Journal of Economic Studies (JES)
Department of Economics,
Nnamdi Azikiwe University, Awka,
Anambra State, Nigeria.

Web: www.nauecojournals.com *ISSN 1119-2259*

EMPIRICAL ANALYSIS OF HUMAN CAPITAL DEVELOPMENT AND ECONOMIC GROWTH IN NIGERIA: EVIDENCE FROM AUTOREGRESSIVE DISTRIBUTED LAG (ARDL)

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Abstract

The paradox in Nigeria's development trajectory, despite its abundant youthful population and natural resources, has given rise to an empirical study of human capital development and its impact on Nigeria's economic growth. The autoregressive distributed lag (ARDL) estimation technique was employed, with human capital index (HCI), government expenditure on education (GEE), and labour force participation (LFP) as core explanatory variables, and real gross domestic product (RGDP) as the control variable. Data were drawn from the Central Bank of Nigeria Statistical Bulletins 2024, National Bureau of Statistics, World Bank Development Indicators 2024 and International Labour Organisation annual data 2024. The result of the study indicated that human capital index has statistically significant positive impact on economic growth in the short run but a negative impact in the long-run. Government expenditure on education and labour force participation has statistically positive impact in both the short and long run. Therefore, the study concluded that structural weaknesses and insufficient long-term human capital development are the bane of economic growth in Nigeria and recommends a comprehensive restructuring of education to enhance efficiency, a better reward system for skilled human capital, the promotion of active labour market participation and strengthening the productivity of human capital. These measures are essential if long term contribution of human capital to economic growth in Nigeria can be sustained.

Keywords: Economic growth, Human Capital Development, Government Education Expenditure, ARDL, Nigeria.
JEL Classification Codes:C4, J24, H52, C5

1.0 Introduction

The sustained increase in a country's capacity to produce and improve goods and services over time is mostly acknowledged as economic growth (OECD, 2023). In recent times, 2024, Nigeria's economic growth has been in a positive trend. However, there seems to be a disconnect between Nigeria's economic growth and its development. According to the National

Bureau of Statistics (2023), Nigeria's economy has been growing at an average of 5.4%. However, this growth has been shrouded with overdependence on crude oil, weak industrialisation, shallow manufacturing base, macroeconomic instability, high unemployment rate, inadequate human capital development and insecurity among others (Human Capital Index, 2023; The World Bank, 2020). The Nigerian economic cost of insecurity has been estimated to by 2% to economic growth (Ibrahim & Bala, 2018), while electricity shortages and logistics bottlenecks reduce firm productivity by more than 40%, how can this growth be justified? The poor infrastructure, high poverty rate and low financial inclusion in Nigeria are still of concern in Nigeria's economy, as the African Development Bank (2021) reported that Nigeria's economy has an infrastructural gap of over $100, resulting in multiple economic problems, including a rise in multidimensional poverty (NBS, 2022).

Economic growth can be measured using different macroeconomic indicators, such as nominal gross domestic product (GDP), which is widely used to measure the total market value of all final goods and services produced within a country over a specific period. Real GDP (RGDP), which is nominal GDP adjusted for inflation (Barro, 1991; Todaro & Smith, 2015). Other quantifiable measures are GDP per capita, often employed to assess improvements in living standards and economic welfare (Romer, 1990; Lucas, 1988). Total Factor Productivity (TFP) is another measure that focuses on the efficiency in labour and capital utilisation (Solow, 1957; Jorgenson & Griliches, 1967) and sectoral outputs to represent economic growth (Ogujiuba & Adeniyi, 2004; Dauda, 2010; Lawal et al., 2016).

Among the recognised pillars of economic growth is human capital. Human capital is the stock of an accumulation of health, knowledge, skills and resilience for economic productivity and self-actualisation. Human capital is acquired through human capital development. According to Schultz (1961), human capital development is an investment into education, health and training of an individual that generates measurable returns. This concept was expanded by Becker (1964) as an investment in human beings for increasing individual earnings, productivity and societal welfare. The African Development Bank (AfDB) incorporated the socioeconomic dimension and argues that human capital development is multidimensional, connecting education, health, nutrition, employment and social inclusion as well as labour market efficiency. Conversely, the United Nations Development Programme (UNDP)

conceptualised it as development outcomes such as life expectancy, literacy and access to basic services (UNDP, 2018). The fundamental inference from all these perspectives is that human capital development is a process that significantly influences economic growth, reduces poverty and improves efficiency in the labour force (Ogundari & Awokuse, 2018; Adebayo, 2018).

Human capital development is mostly measured by improvements in education, health, skills and workforce productivity (Barro & Lee, 2013; UNESCO, 2022). In recent times, the Human Capital Index (HCI) and Human Development Index (HDI) developed by the World Bank (2018) have been adopted by most researchers as the most comprehensive measurement of human capital development. The use of HDI and HCI since its introduction by UNDP (2023) has become prominent, as they incorporate survival rates, expected years of schooling, learning outcomes and health conditions (WHO, 2021). Some researchers have also used other indicators, like government education expenditure, health expenditure, enrollment rates, and labour force participation, to evaluate human capital's contribution to economic growth (Bakare, 2012 and Ogunleye & Ayeni, 2019). The Nigerian human capital development index has indicated a disconnection with the positive economic growth as reported by the NBS (2023), a poverty rate of 46% in 2023 (World Bank, 2025), and youth unemployment was about 40% (NBS, 2023). Also, the 18.5 million out-of-school children and a primary school teacher-to-student ratio of 1:60, which is lower than the advised 1:30 (UNESCO, 2023). One may argue that there are disconnect between human capital development and economic growth, which is theoretically supposed to be positively related.

Nigeria faces not just significant socioeconomic challenges, but also high youth unemployment at 40%, which fuels instability and other social vices. The country, according to the World Bank (2025), has also been designated as the world's second-largest population in poverty (104 million people, a 46% rate). There is also a serious disconnect between the economic growth in the country and human development. The 2024 post-pandemic GDP growth of the country is on average 3.4%, but there has been an unabated increase in inflation at 26.6% and a depreciating currency, causing per capita income to drop to $824, its lowest level in two decades (NBS, 2023). Most critical sectors, such as education, have been severely hampered. Nigeria has about 18.5 million out-of-school children, 1:60 pupils against the recommended ratio of 1:30 (UNESCO, 2023). The health sector is also

in distress due to low funding, resulting in low life expectancy and high child mortality rates (Nigerian Medical Association, 2023; UNESCO, 2023). These problems have further compounded with heightened insecurity, gender inequality and a severe brain drain. The economy remains heavily reliant on oil for foreign exchange, clearly showing a stark contrast between theoretical economic potential and the nation's reality (Central Bank of Nigeria, 2023).

Multiple programs, initiatives and polices have been embarked on by Nigeria government to bolster human capital development. National Social Investment Program (NSIP), which had trained over 500,000 youths through the N-Power scheme by 2020, as well as long-term policy frameworks such as the National Development Plan (2021–2025). Also, the Economic Recovery and Growth Plan (ERGP, 2017–2020), the National Economic Empowerment and Development Strategy (NEEDS, 2003–2007), and the National Development Plan (2021–2025) were both the short and long-term plans. The Nigerian government went further to partner with the community, which led to World Bank investments of about $500 million in education and health infrastructure between 2015 and 2023, alongside planned funding of $500 million each for the HOPE-EDU and NG-CARES projects in 2025. Domestically, the government allocated 7% of the budget to education and 5.5% to health (BudgIT, 2023; World Bank, 2025). However, despite this concerted effort by the government, human capital development has been at best abysmal in Nigeria. These programs, initiatives and polices have not been able to translate into substantial economic growth. Therefore, questioning the increase in the human capital development and economic growth nexus.

While some studies have explored human capital and economic growth in Nigeria, few have provided a thorough, longitudinal examination using key variables like vocational training and health expenditure. A significant oversight in this literature is the exclusion of government expenditure on education (GEE) and labour force participation (LFP). This study aims to fill that gap by integrating these crucial metrics into its analysis that prior studies have largely overlooked.

2.0 Literature Review

2.1 Theoretical Literature

Human Capital Theory (1964)

Human Capital Theory (1964) was propounded by Gary Becker, who argues that investments in health, education, and training improve individual skills and productivity, thereby increasing economic value and fostering national development. The theory was built on the assumptions of

equal access to opportunities, rational investment choices and efficient labour markets that reward acquired skills. In the Nigerian context, however, these assumptions are contested (Adewale & Musa, 2022; Okafor et al., 2017). Critics note that structural barriers such as gender disparities, rural-urban divides and cultural constraints severely limit equal access, undermining the theory's applicability (Eze & Okpala, 2023). Additionally, deficiencies in educational infrastructure, with only 60% of primary schools meeting basic standards in 2023, alongside significant brain drain among skilled professionals, further diminish the potential returns on human capital investments (UNESCO, 2023). Nevertheless, the theory remains useful, as it supports the argument that targeted investments in health and education could enhance productivity and stimulate economic growth, provided that systemic issues of access and infrastructure are adequately addressed.

Endogenous Growth Theory

Endogenous growth theory, propounded by Romer (1986) and Lucas (1988), posits that long-term economic growth is not only internally driven by investments in human capital, but also through innovation and knowledge. It also argues that external capital accumulation alone cannot bolster economic growth. The model was built on the assumptions of increasing returns from human capital development, effective institutions and innovation. This theory and its model are extremely relevant to this study on how human capital development impact on economic growth, most especially as Nigeria is a heavy oil-dependent economy. It also brought to the fore the need to diversify through a skilled workforce to support non-oil sectors like technology and agriculture. The theory is not without criticism; most researchers criticised the theory's applicability in an economy with institutional weaknesses, including corruption and policy instability (Ibrahim & Okonkwo, 2020; Eze & Okpala, 2023). It is also argued that the model ignored the external constraints such as political uncertainty and inadequate infrastructure, which have resulted to a great extent in Nigeria's low 0.36 rank in HDI (World Bank, 2024). Despite these critiques, Endogenous Growth Theory substantiates the core premise of this research, that resolving institutional and funding deficits in health and education can enhance workforce productivity and drive sustainable economic expansion.

2.2 Empirical Literature

Numerous studies have empirically investigated the relationship between human capital development and economic growth; nonetheless, several of the studies that are most relevant are covered in this section.

A study by Chukwu and Ojo (2024) investigated the impact of education on economic growth in Nigeria and Kenya from 1995 to 2022. The study adopted panel regression analysis, drawing data from the World Bank, and they investigated GDP growth alongside school enrolment, teacher quality and education expenditure. The results showed that in Nigeria, a 1% increase in education spending boosted GDP by 0.25% through improved teacher quality, although the overall impact remained limited due to low funding in Nigeria, when compared to Kenya. The study recommended an increase in budgetary allocation for teacher training. In a similar study, Ogunleye and Awe (2024) employed an autoregressive distributed lag (ARDL) technique to examine the role of vocational training in economic growth in Nigeria and Ethiopia from 1990 to 2022. Using GDP growth, vocational enrolment, education funding and unemployment as the variables of analysis, the study found that a 1% increase in vocational training expenditure increases Nigeria's GDP by 0.21%, though short-term gains were modest because program coverage lagged behind Ethiopia's. The study advises expanding vocational training initiatives, aligning with Ethiopia's more successful approach.

A study by Adewale and Musa (2023) explored the impact of health expenditure on economic growth in Nigeria and Botswana from 1985 to 2021. Applying Johansen Cointegration, they found that in Nigeria, a 1% rise in health spending increased GDP by 0.21%. Nonetheless, the short-term impact was weaker in Botswana than in Nigeria due to shortages of medical personnel in Nigerian hospitals. Consequently, the study advocated for greater investment in healthcare workforce training. Similarly, Eniekezimene et al. (2023) study human capital development and economic growth in Nigeria and beyond. The study analysed data from 20 selected developing economies from 1981 to 2021 using ARDL. The result of the analysis indicated that while education expenditure had an insignificant negative impact when compared to other countries, health spending indicated a significant short-run increase in Nigeria's GDP. In another study, Ise et al. (2023) interrogated the relationship between human capital development and economic growth across ten African countries from 1980 to 2020. Applying OLS with cointegrating regression and variables such as the human capital development index, government expenditure, health and education spending, as well as foreign direct investment, the study finds that although life expectancy had a negative impact in Nigeria when compared to other nations, education spending had a significant

positive effect on human capital development in Nigeria. The study concludes by recommending enhanced healthcare infrastructure and increased education funding aligned with UNESCO benchmarks.

Okafor and Bello (2023) conducted a comparative analysis of education investment on economic growth in Nigeria and Rwanda from 1995 to 2021. Found that a 1% increase in education spending raised Nigeria's GDP by 0.23%. The study adopted the panel regression analysis and concluded that Nigeria's gains were weaker than Rwanda's due to poor educational infrastructure. Similarly, Yusuf and Ibrahim (2023) evaluated the effect of skills development on economic growth in Nigeria and South Africa from 1990 to 2021, using secondary data from the CBN Statistical Bulletin and applying Granger Causality Tests. They found that a 1% increase in expenditure on skills training raised Nigeria's GDP by 0.20%.

Salami and Adebayo (2023) evaluated the impact of healthcare on economic growth in Nigeria and Ghana from 1980 to 2021. Drawing data from the WHO and applying the vector error correction model (VECM), the study found that health expenditure has a significantly and positively impactful effect on GDP growth in Nigeria than in Ghana. In a related study, Enyekit et al. (2022) investigated the role of human capital in economic development between Nigeria and South Africa (1995–2020). The study adopted a panel regression approach, and the results revealed that a 1% increase in education spending will boost Nigeria's GDP by 0.24%; however, corruption in the health sector significantly reduced the overall impact. In a similar study, Oluwatoyin and Favour (2022) examined the human capital development on economic growth in 12 selected African countries from 1990 to 2020 using the Johansen Cointegration. The findings of the study showed that in Nigeria, a 1% rise in education investment increased GDP by 0.23%, but the benefits of health expenditure were moderated by infrastructural shortcomings compared to peer countries.

Oluwatobi and Olurinola (2021) investigated human capital investment and economic growth in 15 selected African countries, including Nigeria, from 1980 to 2019. The study found that education expenditure has a positive impact on Nigeria's GDP, though insignificant when compared to Rwanda. This the argued that it might be due to insufficient healthcare facilities. Similarly, Adeyemi and Ogunsola (2021) applied the ARDL approach to compare Nigeria and Botswana over the same period. Their study also found that investment in education bolstered Nigeria's economic growth, while

noting that corruption exerted only a moderate influence on health outcomes relative to the benchmark set by Botswana. Ibrahim & Okonkwo (2020) examined the impact of human Capital Development on economic growth in Nigeria. The study applied the vector error correction model (VECM) and findings showed that education expenditure increases Nigeria's GDP; however, health outcomes were insignificant when compared with other countries due to corruption, as a 1% rise in education spending raised Nigeria's GDP by 0.27%, but corruption continued to limit the health benefits of such investments, particularly when contrasted with Ghana. Similarly, Okeke and Umeh's (2020) study of human capital expenditure on economic growth in Nigeria and Botswana from 1980 to 2018 using the ARDL model found that while education spending has a positive impact on GDP growth, the corresponding health impacts remained positive though insignificant due to corruption. Furthermore, Olanrewaju and Okeke (2020) panel regression analysis of human capital development and economic growth in Nigeria, South Africa and selected Nigerian regions from 1995 to 2018, found that education expenditure is positive and significant on Nigeria's GDP, and corruption significantly reduces the health-related gains when compared with South Africa.

3.0 Data and Methodology

3.1 Theoretical framework

The theoretical framework underpinning this study is the endogenous growth theory of Romer (1986) and Lucas (1988). The endogenous growth theories by Romer and Lucas identify the economic growth drivers in the long-run within the economic system itself. These models propose a direct link between growth and human capital, often expressed in a simple functional form such as:

$$Y = f\ (H) \qquad 3.1$$

Also, econometrically as:

$$Y = \beta_0 + \beta_1 H + \mu \qquad 3.2$$

Where Y denotes economic growth, and H represents human capital measured through education levels, the human capital index (HCI), or skills acquisition.

In this framework, β0 is the intercept, β_1 is the parameter estimate, which is expected to be positive, indicating that increases in human capital raise economic growth. Unlike the Solow model, which attributes long-term growth to external technological progress, Romer and Lucas contend that growth is driven endogenously through deliberate investment in knowledge and skill formation. Their approach highlights key mechanisms such as non-rival knowledge and human capital externalities, which help overcome diminishing returns and sustain growth over time.

This perspective is particularly pertinent to Nigeria, where economic diversification and the movement of labour from low-productivity activities (like subsistence agriculture) to higher-productivity sectors (such as manufacturing and services) depend heavily on improving education, health and skill development to enhance workforce productivity. Romer's contribution focuses on knowledge as a non-rival input whose spillovers from private research and development activities fuel ongoing technological advancement. Lucas complements this by emphasising human capital accumulation, arguing that as individuals acquire more skills, the resulting externalities raise overall productivity and allow for sustained, long-term growth through continuous investment in people.

3.2. Model Specification

To empirically determine the impact of human capital development on economic growth in Nigeria, this study adopts the autoregressive distributed lag (ARDL) model. The ARDL technique is particularly advantageous as it can accommodate variables with different levels of integration and delivers reliable estimates even when the sample size is relatively small. A common feature of macroeconomic data in developing countries. In this framework, the annual GDP growth rate is used as the dependent variable, representing economic performance. The key independent variables are the human capital index (HCI), government spending on education (GEE), and the labour force participation rate (LFP). This model is specified in line with the framework of Adeyemi and Ogunsola (2021), with slight modifications to suit the specific context and data of this analysis.

The general functional form of the ARDL model is given as:

$$RGDP = f\ (HCI, GEE, LFP) \qquad 3.3$$

Where RGDP is real gross domestic product (annual growth rate %), HCI is the human capital index, GEE is the government expenditure on education, and LFP is the labour force participation.

It can also be specified in econometrics form as:

$$\mathrm{RGDP}_t = \beta_0 + \beta_1 \mathrm{HCI}_t + \beta_2 \mathrm{GEE}_t + \beta_3 \mathrm{LFP}_t + \mu_t \qquad 3.4$$

Where: β_0 is an intercept of the model, and β_1 to β_4 are the coefficients of the explanatory variables

Equation 3.4 can further be modified to a normalize form in logarithms to enable the coefficients to be interpreted as elasticities. Therefore, equation 4 modified as:

$$ln\mathrm{RGDP}_t = \beta_0 + \beta_1 lnRGDP_{t-1} + \beta_2 \mathrm{HCI}_{t-1} + \beta_3 \mathrm{GEE}_{t-1} + \beta_4 \mathrm{LFP}_{t-1} + \mu_t \qquad 3.5$$

Where, *In* is the log of the variables and other variables remain as defined in equation 3.3

In other to capture the interactions among the variables as specified in the econometric model 3.3, the ARDL model by Pesaran, Shin and Smith (2001), was used as specified below:

The generalized ARDL (p, q) model is specified as

$$Y_t = \gamma_{0i} + \sum_{i=1}^{p} \delta_1 Y_{t-1} + \sum_{i=1}^{p} \beta_1 X_{t-1} + \mu_t \quad 3.6$$

Where Y_t is a vector and variables in (X_t) [1] are allowed to be purely I (0) or 1(1) or co-integrated; β and δ are coefficients; γ is the constant k; í = 1, p, q are optimal lag orders; ε_t is a victor of the error terms, unobservable zero mean white noise vector process (serially uncorrelated or independent).

Therefore, equation 3.6 is modified as:

$$\Delta \text{InRGDP}_t = \text{In}\beta_0 + \beta_1 In\text{RGDP}_{t-1} + \beta_2 In\text{HCI}_{t-1} + \beta_3 In\text{GEE}_{t-1} + \beta_4 In\text{LFP}_{t-1} + \sum_{i=1}^{p} \alpha_1 \Delta InRGDP_{t-1} + \sum_{i=1}^{p} \alpha_2 + \Delta InHCI_{t-1} + \sum_{i=1}^{p} \alpha_3 + \Delta InGEE_{t-1} + \sum_{i=1}^{p} \alpha_4 + \Delta InLFP_{t-1} + \mu_t \quad 3.7$$

Equation 3.7 as specified integrated all the objectives of this study and were estimated.

Table 3.1: Description and Measurement of Variables

Variable	Measurement	Source of data
Real Gross Domestic Product (RGDP)	Annual RGDP growth rate (%) discounted for inflation.	National Bureau of Statistics (NBS), (2025)
Human Capital Index (HCI)	Composite index of health and education outcomes (scale 0–1)	World Bank, (2025)
Government Expenditure on Education (GEE)	Total public spending on education (% of government expenditure or NGN)	World Bank, (2025)
Labour Force Participation (LFP)	Percentage of working-age population (15–64) employed or seeking employment	International Labour Organization (ILO), (2025)

Sources: Researchers' computation, 2025.

3.3. Data Analysis Techniques

The analysis is time series-based; NBS, World Bank, and International Labour Organisation (ILO) provided the data for the variables. The ADF test was adopted to ascertain stationarity. To check for long-term relationships, the Johansen cointegration test was also performed. The model's parameters are estimated using the ARDL approach.

4.0 Presentation of Results and Discussion of Findings

4.1. Stationarity Test

The stationarity is established using the ADF test, and the result is stated in Table 4.1.

Table 4.1: Summary of ADF Unit Root Test Results

Table 4.1: Unit root (ADF)

Variables	ADF test at levels	5% critical value at level	ADF test (first diff)	5% critical value (first diff)	Order of integration	Remarks
RGDP	-2.7308	-2.8801	-3.7850	-2.8801	I(1)	Stationary
HCI	-2.9285	-2.8796			I(0)	Stationary
GEE	-0.9781	-2.8796	-3.7832	-2.8796	I(1)	Stationary
LFP	-5.6390	-2.8796			I(0)	Stationary

Source: Researchers' compilations, 2025

Decision Rule: Reject H_0 if the ADF test statistic is greater than 5% critical value, otherwise accept. From Table 4.1, the real gross domestic product RGDP and government expenditure on education (GEE) were greater than their 5% critical value at level *I*(*1*), as indicated, while the human capital index (HCI) and labour force participation (LFP) are greater than their 5% critical value at first difference level *I*(*0*). These unit root results reveal that the variable have mix order integration of *I(0)* and *I(1).* In such a context, the ARDL bounds test approach is suitable to examine if there are long run relationship among the variables.

4.2: Lag Length and Order Selection Criteria

Choosing the ideal lag length is essential for estimating the parameters of this model. Table 4.2 displays the outcome of this investigation, which used an optimal lag length selection criterion.

Table 4.2: Lag Selection and Lag Order Results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	98.06917	NA	1.51e-09	-8.958968	-8.760012	-8.915790
1	131.9303	51.59792	2.86e-10	-10.66003	-9.665246	-10.44414
2	169.6532	43.11189*	4.41e-11	-12.72888	-10.93827	-12.34027
3	196.7283	20.62867	2.80e-11*	-13.78365*	-11.19721*	-13.22233*

Source: Researchers' computation, 2025.

Using the Schwarz Criterion (SC) in Table 4.2, with a lag length of 3, possesses the smallest value (-11.19721) and is thus selected for the model.

4.1.4 Cointegration Test (Bound Test)

Table 4.3: ARDL Bound Test Results

Model 1	Value	Significance	1(0)	1(1)
F-statistics	5.937767	10%	2.37	3.2
K	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

Researchers' computation, 2025

The co-integrating was evaluated through the ARDL bounds test. The result in Table 4.3 indicates that the F-statistic value (5.937767) is greater than the lower and upper critical bounds at 5% significant value. This result indicates evidence of co-integration among the variables. The conclusion from the result is the rejection of the null hypothesis of no co-integration. Since the variables are co-integrated, we estimate the long-run consumption function and the short-run dynamic using the ARDL technique as suggested by Stock and Watson (1993).

4.4 Evaluation of Long and Short Run Estimation

Since the bounds test indicated the presence of long-run relations among the variables, we then go further to estimate the long-run model to ascertain the coefficients of the variables. The long-run and short-run dynamics results are presented in Table 4.4. economic growth. This is suggestive of brain drain in the country.

The results in Table 4.4 indicated that although most variables follow theoretical expectations, the human capital index deviates from this a priori expectation and not all variables show statistical significance in the long run. The long-run coefficient for the human capital index (0.36) indicates that a 1% increase in the human capital index leads, on average, an increase of 0.36% decline in Nigeria's RGDP. This implies that human capital development, as measured in this study, exerts a negative long-term effect on

In contrast, the long-run coefficient for government expenditure on education is 3.45, which implies that a 1% increase in education expenditure results in an increase of 3.5% in RGDP. This finding also aligns with the studies of Keji (2021) and Ise et al. (2023), which similarly found a positive relationship between education investment and economic growth. The coefficient for labour force participation is 79.06, indicating that a 1% increase in labour participation causes an increase of 8% in

RGDP, highlighting its strong positive long-run impact in economic growth of Nigeria.

Table 4.4: Summary of Long Run Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
InHCI	-0.359049	12.26529	-0.029274	0.9772
InGEE	3.450210	2.248739	1.534287	0.1532
InLFP	79.06220	58.52241	1.350973	0.2038
C	-344.4881	246.4332	-1.397896	0.1897

Short Run Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(InGDP(-1))	0.574958	0.165525	3.473552	0.0052
D(InHCI)	18.00992	3.301111	5.455715	0.0002
D(InHCI(-1))	11.71417	3.033878	3.861120	0.0026
D(InGEE)	0.170240	0.589146	0.288960	0.7780
D(InLFP)	17.79205	3.038396	5.855740	0.0001
D(InLFP(-1))	-7.460695	2.398413	-3.110680	0.0099
CointEq(-1)*	-0.342347	0.053805	-6.362765	0.0001
R-squared	0.789667	Mean dependent var		-0.033048
Adjusted R-squared	0.705533	F-statistics		5.937767
S.E. of regression	0.250380	Akaike info criterion		0.321699
Sum squared resid	0.940354	Schwarz criterion		0.668849
Log likelihood	3.461312	Hannan-Quinn criter.		0.403477
Durbin-Watson stat	1.957978			

Researchers' computation, 2025.

On the short-run estimates, all the coefficients follow expected signs, showing positive short-term impacts for the human capital index, government expenditure on education and labour force participation, with respective coefficients of 18.01, 0.170, and 17.79. This implies that a 1% increase in these variables increases short-run economic growth by roughly 1.8%, 0.17%, and 1.8%. However, it is only education expenditure that is not statistically significant, while all other variables are significant. The error correction term also behaves as expected: its coefficient of –0.34 indicates that about 34% of deviations from long-run equilibrium are corrected each year.

The model also demonstrates strong explanatory power, with an R^2 of 0.7055, meaning that roughly 71% of the variation in GDP is explained by the included variables. A higher adjusted coefficient of determination (0.7897) further supports the model's robustness. The F-statistic of 5.938 confirms the joint significance of all explanatory variables. Additionally, the Durbin-

Watson statistic of 1.96 suggests the absence of autocorrelation, indicating that the model is statistically reliable.

4.5. Post Estimation Diagnostic Tests

4.5.1. Heteroscedasticity Test

An estimated model with non-constant variance may produce a biased outcome; thus, the Breusch-Godfrey serial correlation LM test was utilised to check if the model is homoscedastic.

Table 4.5. Breusch-Pagan-Godfrey Heteroskedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.289792	Prob. F(10,11)	0.9696
Obs*R-squared	4.587321	Prob. Chi-Square(10)	0.9170
Scaled explained SS	1.530151	Prob. Chi-Square(10)	0.9988

Researchers' computation, 2025.

Heteroscedasticity is nonconstant of the error variance, where the variance of the residuals is unequal over a range of measured values. Heteroscedasticity. Decision rule: Reject H0 if Obs* R-squared of probability chi-square is less than 5% critical value. From the result above, since the Obs* R square probability chi-square is greater than 0.05 i.e. 4.5873 > 0.05, we therefore accept H0 and conclude that errors in the regression have constant variance. The result is shown in Table 4.5.

4.5.2. Test for Serial Correlation

Using the Breusch-Godfrey Serial Correlation LM Test shown below, the test for serial correlation was conducted.

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	2.184040	Prob. F(2,9)	0.1686
Obs*R-squared	7.188599	Prob. Chi-Square(2)	0.0275

Source: Researchers' computation, 2025.

Serial correlation is defined as the correlation between members of a series of observations ordered in time. The test is to see if there are residuals that are correlated with each other. The decision rule is based on the probability of the chi-square. Ho: There is no serial correlation among the

independent variables. And based on the result in Table 4.6, the p-value obtained is 0.1686, we accept the null hypothesis that there is no serial correlation and reject the alternative hypothesis. Therefore, the variables in the models are reliable for predictions.

Test for Stability

The stability of a model is shown by its capability to justify that the coefficients of the model are steady over the sample interval, and the stability of this model was verified using the CUSUM and CUSUM of squares.

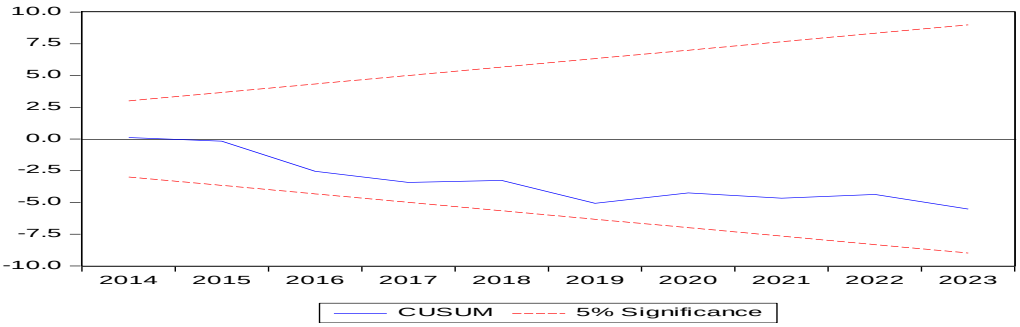

Figure 4.1: CUSUM Test
Researcher's computation, 2025.

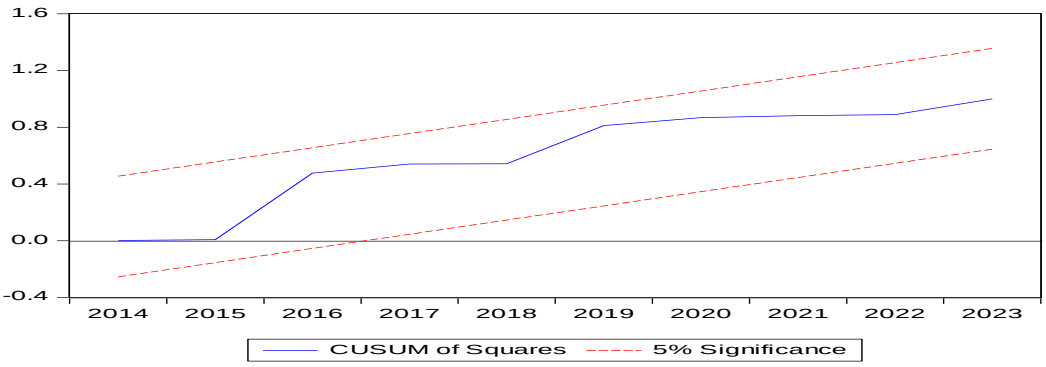

Figure 4.2: CUSUM of Squares Test
Researcher's computation, 2025.

The results of the stability tests indicated that the CUSUM line falls within -2 and +2 standard errors, and the CUSUM of squares plot line falls within -0.4 and +4 standard errors, all at a five per cent level of significance. These results show that the model is stable over the period under study.

5.0 Conclusion and Recommendations

5.1 Conclusion

The empirical results from Table 4.4 clearly demonstrate how human capital influences Nigeria's economic growth. In the long run, the human capital development indicated a negative and statistically significant impact on economic growth, suggesting structural weaknesses in the quality, efficiency or utilisation of human capital in Nigeria. This outcome strongly suggested that despite improvements in education and health indicators, the gains are not yet translating

into sustained long-term productivity, hence sustained economic growth. However, government expenditure on the other hand, on education asserts a strong, positive and significant long-run impact on economic growth, reinforcing the idea that targeted investments in the education sector hold substantial potential for stimulating economic growth in Nigeria. Labour force participation also shows a positive impact on economic growth in both the long and short run, highlighting the importance of an active and engaged workforce in driving economic growth. The short-run estimates further affirm positive contributions from all variables, although education expenditure is not statistically significant in the short term. The error correction term is correctly signed, indicating a stable system that adjusts toward long-run equilibrium at a moderate speed of 34%. Overall, the model satisfies all the statistical requirements and can be adjudged robust and reliable.

5.2 Policy Recommendations

Based on these findings, some policy recommendations are adduced. The negative long-run impact of human capital development suggests an urgent need to improve the quality and effectiveness of human capital development policies. The government should intensify initiate and intensify efforts to enhance the quality of education and health service delivery in the country. Focusing on access to education may not be enough, but also on learning outcomes, teacher quality, healthcare infrastructure and skill relevance to labour market needs.

Given the strong positive impact of government expenditure on education, policymakers have to increase and sustain education funding, ensuring that resources are efficiently used, properly allocated and targeted toward critical areas such as teacher training, school facilities, research and development, as well as curriculum modernisation. The policymakers should also significantly encourage labour force participation by creating and expanding job opportunities, strengthening vocational and technical training, and designing labour-market policies that encourage higher workforce engagement.

Additionally, since short-run results show an insignificant impact of education expenditure, government intervention should prioritise long-term structural reforms over temporary or fragmented expenditure. The economic policy should strengthen or initiate a continuous monitoring and evaluation system that should be able to track progress and ensure that human capital investments generate measurable economic returns over time.

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