

Human Capital Investment and Economic Development in Nigeria

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Abstract

This study investigates the relationship between human capital investment and economic development in Nigeria from 1990 to 2024, using recurrent expenditures on education, health, research and development, and social services as proxies for human capital investment. Economic development is measured by real GDP per capita growth. Data were sourced from the World Bank, UNDP, and the Central Bank of Nigeria Statistical Bulletin. The study employs descriptive statistics, ADF unit root tests, ARDL bounds cointegration, ARDL estimation, and diagnostic tests. Findings reveal the existence of a long-run relationship among the dependent and independent variables. The ARDL estimates show that education, health, and research and development expenditures exhibit no statistically significant effects on real GDP per capita growth, while social services expenditure exerts a statistically significant positive effect on real GDP per capita growth. The error correction results indicate moderate speeds of adjustment toward long-run equilibrium. The study concludes that human capital investment remains an important driver of economic development in Nigeria, although the effectiveness of such investments depends largely on the efficient allocation, management, and utilization of public resources. Based on these findings, the researcher recommends among others that the government should reform the research and development sector by promoting innovation partnerships between universities, industries, and research institutions. Incentives such as grants, tax reliefs, and innovation hubs would help transform R&D investment into productivity growth.

Keywords: ARDL, GDP per capita, human capital investment, and economic development

1. Introduction

Human capital investment constitutes a central pillar of modern growth theory and development economics. Classical endogenous growth models emphasize that investments in education, health, and labor productivity enhance the quality of the workforce and ultimately stimulate sustainable economic growth (Becker, 1964; Lucas, 1988). Human capital refers to the stock of knowledge, skills, competencies, and health embodied in individuals that contribute to productive economic activity. Consequently, countries that allocate substantial resources toward education and health systems typically experience higher levels of productivity, innovation, and long-run economic development (Barro, 2013).

In developing economies, particularly in Sub-Saharan Africa, human capital development has become increasingly recognized as a key determinant of economic transformation. Nigeria, the largest economy and most populous country in Africa, provides a compelling case for

examining the relationship between human capital investment and economic development. Despite abundant natural resources, Nigeria continues to experience persistent development challenges characterized by relatively low human development indicators and uneven economic performance (World Bank, 2023).

Empirically, Nigeria's macroeconomic performance over the last three decades presents a paradox. Although the country recorded substantial economic growth following structural reforms and oil price booms, improvements in human development outcomes have been relatively modest. According to World Bank statistics, Nigeria's GDP per capita increased from approximately US\$556 in 1990 to about US\$3,088 in 2014 before declining to roughly US\$1,084 by 2024 due to economic shocks and exchange rate depreciation (World Bank, 2024a). A key factor influencing these outcomes is the level of investment in human capital sectors. Government expenditure on education and health represents a critical mechanism through which states build productive human capacity. However, Nigeria has historically allocated relatively limited resources to these sectors. Data from the Central Bank of Nigeria show that federal government recurrent expenditure on education fluctuated around 2.40 to 752.98 billion Naira between 1990 and 2023, significantly below the UNESCO recommended benchmark of 15–20 percent (Central Bank of Nigeria, 2023). Similarly, government recurrent health expenditure has remained comparatively low. World Bank data indicate that government health expenditure averaged less than 1 percent of GDP during much of the period between 1990 and 2020, for instance the health expenditure decreased from 0.5% in 2012 to 0.3% in 2023, limiting the capacity of the health system to improve population health outcomes (World Bank, 2024b). Beyond fiscal allocations, educational attainment and labor market participation constitute critical components of human capital accumulation. Secondary school enrollment rates have increased gradually over time but remain relatively low compared with global standards. According to World Bank statistics, Nigeria's secondary school gross enrollment ratio increased from approximately 24 percent in 1990 to about 47 percent by 2023, indicating gradual progress but still reflecting substantial gaps in access to education (World Bank, 2024c). Likewise, the labor force participation rate, which measures the proportion of the working-age population engaged in economic activity, has fluctuated between 82 and 83 percent over the past three decades, reflecting structural challenges in employment generation and labor market efficiency (World Bank, 2024d).

Despite the growing body of literature on human capital and economic growth in Nigeria, there remains a need for comprehensive empirical analysis that considers multiple human capital indicators and development outcome. In particular, examining the combined effects of government expenditure on education, government expenditure on health, secondary school enrollment, and labor force participation on GDP per capita.

2. Literature Review

Theoretical Review

2.1 Human Capital Theory

Human Capital Theory was prominently developed by Gary Becker (1964) building on earlier contributions by Theodore Schultz (1961) and Jacob Mincer (1974). These scholars argued that investments in education, training, and health improve the productivity and efficiency of labour, which subsequently leads to higher economic growth and improved welfare outcomes. The theory is based on several fundamental assumptions:

- i. Individuals are rational investors in their own skills and knowledge. People invest in education, training, and health in order to increase their productivity and future earnings (Becker, 1964).
- ii. Education and health are forms of capital. Similar to physical capital, investments in human capital yield returns in the form of increased productivity and income (Schultz, 1961).

iii. Human capital enhances labour productivity. A more educated and healthier workforce is more efficient and capable of producing higher levels of output.

iv. Returns to human capital investment accrue at both micro and macro levels. Individuals benefit through higher wages while society benefits through increased economic growth and development (Mincer, 1974).

v. Government intervention is necessary to support human capital formation. Public expenditures on education and health can correct market failures and expand access to human capital investment. Human Capital Theory posits that economic development depends significantly on the accumulation of skills, knowledge, and health status among individuals within an economy. According to Becker (1964), investments in education and health improve the productivity of workers, enabling them to contribute more effectively to the production process. This improved productivity leads to increased income levels at the individual level and greater national output at the macroeconomic level.

Schultz (1961) emphasized that education and health expenditures should be viewed as investments rather than consumption expenditures because they enhance human capabilities and generate long-term economic returns. Education improves cognitive skills, technical competencies, and innovation capacity, while health investments increase labour efficiency by reducing absenteeism and improving physical and mental capacity for productive activities. The theory further explains the role of government policy in promoting human capital formation. Government expenditures on education expand access to schooling, increase enrolment rates, and improve the quality of human resources. Similarly, public health expenditures improve life expectancy, reduce disease burden, and increase labour productivity. These investments enhance the stock of human capital within an economy, thereby stimulating economic growth and development (Kwon, 2009).

2.2 Endogenous Growth Theory

Endogenous Growth Theory emerged in the mid-1980s through the works of Paul Romer (1986) and Robert Lucas (1988). The theory was developed as an extension and critique of the neoclassical growth model, particularly the Solow model, which treated technological progress as an exogenous factor. Endogenous growth theory instead emphasizes that technological change and productivity growth are determined within the economic system through investments in human capital, innovation, and knowledge. The theory is based on several key assumption:

i. Human capital accumulation drives long-run economic growth. Education, training, and learning increase productivity and stimulate innovation (Lucas, 1988).

ii. Knowledge and innovation generate increasing returns. Unlike physical capital, knowledge does not diminish when shared and can create spillover effects across the economy (Romer, 1986).

iii. Technological progress is endogenous. Economic growth results from deliberate investments in research, education, and human capital rather than external technological shocks.

iv. Government policies influence growth outcomes. Public investments in education, health, and research can enhance human capital and stimulate innovation.

v. Learning-by-doing and knowledge spillovers enhance productivity. Workers and firms improve productivity through experience and knowledge sharing within the economy. Endogenous growth theory emphasizes the central role of human capital accumulation in generating sustained economic growth. Romer (1986) argued that knowledge and innovation are fundamental drivers of productivity growth and that investments in human capital enable societies to develop new technologies and improve existing production processes. Unlike the neoclassical growth model, which predicts diminishing returns to capital, endogenous growth

theory suggests that investments in knowledge and skills can produce increasing returns and sustain long-term economic growth.

Lucas (1988) further highlighted the role of education in fostering human capital accumulation and improving labour productivity. According to Lucas, the process of learning and skill acquisition enhances the ability of workers to adopt new technologies and improve efficiency within the production process. This results in knowledge spillovers where the productivity gains of one individual or firm benefit others in the economy, thereby generating broader economic growth. The theory also emphasizes the role of government in facilitating growth through investments in education, health, and research and development. Public expenditures on education increase the stock of human capital, while health investments improve labour productivity and life expectancy. These investments stimulate technological progress, enhance innovation, and improve overall economic performance (Mengesha & Singh, 2023).

Moreover, endogenous growth theory highlights the importance of educational attainment, labour force participation, and technological advancement in driving economic development. Secondary school enrolment contributes to the development of a skilled workforce capable of adapting to technological changes and participating effectively in productive activities. Similarly, increased labour force participation expands the productive capacity of the economy and promotes inclusive growth. In developing countries such as Nigeria, endogenous growth theory suggests that sustained economic development depends largely on policies that promote human capital formation and innovation. Government expenditure on education and health can stimulate knowledge creation, improve workforce productivity, and enhance economic competitiveness. As a result, increased investment in human capital can lead to higher GDP per capita and improved human development outcomes, reinforcing the long-run growth potential of the economy.

2.3 Solow Neoclassical Growth Theory (Augmented Solow Model)

The Solow Neoclassical Growth Theory was developed independently by Robert Solow (1956) and Trevor Swan (1956) to explain the determinants of long-run economic growth. The model became one of the most influential frameworks in growth economics because it introduced a systematic explanation of how capital accumulation, labour growth, and technological progress interact to determine economic output. However, the original Solow model did not explicitly account for human capital such as education and health. Recognizing this limitation, Mankiw, Romer, and Weil (1992) extended the model by incorporating human capital accumulation as an additional factor of production, thereby creating the Augmented Solow Model (Snowdon, 2015; Gustafsson, 2014). The Solow model is built on several important assumptions that explain long-run economic growth dynamics. First, production in an economy depends on physical capital, labour, and technological progress, which combine to generate output. Second, the model assumes constant returns to scale but diminishing marginal returns to each individual factor of production. Third, technological progress is assumed to be exogenous, meaning that it occurs independently of the economic decisions made within the model. Fourth, economies accumulate capital through savings and investment, which increases the capital stock and raises output levels. Finally, economies converge toward a steady-state equilibrium, where the rate of capital accumulation equals the rate of capital depreciation and labour growth (Solow, 1956). The Solow growth model explains economic growth through a production function in which output is determined by capital, labour, and technology. According to Solow (1956), increases in physical capital initially raise output and income levels; however, due to diminishing returns to capital, the growth effect of additional capital gradually declines over time. As a result, long-run economic growth in the Solow model depends primarily on technological progress, which improves productivity and allows economies to maintain sustained increases in output per worker.

Although the original model provided a strong theoretical explanation for economic growth, it faced criticism because it overlooked the role of human capital, which includes education, skills, and health conditions that enhance labour productivity. Empirical studies later demonstrated that differences in human capital investment could explain variations in economic growth across countries. To address this limitation, Mankiw, Romer, and Weil (1992) introduced human capital into the Solow framework, creating the Augmented Solow Model. This extension recognizes that education and health improve the quality of labour and increase the productive capacity of an economy.

The augmented Solow model expands the production function by including human capital alongside physical capital and labour. The model can be expressed as:

$$Y = AK^{\alpha}H^{\beta}L^{1-\alpha-\beta}$$

Where Y represents output, K denotes physical capital, H represents human capital, L is labour, and A represents technological progress. In this formulation, both physical capital and human capital contribute directly to economic production. Countries that invest more heavily in education, health, and skill development accumulate higher levels of human capital, which increases productivity and raises output per worker (Mankiw, Romer & Weil, 1992).

Human capital accumulation plays a critical role in improving labour productivity and technological adoption. Education enhances workers' knowledge and technical abilities, enabling them to use advanced technologies more efficiently and adapt to changing production methods. Similarly, improvements in health increase workers' physical and cognitive capacity, reducing absenteeism and improving overall labour efficiency. Consequently, investment in education and healthcare contributes to sustained economic growth by increasing the effectiveness of the labour force (Dhrifi *et al.*, 2021).

The augmented Solow model also highlights the importance of government expenditure on education and health in promoting economic development. Public investment in education improves school enrolment and increases the stock of skilled labour within the economy. Secondary school enrolment, for instance, expands the supply of workers with intermediate and advanced skills required for industrial production and technological innovation. Likewise, government expenditure on health improves life expectancy and labour productivity, which strengthens the capacity of individuals to participate in economic activities (Sinha, 2023).

Another key implication of the augmented Solow model is the concept of conditional convergence. The model predicts that countries with similar savings rates, population growth rates, and human capital investment levels will converge toward similar levels of income over time. However, countries with low levels of education and health investment may experience slower economic growth and remain trapped at lower income levels. This explains why many developing countries with limited human capital investment often exhibit lower GDP per capita and weaker human development outcomes (Kurz & Salvadori, 2008).

Empirical Review

Nyeche, Aninwagu, and Odu (2025) investigated the effects of gender-focused investment in education on economic growth in Nigeria using annual data covering the period from 1990 to 2023. The study examined the combined effects of female secondary school enrolment, government recurrent expenditure on education, and the Gender Parity Index (GPI) for primary school enrolment on real GDP per capita. Data on government recurrent expenditure on education were obtained from the Central Bank of Nigeria Statistical Bulletin, while data on real GDP per capita, female secondary school enrolment, and the gender parity index were sourced from the World Development Indicators. The study employed the Autoregressive Distributed Lag (ARDL) model to estimate both short-run and long-run relationships among the variables. The long-run ARDL results revealed that government recurrent expenditure on

education and female secondary school enrolment exerted positive and statistically significant effects on real GDP per capita in Nigeria. Conversely, the gender parity index for primary school enrolment exerted a negative and statistically significant long-run effect on economic growth. Onabote et al. (2023) examined the effects of government sectoral spending on human development in Nigeria using annual data covering the period from 1986 to 2021. The study differed from earlier studies by adopting a comprehensive human development index that captured multiple dimensions of development, including educational attainment, life expectancy, and per capita income, instead of relying solely on gross domestic product as a proxy for development. The study employed the Autoregressive Distributed Lag (ARDL) model to estimate both short-run and long-run relationships between sectoral government spending and human development indicators. The empirical results revealed that government sectoral spending did not exhibit a statistically significant relationship with human development in both the short run and the long run. However, the Error Correction Model (ECM) results suggested that government sectoral spending might exert influence on human development in the long run through gradual adjustment mechanisms within the economy.

Similarly, Eniekezimene and Wodu (2023) investigated the impact of human capital development on economic growth in Nigeria using annual data spanning the period from 1981 to 2021. The study utilized the ARDL approach to analyze the relationship between real gross domestic product growth rate and human capital variables such as government expenditure on education, government expenditure on health, gross fixed capital formation, and school enrolment at primary, secondary, and tertiary levels. Data for the study were sourced from the Central Bank of Nigeria Statistical Bulletin and the UNESCO Institute for Statistics. The Augmented Dickey–Fuller unit root test revealed that the variables were integrated at mixed orders of $I(0)$ and $I(1)$, which justified the application of the ARDL bounds testing approach. The bounds test confirmed the existence of a long-run relationship among the variables as the calculated F-statistic exceeded the upper critical bound. The ARDL estimates showed that in the long run government expenditure on education and tertiary enrolment exerted insignificant negative effects on economic growth, whereas government expenditure on health, gross fixed capital formation, and primary and secondary school enrolment exerted insignificant positive effects. In the short run, government expenditure on education produced a significant negative effect on economic growth, while government expenditure on health showed a significant positive effect. Aninwagu et al. (2026) examined the determinants of Nigeria's economic growth from 1990 to 2023 using the ARDL bounds-testing approach. Real GDP per capita served as the dependent variable, while trade, foreign direct investment, gross fixed capital formation, and government education expenditure constituted the explanatory variables. The findings showed that trade and education expenditure had negative short-run effects, while FDI had a negative short-run but positive and significant long-run effect. Gross fixed capital formation had a positive and significant short-run effect but an insignificant long-run effect. The error correction term indicated approximately 62% annual adjustment toward long-run equilibrium.

Jiang and Wang (2023) investigated the nonlinear effects of human health capital on economic growth in China using annual data covering the period from 1978 to 2021. The study employed the Nonlinear Autoregressive Distributed Lag (NARDL) model to capture asymmetric effects of positive and negative changes in health capital variables on economic growth. Human health capital was measured using private health expenditure, government health expenditure, and social service expenditure. The empirical results revealed that reductions in private health expenditure significantly reduced GDP per capita in the short run, whereas increases in private health expenditure contributed positively to economic growth. Similarly, decreases in government health expenditure significantly reduced economic growth, while increases in social service expenditure promoted economic performance. The results also indicated the

presence of asymmetric effects of health capital on economic growth in both the short run and the long run. The study concluded that well-distributed investment in human health capital significantly enhanced economic growth.

Villela and Paredes (2022) evaluated the relationship between public expenditure on education, human capital, and economic growth in Honduras using annual data covering the period from 1990 to 2020 obtained from the World Bank database. The study employed the instrumental variables estimation technique to analyze the relationship between education expenditure, human capital, and economic growth while controlling for additional socio-economic factors. The empirical findings revealed that public expenditure on education did not show a statistically significant relationship with economic growth. The results also suggested that human capital accumulation did not significantly contribute to economic growth in Honduras during the study period. The study concluded that structural constraints and other socio-economic factors might have limited the effectiveness of human capital investments in promoting sustainable economic growth in the country.

Keji (2021) empirically examined the relationship between human capital and economic growth in Nigeria for the period from 1981 to 2017. The study was motivated by the observed weak policy outcomes in key sectors such as education and health that were expected to enhance productivity and economic transformation in Nigeria. The study employed the Vector Autoregressive (VAR) model and the Johansen cointegration technique to determine the long-run relationship between human capital indicators and economic growth. The empirical findings revealed that human capital exerted a significant long-run effect on economic growth in Nigeria. Diagnostic tests, including normality tests, residual serial correlation LM tests, and residual heteroskedasticity tests, confirmed the robustness and validity of the estimated results

3. Methodology

This study adopts an ex-post facto design. This is because it is deemed suitable, as the research depends on pre-existing data that researchers cannot alter. The data for this study was sourced from the World Bank's World Development Indicators (WDI), and the Central Bank of Nigeria Statistical Bulletin from 1990 to 2024

The modelling of this study was theoretically anchored on Human Capital Theory, initially articulated by Schultz (1961) and later formalized by Becker (1964)..

The study specifies the following models:

$$GDPPC_t = f(EDEXP_t, HEXP_t, EXPRD_t, EXPSE_t) \quad 3.1$$

$$GDPPC_t = \alpha_0 + \alpha_1 \ln EDEXP_t + \alpha_2 \ln HEXP_t + \alpha_3 \ln EXPRD_t + \alpha_4 \ln EXPSE + \varepsilon_t \quad 3.2$$

Where:

$GDPPC$ = Real Gross Domestic Product *per capita* growth

$\ln EDEXP$ = Logarithm of recurrent expenditure on education

$\ln HEXP$ = Logarithm of recurrent expenditure on health

$\ln EXPRD$ = Logarithm of expenditure on research and development

$\ln EXPSE$ = Logarithm of expenditure on social services

α_0 = intercept terms

α_i = estimated coefficients

t = time period (1990–2024)

ε_t = stochastic error terms

NOTE: The logarithmic transformation of explanatory variables was intended to normalize the data, reduce heteroskedasticity, and interpret coefficients in elasticity terms.

4. Data Analysis

Table 4.1: Summary of Descriptive Statistics for the Variables

	GDPPC	LNEXP	LNEXPRD	LNEXPSE	LNHEXP
Mean	1.432857	3.704723	3.200273	3.915242	4.407698
Median	1.920000	4.405621	3.943522	4.365389	4.920856
Maximum	12.21000	6.204780	5.562603	6.359262	6.686398
Minimum	-8.340000	-1.897120	-1.203973	0.398776	-1.237874
Std. Dev.	3.934968	2.218982	2.135039	1.646524	1.992134
Skewness	0.109973	-0.840626	-0.886894	-0.644195	-0.998640
Kurtosis	3.886862	2.708576	2.496879	2.411685	3.370632
Jarque-Bera	1.217562	4.245989	4.957540	2.925508	6.017809
Probability	0.544014	0.119673	0.083846	0.231598	0.049346
Sum	50.15000	129.6653	112.0095	137.0335	154.2694
Sum Sq. Dev.	526.4551	167.4119	154.9853	92.17541	134.9324
Observations	35	35	35	35	35

Source: Researcher's computations using Eviews 12, (2026)

Table 4.1 presents the distributional characteristics of the study variables from 1990 to 2024. The mean values for real GDP per capita growth (GDPPC) is 1.432. Real GDP per capita growth ranges from -8.340 to 12.210. The mean of the logarithm of recurrent expenditure on education (LNEXP) is 3.704, and the mean for the logarithm of expenditure on research and development (LNEXPRD) is 3.200. LNEXP ranges from -1.897 to 6.204, whereas LNEXPRD ranges from -1.203 to 5.562. The average values for the logarithm of social services expenditure (LNEXPSE) and the logarithm of recurrent health expenditure (LNHEXP) are 3.915 and 4.407, respectively. LNEXPSE ranges from 0.398 to 6.359, while LNHEXP varies from -1.237 to 6.686.

The standard deviations indicate that the observations for all variables are concentrated around their respective means, with standard deviations lower than the mean values, except for GDP per capita growth (GDPPC).

Unit Root Test

Table 4.2: Augmented Dickey-Fuller (ADF) Test Results

Variables	ADF Level	at Critical value 5%	ADF at 1st Diff.	Critical value 5%	Order of Integration
GDPPC	-3.925504	-2.951125	NA	NA	1(0)
LNEXP	-4.816821	-2.976263	-4.241238	-2.954021	1(1)
LNEXPRD	-2.289040	-2.951125	NA	NA	1(0)
LNEXPSE	-1.851302	-2.954021	-5.174689	-2.954021	1(1)
LNHEXP	-6.251021	-2.957110	NA	NA	1(0)

Source: Researcher's computation using Eviews 12 (2026).

The results of the Augmented Dickey-Fuller (ADF) unit root test, as presented in Table 4.2, indicate that only real GDP per capita (GDPPC), the logarithm of research and development expenditure (LNEXPRD), and the logarithm of health expenditure (LNHEXP) are stationary in their level forms. This is evidenced by their respective ADF statistics of -3.925504, -2.289040, and -6.251021, which exceed the critical values at the 5% significance level. Consequently, the study rejects the null hypothesis of a unit root for real GDP per capita, the

logarithm of research and development expenditure, and the logarithm of recurrent health expenditure.

Conversely, the remaining variables demonstrate stationarity only after first differencing, as their ADF values surpass the 5% significance threshold in their differenced forms. This finding implies that these variables are integrated of order one (I(1)), necessitating differencing to achieve stationarity.

Therefore, the series analysed in this study comprises a mixture of variables integrated of order zero (I(0)) and order one (I(1)), as detailed in the table. This information is vital for understanding the characteristics of the variables and for conducting subsequent analyses and modelling.

Furthermore, this methodological approach aligns with the econometric frameworks proposed in recent studies, including those by Aninwagu, Onyema, Momodu, and Amadi (2025), as well as Aninwagu and Nyeche (2025).

Table 4.3: Bounds cointegration test results for the model

F-Bounds Test		Null Hypothesis: No relationship	No levels	
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	4.186144	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Source: Researcher's computation using Eviews 12, (2026).

The ARDL bounds cointegration test results, as shown in Table 4.3, indicate F-statistic value of 4.186144 for real GDP per capita growth exceed the lower (2.56) and upper (3.49) critical bounds at the 5% significance level

Model Result and Discussion

Table 4.4: ARDL Short and Long Run Results

Dependent Variable: GDP per capita growth (GDPPC)

Short run result				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNEDEXP)	-0.311361	1.913078	-0.162754	0.8734
D(LNEDEXP(-1))	14.52297	2.922287	4.969729	0.0003
D(LNEDEXP(-2))	10.42188	2.810451	3.708258	0.0030
D(LNEDEXP(-3))	10.23992	1.967517	5.204488	0.0002
D(LNEXPRD)	6.954510	1.728179	4.024184	0.0017
D(LNEXPSE)	1.611633	0.936700	1.720543	0.1110
D(LNEXPSE(-1))	-4.263552	1.348571	-3.161534	0.0082
D(LNEXPSE(-2))	-2.928057	1.209559	-2.420764	0.0323
D(LNEXPSE(-3))	-6.771682	1.145454	-5.911790	0.0001
D(LNHEXP)	-5.864846	2.776712	-2.112155	0.0563
D(LNHEXP(-1))	-13.51866	2.670688	-5.061866	0.0003
D(LNHEXP(-2))	-5.013267	2.290213	-2.188996	0.0491

D(LNHEXP(-3))	-7.469126	1.893517	-3.944579	0.0019
CointEq(-1)*	-0.563612	0.094485	-5.965084	0.0001

Long-run result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNEXP	-12.17726	8.648014	-1.408098	0.1845
LNEXP	-1.344482	4.712107	-0.285325	0.7803
LNEXP	13.61922	4.336884	3.140324	0.0085
LNHEXP	4.737587	10.59609	0.447107	0.6628
C	-24.30049	18.76431	-1.295038	0.2197

R² = 0.861446; Adj. R² = 0.755493

Source: Researcher's Computation (EViews 12), 2026.

The ARDL short- and long-run results presented in Table 4.4 reveal that the coefficient for the logarithm of recurrent education expenditure in the immediate year has a negative effect, with no statistically significant impact on real GDP per capita in Nigeria in the short run. At lags 1, 2, and 3, however, there is a statistically significant positive correlation with Nigeria's real GDP per capita growth, indicating that a 1% change in the logarithm of recurrent education expenditure results in increases of 14.52, 10.42, and 10.23 units in real GDP per capita growth, respectively, in the short run. These short-run findings are consistent with human capital theory as advanced by Gary Becker (1964), building on the foundational work of Theodore Schultz (1961) and Jacob Mincer (1974), which posits that investments in education and training enhance labor productivity and efficiency, thereby fostering economic growth and development. In contrast, the long-run coefficients indicate a negative, statistically insignificant effect on real GDP per capita growth in Nigeria, suggesting that a 1% change in recurrent education expenditure reduces real GDP per capita growth by 12.177 units. This outcome contradicts the study's initial expectations and the capability approach proposed by Amartya Sen (1985; 1999), which asserts that education is a fundamental element of human development, expanding individuals' capabilities and empowering them to participate more effectively in economic and social activities."

The ARDL short- and long-run estimates further demonstrate that the coefficient for the logarithm of research and development expenditure in the immediate period exhibits a statistically significant positive correlation with real GDP per capita growth in Nigeria. Specifically, a 1% change in research and development expenditure raises real GDP per capita growth by 6.954 units in the short run. This result aligns with the human capital theory developed by Becker (1964), Schultz (1961), and Mincer (1974), which emphasizes the critical role of skill accumulation, research, and training in economic development. Conversely, the long-run coefficient indicates a negative, statistically insignificant influence, with a 1% increase in research and development expenditure reducing real GDP per capita growth by 1.344 units over the long term.

Additionally, the ARDL short- and long-run analysis indicates that the coefficient for the logarithm of social services expenditure in the immediate period is positively correlated, though not statistically significant, with real GDP per capita growth in Nigeria in the short run. However, at lags 1, 2, and 3, a statistically significant negative effect on real GDP per capita growth is observed. In the long run, the coefficient demonstrates a statistically significant positive relationship, implying that a 1% increase in social services expenditure enhances real GDP per capita growth by 13.619 units. This finding is consistent with the study's initial expectations and supports Romer's (1986) endogenous growth theory, which

highlights the importance of investment in knowledge and innovation through social services as key drivers of productivity growth and development.

The ARDL short- and long-run estimates also indicate that the coefficients for the logarithm of recurrent health expenditure in the current period and at lags 1, 2, and 3 exhibit a negative correlation, with statistical significance observed only at the lagged periods. The long-run coefficient for recurrent health expenditure reveals a positive, though statistically insignificant, impact on real GDP per capita, suggesting that a 1% increase in health expenditure raises real GDP per capita growth by 4.737 units over the long term. These findings support the study's initial expectations and the contributions of Becker (1964), Schultz (1961), and Mincer (1974) to human capital theory, which contend that investments in health improve worker productivity, thereby enhancing their contribution to the production process and ultimately leading to higher individual incomes and increased national output.

The error correction term, $CointEq(-1)$, which indicates the rate of adjustment to equilibrium, is statistically significant (-0.563612, Prob. = 0.0001). This value suggests that approximately 56% of deviations from the long-term equilibrium are corrected annually, reflecting a rapid adjustment process to short-term fluctuations. The R-squared value of 0.861446 indicates a strong model fit, confirming the explanatory power of the analyzed variables regarding their impact on Nigeria's inflation rate.

Table 4.5: Post-Estimation Tests Results

Test	Null Hypothesis	F-Statistic	Probability	Decision
Serial Correlation LM Test	H_0 : No serial correlation	0.329655	0.7237	Retain H_0
Heteroskedasticity Test	H_0 : Homoscedasticity	0.692601	0.7664	Retain H_0
Normality Test	H_0 : Normally distributed	0.730747	0.693938	Retain H_0

Source: *Researcher's Computation using Eviews 12.*

The post-estimation diagnostics in Table 4.5 indicate that the ARDL model satisfies the principal classical econometric assumptions. There is no evidence of residual serial correlation: the Breusch–Godfrey LM statistic is 0.329655 with a p-value of 0.7237, which exceeds the 5% significance level and leads to a failure to reject the null of no serial correlation.

The Breusch–Pagan–Godfrey test supports homoscedasticity; its p-value of 0.7664 likewise exceeds 0.05, so the null hypothesis of constant variance is not rejected.

In addition, the Jarque–Bera statistic of 0.730747 yields a p-value of 0.693938, greater than 0.05, indicating that the residuals are normally distributed.

5. Conclusion and Recommendations

Conclusion

The study concludes that while human capital investment remains essential for economic development in Nigeria, the effectiveness of government expenditure depends largely on efficient allocation, implementation, and monitoring of resources. Strengthening institutional efficiency and ensuring that investments in education, health, research and development, and social services are properly targeted would enhance productivity, and promote sustainable economic development in Nigeria.

Recommendations

Based on the findings and conclusion drawn from this study, the following recommendations are made:

- i. The Nigerian government should improve the efficiency of education spending by prioritizing technical, vocational, and digital skills development that aligns with labour market demands.
- ii. The government should reform the research and development sector by promoting innovation partnerships between universities, industries, and research institutions. Incentives such as grants, tax reliefs, and innovation hubs would help transform R&D investment into productivity growth.
- iii. Nigeria should expand and better target social services expenditure toward infrastructure, poverty reduction, and basic welfare programs.
- iv. The government should increase and efficiently manage healthcare expenditure through stronger primary healthcare systems, universal health coverage, and preventive care programs.

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