checks. The study therefore recommends strengthening government recurrent expenditure on health in Nigeria to enhance its benefits in terms of improving the country's economy at all levels of economic performance.

Keywords: Economic growth, Government, Health expenditure, Nigeria, Quantile regression, Recurrent government.
JEL Classification: C01; C21; HS1; O40.

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Contents

Contribution of this paper to the literature
This study contributes to the literature by providing insights into the influence of recurrent government health expenditure on economic growth at different economic growth quantiles. It enhances understanding of whether recurrent government health expenditure has a weaker or stronger impact on economic growth during high, low, or moderate economic growth.

1. Introduction

Government expenditure on health plays a crucial role in shaping human capital, productivity, and a country's economic performance. Government health expenditure is divided into recurrent and capital health expenditure. In developing countries like Nigeria, government recurrent expenditure on health constitutes the major share of the government's spending on health (Development Research and Projects Centre, 2023). This suggests that in these countries, the adequacy and effectiveness of the government's recurrent health expenditure are essential for the efficiency of health delivery. In Nigeria, in particular, the adequacy and efficiency of recurrent government expenditure on health are crucial, as the country has, over the years, faced persistent health system weaknesses, low life expectancy, and high disease incidence, among other challenges. These have potentially undermined labor productivity and, by extension, impeded economic growth.

Health expenditure improvements, especially recurrent expenditure that maintains delivery of services, should, in principle, enhance short- and long-run economic growth. However, empirical evidence indicates that the effect of government expenditure on health on economic growth is not unanimous. Earlier studies on the health expenditure of government and economic growth have reported mixed findings, with some presenting positive, while others reporting negative influence of government health expenditure on economic growth (Chinweoke & Chinagorom, 2022; Mladenović, Milovančević, Mladenović, Marjanović, & Petković, 2016; Muhammad & Bichi, 2022; Piabuo & Tieguhong, 2017; Qehaja, Qehaja, Arber, & Marovci, 2023; Ugochukwu & Oruta, 2021). Some studies reported an insignificant effect of public health expenditure on economic growth (Eboh, Aduku, & Onwughalu, 2022; Musa, Ismail, & Magaji, 2024). Hu and Wang (2024) and Muhammad and Bichi (2022) observed that the effect of health expenditure on economic growth depends on the threshold level.

The government of Nigeria has, over the years, made efforts to improve Nigeria's economic performance through more funding allocation to the country's health sector. Nonetheless, the country has continued to experience poor health outcomes and unstable economic growth. For instance, the life expectancy at birth in Nigeria is currently 54.8 years (World Economics, 2025). The Federal Ministry of Health and Social Welfare (2025) observed that Nigeria, with a yearly child death rate of 850,000, is the greatest contributor to the world under-five mortality burden. According to the World Bank (2022), Nigeria accounts for about 17% of under-five deaths in the world. In terms of economic growth, Nigeria, which was once the largest, is now the fourth-largest economy in Africa. These raise many concerns about the effectiveness of recurrent government expenditure on health in improving health outcomes and enhancing the country's economic growth. Government recurrent health expenditure in Nigeria, which includes salaries, wages, operational costs, and consumables, forms the greater part of public health expenditure annually. For instance, while government capital health expenditure increased in Nigeria from N55.61 to N445.16, the recurrent counterpart rose from N252.86 billion to N578.99 billion from 2017 to 2023, respectively (Development Research and Projects Centre, 2023). The lack of balance between government capital and recurrent expenditure raises a question about whether the existing recurrent expenditures of the government on health benefit Nigeria in terms of improving economic growth.

The World Bank (2025a) contends that investments in health directly create jobs, such as those for nurses and doctors, and in medical technology, support services, pharmaceuticals, digital health, and biotechnology. Theoretically, health is widely documented as a major economic growth driver through its impact on job creation, labour supply, accumulation of human capital, and productivity. However, Nigeria's health system suffers from poor hospital maintenance, inadequate staffing, weak institutional management, and shortages of essential drugs. The country has, over time, consistently failed to meet the Abuja Declaration benchmark of allocating a minimum of 15% of its national budget to the health sector, with recurrent expenditure taking a higher share than capital expenditure. For instance, in the 2026 budget, the Nigerian government proposed to spend N2.48 trillion (which represents only 4.2% of the proposed budget) on health. The low fund allocations to the country's health sector potentially undermine the effectiveness of Nigeria's health system and the health status and productivity of the Nigerian population.

From the perspective of macroeconomics, health is an important component of human capital and a key economic growth driver. Underinvesting in health systems that enhance the longevity and productivity of workers could translate into economic losses amounting to billions yearly, hence weakening long-run potentials for growth (World Bank, 2025b). Empirical evidence indicates that adequate and robust investments in health enhance health quality, thereby improving productivity of labor, minimizing mortality, increasing life expectancy, and boosting long-run economic growth (Nisa, 2023; Sen, 1999; Sorkin, 1976; Tompa, 2002). Given the persistent low growth of Nigeria's economy, particularly in recent times, and the importance of government expenditure on health, a robust understanding of the impact of recurrent expenditure of the government on economic growth is critical.

Available evidence in the context of Nigeria indicates that the government's recurrent expenditure on health has inconsistent effects on economic growth (Onyinyechi & Wosu, 2025; Ozor et al., 2025). Structural challenges, such as overreliance on recurrent rather than capital health expenditure, weak institutional capacity, and inadequate budget allocation to the health sector, potentially compound the mixed impact of health expenditure on economic growth in Nigeria. Hence, a need for further investigation of the government's recurrent health expenditure on economic growth. Besides the mixed findings reported by the earlier studies, these studies relied more on mean-based techniques of estimation like the autoregressive distributed lag (ARDL), ordinary least squares (OLS), vector error correction model (VECM), and pooled OLS, among others, in assessing the recurrent government health spending and economic growth nexus. These approaches assume uniform impacts of government recurrent health expenditure on economic growth across the conditional distribution of economic growth. Hence, failed to capture well the potential heterogeneity in the reaction of economic growth at different levels of an economy's performance. This calls for the use of a more nuanced and robust technique capable of revealing how the impact of recurrent

government health expenditure may vary across economic growth distribution. The quantile regression technique provides such an opportunity by enabling the estimation of recurrent government health expenditure's impact on economic growth at different economic growth quantiles rather than revealing only the mean effects. This provides a robust understanding of whether recurrent government health expenditure has a weaker or stronger impact on economic growth during high, low, or moderate levels of economic growth. Thus, this study applied the quantile regression technique to assess the heterogeneous impact of recurrent health expenditure of the government across different levels of economic growth in Nigeria, thereby offering policymakers robust insights for improving economic growth through recurrent health expenditure.

The remainder of this study is structured into the following sections. Section 2 covers the theoretical underpinning. Section 3 is empirical literature. The methodology of the study is presented in Section 4. Section 5 presents the results and discussion, while Section 6 is the conclusion and recommendations.

2. Theoretical Underpinning

2.1. Endogenous Growth Model

The present study is anchored on the endogenous growth theory. This theory posits that factors internal to the economic systems derive long-run economic growth (Romer, 1994). These include public policy, productive government expenditure, and accumulation of human capital (Liberto, 2025). The foundation of this theory is the idea that improvements in knowledge, innovations, and human capital result in improvements in productivity, thereby improving economic growth (Corporate Finance Institute, 2024). Unlike the neoclassical model of growth, where technological progress (an exogenous variable) drives economic growth, the endogenous theory of growth allows domestic government spending (an endogenous variable) to impact economic growth by affecting the quality, productivity, and efficiency of production factors.

In this study, the government's recurrent health expenditure is treated as a productive factor input that enhances labor quality, boosts labor efficiency, and increases total output. Recurrent government health spending, like drug procurement, health facility maintenance, disease control and prevention, and salaries of workers, plays an indispensable role in improving and sustaining the health of the population and enhancing the productivity of labor over time. By minimizing absenteeism, premature mortality, and morbidity, recurrent expenditure of the government on health not only enhances the effective supply of labor but also boosts per-worker output, thus improving economic growth. In this study, the endogenous growth model is stated as a production function in which recurrent expenditure of the government on health is captured as a factor of production. Equation 1 states the endogenous growth model.

$$G_t = A_t K_t^{\alpha} (H_t L_t)^{1-\alpha} \quad (1)$$

Where G_t, , K_t, L_t, and H_t respectively denote economic growth, physical capital, labour and health capital, at time t. In the equation, total factor productivity is captured by A_t. The α represents the physical capital output elasticity. It measures physical capital's contribution to economic growth and satisfies the condition $0 < \alpha < 1$, suggesting diminishing marginal productivity of K_t.. The $1 - \alpha$ in the equation denotes elasticity of effective labour's output that captures health capital and output of labour $(H_t L_t)$. Consistent with the endogenous growth model, the study assumes constant returns to scale in effective labor and physical capital. It is important to state that in this study, all else constant, recurrent government spending on health enhances H_t, thereby improving the productivity of labour and, by extension, increasing economic growth. That is, it is expected that recurrent expenditure of the government on health should enhance health capital, thereby improving economic growth. The endogenous growth model is relevant for this study. The study focuses on Nigeria, a developing economy where health outcomes are fragile, and the productivity of labour is sensitive to effective public investment in health.

3. Empirical Literature

Several studies have assessed the impact of health expenditure, population, foreign direct investment, and exchange rate on economic growth, some of which have been reviewed in this study. Muhammad and Bichi (2022) assessed health expenditure on economic growth using annual data from Nigeria from 1986 to 2021. The findings from the Ordinary Least Squares (OLS) show that government expenditure on health has a significantly negative effect on economic growth. Besides, government expenditure on education impacts economic growth positively. In 33 Organisation for Economic Co-operation and Development (OECD) countries, Hu and Wang (2024) analysed the impact of public health expenditure on economic growth. The annual data covering 2001-2017 were used to achieve the study's objective. The findings from the analysis using the theoretical panel threshold model indicate that public health expenditure has a negative effect on economic growth at a consumption threshold below 9.63. However, when the level of consumption exceeds 9.63, the impact of public health expenditure on economic growth becomes positive and statistically significant. The results also reveal that when employees' wages are lower than the threshold, the impact of health expenditure on economic growth is negative and statistically significant, but becomes positive and significant when workers' wages are greater than 10.57. Furthermore, when human capital investment is lower than the 8.73 threshold, the impact of public health expenditure on health is negatively significant. However, the effect becomes positive and statistically significant when human capital investment exceeds 8.74.

Piabuo and Tieguhong (2017) carried out a comparative analysis of the effect of health expenditure on economic growth between Central African states and other African countries that have realized the Abuja Declaration to allocate not less than 15% of government expenditure to health. The panel OLS, dynamic OLS, and fully modified OLS techniques were used to achieve the study's objective. The results revealed that in the two sampled countries, expenditure on health has a positive and significant effect on economic growth. Chinweoke and Chinagorom (2022) examined the effect of government recurrent health expenditure on economic growth using annual data from 1981 to 2020. The result from the analysis using the Vector Error Correction Model (VECM) indicates that recurrent expenditure by the government on health has a significantly negative effect on the economy in the short and long run. Christopher (2025) focused on assessing the effect of government spending on health and education in Nigeria. The findings from analysis using annual data spanning 1986-2023 and the ARDL approach revealed that recurrent

health expenditure has a significantly negative impact on economic growth. Ugochukwu and Oruta (2021) evaluated various government expenditures' impacts on economic growth from 1981 to 2020. The study applied the ARDL technique to annual data, and the findings revealed that while the short-run impact of government expenditure on health expenditure is negative, the long-run impact is positive and significant.

Olulu, Erhieyovwe, and Andrew (2014) used the Ordinary Least Squares (OLS) and yearly data from 1980 to 2010 to examine the effect of government expenditure on economic growth. The outcome shows that government expenditure on health has a significant negative effect on economic growth. In Kenya, Alwago (2023) evaluated the impact of life expectancy and healthcare spending on economic growth using yearly data from 2000 to 2020. The results from the error correction model (ECM) and ARDL approaches indicate that, in the short run, expenditure on health has a positive and insignificant effect on economic growth. In the long run, however, it has a positive, significant effect on economic growth. Furthermore, the finding shows unidirectional causality from health expenditure to economic growth. Mladenović et al. (2016) analyze the health expenditure's effect on economic growth in 28 European Union countries. The data, spanning 1974 to 2015, were analyzed using the adaptive neuro-fuzzy inference system (ANFIS) approach. It was found that expenditure on healthcare has a negative effect on economic growth. Faruk, Haque, Tausif, and Khan (2022) assess the association between spending on health and economic growth and the role of institutions in enabling expenditure on health to enhance economic growth in the context of Middle East and North Africa countries. The outcome of analysis using fully modified OLS, dynamic OLS, and panel OLS showed that spending on health does not contribute to economic growth directly. Also, the result indicates an absence of Granger causality between expenditure on health and economic growth. Qehaja et al. (2023) assessed the effect of expenditure of government, average age, death rate, and health insurance on economic growth in the context of Western Balkan countries using annual data spanning 2000-2020. Their finding, based on analysis using the pooled OLS, fixed and random effects, revealed that government expenditure on health has a positive and significant effect on economic growth. Borensztein, De Gregorio, and Lee (1998) assessed the effect of foreign direct investment on economic growth and the channel through which foreign direct investment impacts economic growth in the context of 69 developing countries from 1970 to 1989. The outcome from the seemingly unrelated regressions (SUR) analysis approach indicates that foreign direct investment has a significantly positive effect on economic growth; however, when a country has a minimum human capital stock threshold. Almfraji and Almsafir (2014) present a review of studies on the nexus between foreign direct investment (FDI) and economic growth from 1994 to 2012. The findings from the content analysis approach suggest that FDI has a significant positive effect on economic growth, with a few cases where FDI has a negative or no effect on economic growth. In the context of 84 countries, Li and Liu (2005) assessed whether FDI impacts economic growth using yearly data from 1970 to 1999. The analysis results from single-equation and simultaneous-equation system approaches show that a significant endogenous association exists between FDI and economic growth from the mid-1980s onwards. Besides, not only does FDI affect economic growth positively, but its interaction with human capital also increases economic growth significantly.

In Latin America, Alvarado, Iñiguez, and Ponce (2017) assessed foreign direct investment's influence on economic growth using yearly data spanning 1980-2014. The outcome from the fixed and random effects approaches indicates that, on average, FDI has an insignificant effect on economic growth. However, when accounting for the development level attained by countries, the outcome shows that FDI has a significant positive impact on economic growth in high-income countries, a significant uneven effect on upper-middle-income countries, and a significant negative effect on lower-middle-income countries. In China, Zhang (2001) evaluated FDI's role in the market-oriented transition and income growth of the country from 1984 to 1998. The results from cross-sectional and panel data show that FDI assists the economy of China and enhances income growth. Kaddouri and Benelbar (2024) examine the short- and long-run association between FDI and economic growth from 1990 to 2003 in Algeria. The findings from the ARDL approach reveal that FDI has a positive effect on economic growth.

In Nigeria, Gold and Tregenna (2024) assessed the effect of hydroelectric power production, trade openness, and FDI on economic growth from 1988 to 2022. The results from the ARDL and fully modified OLS approaches indicate that, in the short run, FDI has a positive effect on economic growth. In the long run, however, FDI has a significantly negative effect on economic growth. Applying the ARDL technique, Ehigiamusoe and Lean (2019) investigated capital inflows' impact on economic growth in Nigeria from 1980 to 2015. The outcome shows that FDI has a positive and insignificant influence on economic growth. Also, focusing on Nigeria, Akinlo (2004) evaluated the effect of FDI on economic growth using yearly data from 1970 to 2001 using the ECM approach. The finding suggests that FDI has a positive, not statistically significant, effect on economic growth. Adegbite and Ayadi (2011) examined the association between FDI inflows and economic growth in Nigeria using annual data from 1992 to 2007. The findings from the OLS approach show that FDI has a positive effect on economic growth.

Lianos, Tsounis, and Pseiridis (2022) examined the association between growth of the population and economic growth in France, Germany, Italy, the UK, and the US using yearly data spanning 1820-1938 and 1950-2016. The outcome from analysis using the Sims and Toda-Yamamoto Granger causality tests indicates that during the later period, unidirectional causality runs from economic growth to population. But unidirectional causality runs from population to economic growth during the former period. Huang and Xie (2013) examine the relationship between population growth and economic growth in 90 counties based on yearly data from 1980 to 2007. The data were analysed using the Generalised Method of Moments analysis technique, and the results indicated that previous and current population growth had respectively negative and positive effects on economic growth in the short run. In the long run, population growth has an insignificant positive effect on economic growth. Ayanaw Alemu and Belay Zegeye (2024) studied the relationship between population and economic growth in Ethiopia using yearly data from 1991 to 2022. The analysis outcome from the VECM technique shows that population improves economic growth significantly in the short run, but in the long run, population decreases economic growth significantly. Furthermore, no causal association was observed between population and economic growth.

Ogunjobi, Oladipo, and Oladipo (2024) investigated the impact of human capital development, population growth, and economic growth in Nigeria. The finding from an analysis using annual data from 1988 to 2022 and the ARDL technique shows that growth in population has a negative effect on economic growth. Alimi, Fagbohun, and Abubakar (2021) used yearly data from 1981 to 2018 and the ARDL technique to study the impact of output growth, population growth, and per capita income in Nigeria. The finding reveals that in the long run, population growth

has a significant positive impact on economic growth. In the short run, however, population growth has a significant negative effect on economic growth. Oyedepo, Obayelu, and Owuru (2023) investigate the impact of population growth on economic growth in China, India, Nigeria, and the US. The outcome from analysis using annual data spanning 1991-2020 and the ARDL technique shows that in all the countries, the long-run effect of population growth on economic growth is negative. In Nigeria, the effect of change in working age population on economic growth in the short and long run is negative and significant.

Habib, Mileva, and Stracca (2017) assessed the impact of real exchange rate movements on economic growth in 150 countries using yearly data from 1970 to 2010. The result from the pooled OLS and instrumental variable techniques shows that depreciation/appreciation of the exchange rate raises (reduces) economic growth significantly. To examine the dynamic association between exchange rate, inflation, and economic growth in Ethiopia, Malec, Maitah, Rojik, Aragaw, and Fulnečková (2024) utilise annual data covering 1991-2020 and the ARDL technique. The finding indicates that the exchange rate has a significant negative effect on economic growth. Awadzie, Attah-Botchwey, and Mawudor (2025) assess the exchange rate's threshold influence on economic growth in Ghana. The findings from the analysis using yearly data spanning 1990-2021 and the endogenous threshold autoregressive (TAR) approach indicate a nonlinear association between exchange rate and economic growth. Above the threshold of 8.9%, the exchange rate reduces economic growth considerably. Furthermore, the exchange rate has a negative effect on economic growth in the low and high exchange rate regimes, but the effect is insignificant in the high regime. Ridhwan, Ismail, and Nijkamp (2024) carried out a meta-analysis of the nexus between exchange rate and economic growth using 51 empirical studies. The outcome suggests that appreciation or undervaluation of the exchange rate significantly improves economic growth, with the improvement greater in developed economies than in their developing counterparts. Ramoni-Perazzi and Romero (2022) examine the impact of exchange rate volatility on economic growth in 194 countries. Utilizing yearly data from 1995 to 2019 and methods such as generalized autoregressive conditional heteroskedasticity (GARCH) and the system and difference generalized method of moments, the findings show that exchange rate volatility has a significant negative effect on economic growth. In Nigeria, Nyeche (2024) assessed the exchange rate's effect on economic growth using yearly data from 1980-2021 and the ARDL technique. The finding shows that the exchange rate has a significant positive impact on economic growth in the long run. Similarly, David (2021) examines the impact of exchange rates on economic growth in Nigeria. Using 1981-2020 annual data and the ARDL approach, the results reveal that the exchange rate has a positive and significant impact on economic growth.

Evidence from the empirical review reveals that no study has investigated the impact of government recurrent health expenditure on economic growth across different quantiles. This study filled this gap by employing the quantile regression approach to assess the heterogeneous impact of recurrent expenditure of the government on economic growth in Nigeria across different levels of economic performance. Besides, it accounted for the role of exchange rate, population, and FDI in assessing the heterogeneous impact of recurrent government expenditure on economic growth across different levels of growth quantiles. The study, therefore, contributes to the literature in the following ways. Firstly, it provides insights into the influence of government recurrent health expenditure on economic growth at different economic growth quantiles. Secondly, it accounts for the potential influence of population, exchange rate and FDI in understanding the impact of recurrent expenditure of the government on health on economic growth across different quantiles of economic performance.

4. Methodology

4.1. Data Description and Sources

This study examined the impact of recurrent government health expenditure on economic growth using annual data from 1980 to 2024. The decision regarding the time span was guided purely by data availability on the key variables. The variables used are economic growth measured by nominal gross domestic product (GDP) and recurrent public spending on health, both measured in Naira. Other variables included in the model are exchange rate, foreign direct investment, and population. Including these variables in the model potentially enhanced the robustness of the findings by addressing any biases associated with omitted variables. Foreign direct investment is measured in terms of the net inflow of foreign direct investment, the exchange rate in terms of one unit of the naira to a US dollar, and population in terms of the number of people in a year. The data were obtained from the Central Bank of Nigeria (2025) statistical bulletin and the World Bank (2025b).

4.2. Unit Root Test

The variables were subjected to a stationarity assessment to ensure that they do not contain a unit root, which potentially biases regression analysis outcomes. The Phillips and Perron (1988) and Augmented Dickey and Fuller (1979) approaches to testing for a unit root in time series were employed to examine the variables for stationarity. Equations 2 and 3 express the ADF unit root test equations.

$$g_t = \upsilon + \tau_1 g_{t-1} + \sum_{f=1}^{w} \tau_f \Delta g_{t-f} + \xi_t \quad (2)$$

$$g_t = \upsilon + \phi t + \tau_1 g_{t-1} + \sum_{f=1}^{w} \tau_f \Delta g_{t-f} + \xi_t \quad (3)$$

$$t = 1,\ 2,\ 3,\ \ldots\ldots\ldots\ldots\ldots,\ n$$

In Equations 2 and 3 g_t is the variable whose stationarity status is ascertained υ is the constant term, τ_1, τ_f and ϕ are parameters, while Δ and ξ_t are difference operator and the error term at time t. In Equation 2, t and ϕ are trend term and parameter of the trend term, respectively. For Equations 2 and 3, the null and alternative hypothesis are:

$H_0: \tau_1 = 0$ (There is a unit root $\rightarrow$ non-stationary)

and

$H_0: \tau_1 < 0$ (There is no unit root $\rightarrow$ stationary)

If the test's result fails to reject the null hypothesis, a unit root is present, suggesting that the series is not stationary. But rejecting the null hypothesis suggests that the series does not contain a unit root (is stationary). Equations 4 and 5 express the PP unit root test models.

$$\Delta g_t = \pi + \sigma g_{t-1} + \xi_t \quad (4)$$
$$\Delta g_t = \psi + \theta t + \sigma g_{t-1} + \xi_t \quad (5)$$

Where π and ψ are the intercepts, while σ is the parameter of the variable. In Equation 5, θ is the coefficient of the trend term. The null and alternative hypotheses of the PP test are stated as follows.

$H_0: \sigma = 1$ (There is a unit root $\rightarrow$ non-stationary)

$H_0: |\sigma| < 1$ (There is no unit root $\rightarrow$ stationary)

This suggests that a series is stationary only if and only if the test result fails to accept the null hypothesis. In a case where the test result fails to reject the null hypothesis, the series is not stationary.

4.3. Model Specification

To assess how recurrent expenditure of the government on health impacts economic growth at different quantiles, the study employed the Koenker and Bassett Jr (1978) quantile regression technique. $Q_\tau(EGR_t/X_t)$ represent the conditional $\tau - th$ quantile of economic growth in which $\tau \in (0,1)$. Equation 6 states the quantile regression Model.

$$Q_\tau(EGR_t/X_t) = \varphi_{0\tau} + \varphi_{1\tau}RHE_t + \varphi_{2\tau}EXR_t + \varphi_{3\tau}FDI_t + \varphi_{4\tau}POP_t \quad (6)$$

Where $ln\,E\,GR_t$, $ln\,R\,HE_t$, $ln\,E\,XR_t$, FDI_t and $ln\,P\,OP_t$, respective denote natural log of economic growth, recurrent government expenditure on health, natural log of exchange rate, foreign direct investment, and natural log of population all at time t. Five quantiles, including 0.10, 0.25, 0.50, 0.75, and 0.90, were estimated. These enabled capturing low, moderate, and high conditions of economic growth. The quantile regression technique benefits research in several ways. For example, the technique is robust to some common features of time series data, including leptokurtosis, heteroskedasticity, and skewness. Besides, it reveals the heterogeneous impact of a dependent variable or dependent variables on the dependent variables ignored by other techniques, such as the ARDL, OLS, VAR, etc. Hence, providing a better understanding of how a variable responds to changes in its determinants. Three quantiles, including 0.25, 0.50, and 0.75 model and the OLS technique were estimated to examine the robustness of the estimates of the result produced by the five quantiles regression model. Equation 7 states the OLS model

$$ln\,G\,DP_t = \rho_0 + \rho_1\,ln\,G\,RE_t + \rho_2\,ln\,E\,XR_t + \rho_3 FDI_t + \rho_4\,ln\,P\,OP_t + \upsilon_t \quad (7)$$

Where ρ_0 is the intercept of the model, ρ_1, ρ_2, ρ_3 and ρ_4, denote coefficients of government recurrent health expenditure, exchange rate, foreign direct investment, and population, respectively. The υ_t is the white noise error term assumed to be independent and identically distributed with constant variance and zero mean.

5. Result and Discussion

Table 1 presents the descriptive statistics results. Each variable has a complete number of observations. As evident in the standard deviation values, the variables exhibit less variability. This is supported by the variables' minimum, maximum, mean, and median values. The median value of each variable does not deviate significantly from its respective mean value, and the mean and median values of each variable are less than but greater than the respective maximum and minimum values, respectively. While FDI exhibits positive skewness, the other variables exhibit negative skewness. Economic growth, government recurrent expenditure on health, population, and exchange rate are platykurtic, while FDI is leptokurtic. The null hypothesis that the series are normally distributed is rejected only for FDI, indicating that all the series but FDI are normally distributed.

Table 1. Descriptive statistics.

Statistics	lnEGR	lnGRE	lnPOP	lnEXR	FDI
Mean	8.9332	2.4210	18.7096	3.7042	1.1542
Median	9.3399	3.5046	18.7094	4.7755	0.8534
Maximum	12.3455	6.1498	19.2652	7.2991	4.2821
Minimum	4.9267	-3.1865	18.1164	-0.6037	-1.1509
Std. Dev.	2.5557	3.1302	0.3486	2.1658	0.9933
Skewness	-0.2918	-0.4243	-0.0366	-0.6993	0.6657
Kurtosis	1.6317	1.6909	1.7585	2.3596	3.8617
Jarque-Bera	4.1492	4.5630	2.9001	4.4368	4.71621*
Probability	0.1256	0.1021	0.2346	0.1088	0.0946
Observations	45	45	45	45	45

Note: * denotes statistically significant at 10%.

Table 2 displays the outcome of the unit root test. The results of the two tests indicate that population and FDI are stationary at level when the test captures only the constant term. Similarly, the PP test outcome indicates that the exchange rate is stationary at level when only a constant term is captured in conducting the test. The ADF and PP test results show that economic growth and government recurrent health expenditure stationarity are at first difference when the tests include only a constant term. The result from the ADF reveals that the exchange rate is stationary at the first difference when the test includes a constant and trend terms.

Table 2. Unit root test result.

Variable	ADF		PP	
	Level	First difference	Level	First difference
lnEGR	0.3207[b]	-3.4369***[a]	-0.6179[c]	-3.6171**[c]
lnGRE	0.2024[b]	-5.7442***[b]	-2.9379[c]	-14.3513***[b]
lnPOP	4.5459***[b]	-1.7768[b]	-2.6151*[aab]	-1.0419[c]
FDI	-4.1765***[b]	-10.3837***[c]	-4.1402**[b]	-12.9474***[c]
lnEXR	-1.16927[b]	-5.0261***[c]	-1.1532[b]	-4.9982***[b]

Note: *, **, and *** represent significant at 10%, 5%, and 1%, respectively, while [b] and [c], respectively, denote with only constant term and with constant and trend terms.

The ARDL bounds approach to cointegration was employed to assess the long-run relationship between economic growth and the regressors. Table 3 reports the outcome of the cointegration test. The null hypothesis of the test was rejected at 1% significance level. The F-statistic value is greater than the upper critical bound value at 1% level, suggesting a stable relationship between economic growth and the model's regressors.

Table 3. Cointegration test result.

F-statistic	K	Significance level	Lower Critical Bound	Upper Critical Bound
32.6870***	4	10%	2.2	3.09
		5%	2.56	3.49
		1%	3.29	4.37

Note: *** denotes rejection of null hypothesis 1%.

Table 4 presents the quantile regression result. The coefficients of recurrent government health expenditure at the 10th, 25th, 50th, 75th, and 90th quantiles are, respectively, 0.4836, 0.5499, 0.4970, 0.3853, and 0.3518 and are all statistically significant at 1% level. This suggests that a 1% rise in government recurrent expenditure on health is associated with a 0.4836%, 0.5499%, 0.4970%, 0.3853%, and 0.3518% increase in economic growth at the 10th, 25th, 50th, 75th, and 90th quantiles of economic growth, respectively. That is, the recurrent expenditure of the government on health significantly boosts economic growth at all five quantiles of economic growth. This underscores the endogenous growth model, which posits that investment in human capital (recurrent expenditure of the government in the context of this study) enhances growth. The positive effect of government recurrent expenditure on health is more at the 10th, 25th, and 50th percentiles. This implies that recurrent government expenditure on health boosts economic growth more when the economy is performing poorly or moderately than when the economy is performing well. It suggests that raising the recurrent expenditure of the government on health to improve economic growth yields more results when the economy is performing poorly or moderately than when it is performing well.

Exchange rate has a mixed effect on economic growth across the 10th, 25th, 50th, 75th, and 90th quantiles. Specifically, the impact of the exchange rate on economic growth at the 10th, 25th, and 50th quantiles is negative but statistically not significant. However, at the 75th and 90th quantiles, the exchange rate has a significant positive effect on economic growth. The estimates show that a 1% increase in exchange rate (fall in the value of the Naira against other currencies) reduces economic growth slightly by 0.0060%, 0.0652% and 0.0583%, respectively, at the 10th, 25th and 50th economic growth quantiles, but boosts economic growth significantly by 0.3012% and 0.3340%, respectively, at the 75th and 90th economic growth quantiles. This finding suggests that at lower and moderate levels of economic growth, the exchange rate has a minimal impact on economic growth. However, when the economy is performing well, a decline in the rate at which the naira is exchanged for other currencies significantly boosts economic growth. This further suggests that weakening the value of the Naira against other currencies to strengthen economic growth will ultimately produce the desired outcome only when the economy of the country is performing well.

The coefficients of foreign direct investment at the 10th, 25th, 50th, 75th, and 90th quantiles are -0.0480, -0.0557, 0.0246, -0.0605, and -0.0676, respectively, but they are not statistically significant at any level. The estimates indicate that, all other things being constant, a rise in foreign direct investment inflow by 1 unit reduces economic growth by 0.0480%, 0.0557%, 0.0605%, and 0.0676%, respectively, at the 10th, 25th, 75th, and 90th quantiles of economic growth, but minimally improves economic growth by 0.0246% at the 50% quantile. When the economy performs poorly or well, foreign direct investment somewhat reduces economic growth, but it slightly increases growth when the economy's performance is moderate.

The influence of population on economic growth at all quantiles is positive and statistically significant. Ceteris paribus, a 1% increase in population translates into 3.2057%, 2.9991%, 3.2418%, 1.9859% and 2.1335% improvements in economic growth at the 10th, 25th, 50th, 75th, and 90th economic growth quantiles, respectively. All else constant, the estimates suggest that an increase in population improves economic growth most at the 50th quantile, followed by the 10th quantile, and least at the 75th quantile of economic growth. Furthermore, the result suggests that increasing population as a strategy to enhance economic growth produces the best outcome at the 50th quantile, followed by the 10th quantile, and the least at the 75th quantile of economic growth.

Table 4. Quantile regression result.

Variable	10th quantile	25th quantile	50th quantile	75th quantile	90th quantile
Constant	-32.3688**	-48.3851***	-52.7428**	-29.9942	-32.7211*
	(21.5762)	(14.9843)	(22.2657)	(21.1609)	(18.3785)
lnGRE	0.4836***	0.5499***	0.4970***	0.3852***	0.3518***
	(0.1380)	(0.1095)	(0.1654)	(0.1383)	(0.1242)
lnEXR	-0.0060	-0.0652	-0.0583	0.3012**	0.3340***
	(0.1316)	(0.0925)	(0.1444)	(0.1460)	(0.1223)
FDI	-0.0480	-0.0557	0.0246	-0.0605	-0.0676
	(0.1275)	(0.0929)	(0.1034)	(0.0755)	(0.0546)
lnPOP	3.2057***	2.9991***	3.2418**	1.9859*	2.1335**
	(1.1672)	(0.8095)	(1.2063)	(1.1516)	(0.9995)

Note: *, **, and *** denote statistically significant at 10%, 5%, and 1%, respectively, while (.) represents standard errors.

To validate the findings from this study, two robustness checks were performed. In the first robustness check, the model was estimated based on the 25th, 50th, and 75th quantiles. In the second robustness check, the OLS estimator was employed to regress economic growth on recurrent government expenditure on health, exchange rate, foreign direct investment, and population. Table 5 presents the outcome of the robustness checks from the two estimators. The outcome from the 25th, 50th, and 75th quantile estimators shows that the effect of recurrent government expenditure on health on economic growth is positive and statistically significant at 1%, with a greater impact at lower levels of growth than at higher levels. This finding validates the results from the main estimates. Similarly, the effect of the exchange rate on economic growth at the 25th, 50th, and 75th quantiles does not deviate

from the main estimation. Specifically, at the 25th and 50th quantiles, the exchange rate has a negative but not statistically significant effect on economic growth. However, at the 75th quantile, the impact of the exchange rate on economic growth is positive and statistically significant.

Similar to the main findings, foreign direct investment has a weak, statistically insignificant effect on economic growth at all three quantiles. On the other hand, population has a positive and statistically significant effect on economic growth at all three quantiles of economic growth, with the effect greater at the lower than at the higher quantiles. Overall, the robustness check results from the quantile regression technique reinforce the main findings. Specifically, it reveals changes in the impact of recurrent government health expenditure, exchange rate, population, and foreign direct investment across the conditional variation of economic growth. This confirms that the effect of recurrent government health expenditure and the other variables on economic growth is not uniform.

Turning to the robustness checks from the OLS approach, employing this technique for robustness checks became necessary. It enabled comparing the mean-based result with the heterogeneous impact of recurrent health expenditure of the government on economic growth captured by the quantile regression model. The estimates from the OLS technique offer an overall mean effect of recurrent government expenditure and the other variables included in the model on economic growth. The result shows that recurrent expenditure of the government on health has a positive and statistically significant effect on economic growth. This is consistent with the outcome from the main estimation. Similarly, population has a positive and statistically significant effect on economic growth. While the influence of the exchange rate on economic growth is positive, the influence of foreign direct investment is negative but statistically not significant. Generally, the outcome of the robustness check from the OLS estimator lends credence to the main findings.

Table 5. Robustness.

Variable	25th quantile	50th quantile	75th quantile	OLS
Constant	-52.3688**	-48.3852***	-29.9942	-55.0006***
	(23.1352)	(16.0907)	(20.2397)	(9.9823)
lnGRE	0.4836***	0.5499***	0.3852***	0.3755***
	(0.1452)	(0.1111)	(0.1313)	(0.0572)
lnEXR	-0.0060	-0.0652	0.3012**	0.1074
	(0.1186)	(0.0928)	(0.1391)	(0.0720)
FDI	-0.0480	-0.0557	-0.0605	-0.0542
	(0.1290)	(0.0996)	(0.0769)	(0.0473)
lnPOP	3.2057**	2.9991***	1.9859*	3.3507***
	(1.2515)	(0.8700)	(1.1012)	(0.5435)

Note: *, **, and *** denote statistically significant at 10%, 5%, and 1%, respectively.

6. Conclusion and Recommendations

This study assesses the impact of government recurrent expenditure on health on economic growth in Nigeria using yearly time series data from 1980 to 2024. To enhance the accuracy of the findings, exchange rate, population, and foreign direct investment were included as regressors of the estimated models. The data used were analyzed using the quantile regression technique. By assessing government recurrent health expenditure on economic growth across different economic growth distributions, this study presents deeper insights into the non-linear and heterogeneous nature of the association between recurrent government expenditure on health and economic growth in Nigeria. The findings revealed that recurrent health expenditure of the government has a positive and statistically significant impact on economic growth, with the greatest impact at the lower and middle quantiles of the economic growth distribution. This means that government recurrent expenditure on health plays a bigger role in boosting economic growth during relatively low economic performance periods. The magnitude of the impact of recurrent health expenditure on economic growth diminishes at higher growth quantiles, suggesting diminishing marginal returns to government recurrent health expenditure as economic growth improves. Foreign direct investment, population, and exchange rate also exhibit quantile-specific effects on economic growth, suggesting that the impact of those variables on economic growth in Nigeria is heterogeneous.

The study therefore recommends strengthening government recurrent expenditure on health in Nigeria. Given the stronger effect of government recurrent expenditure on health on economic growth at the lower and middle growth quantiles, policymakers in Nigeria and the Nigerian government should focus on the quality and efficiency of government recurrent health expenditure. Better monitoring mechanisms and governance are essential in ensuring that recurrent health expenditure of the government in the country translates into stronger gains in terms of enhancing economic growth.

Also, targeted government recurrent health expenditure strategies should be adopted during periods of low economic growth. The study's findings indicate that recurrent government expenditure on health enhances economic growth more when the performance of the economy is weak or moderate. Thus, the government of Nigeria should implement a countercyclical recurrent health spending strategy, with well-targeted countercyclical and increased recurrent health expenditure during low economic performances to boost economic growth.

Furthermore, integrating health policy with wider macroeconomic management is crucial. Government recurrent health expenditure decisions should coordinate with population and exchange rates, since the effect of recurrent expenditure of the government on health on economic growth is not uniform across levels of economic growth. This will potentially strengthen the overall performance of government recurrent health expenditure as a long-term economic growth driver in Nigeria.

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