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Human Development and Economic Growth in Nigeria: Disaggregated Evidence from an ARDL Bounds Testing Approach, 2000 to 2024

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Abstract: *The relationship between human development and economic growth is usually examined by regressing output on the composite Human Development Index, a practice that conceals which dimension of human development actually carries the growth effect. Recent cross-country evidence sharpens the question, since Puttitanun and Lerskullawat (2025) find that human development raises growth significantly in middle- and high-income countries but not in low-income ones, while Ogundari and Awokuse (2018) find health contributing more than education across sub-Saharan Africa. This paper separates the index into its three constituent dimensions, namely a long and healthy life, access to knowledge, and a decent standard of living, and estimates the effect of each on economic growth in Nigeria over the period 2000 to 2024. An autoregressive distributed lag bounds testing approach is applied to annual time series data drawn from the Central Bank of Nigeria, the National Bureau of Statistics, the United Nations Development Programme, and the World Bank, with the inflation rate retained as a macroeconomic control. The bounds test returns an F statistic of 7.264 against an upper critical bound of 4.68 at the 1% level, confirming a stable long-run relationship. In the long run, all three dimensions raise economic growth significantly: life expectancy carries a coefficient of 4.501, access to knowledge 10.644, and standard of living 0.148, while inflation is insignificant. The error correction term is negative and significant at -0.894, indicating that approximately 89% of short-run deviation from equilibrium is corrected within a single year. Two findings carry particular weight. Access to knowledge exerts the largest long-run effect of the three dimensions, which reverses the ordering Ogundari and Awokuse (2018) report for the region. And the short-run coefficients on life expectancy and access to knowledge are negative even though their long-run effects are strongly positive, a pattern consistent with human capital investment imposing costs before it yields returns. The paper concludes that human development in Nigeria is a driver of growth rather than merely a consequence of it, and that the composite index obscures a substantial difference in the growth relevance of its parts.*

Keywords: human development; economic growth; life expectancy; access to knowledge; standard of living; ARDL bounds test; Nigeria
JEL Classification: O15, O47, I15, I25, C22

INTRODUCTION

Whether development should be measured by output or by the lives people are able to lead is among the oldest questions in development economics, and it remains unsettled in practice. Sen (1999) argued that development is properly understood as the expansion of the real freedoms people enjoy, and that identifying it with growth in gross national product, rising personal incomes, industrialisation, or technological advance mistakes an instrument for an end. This is not a claim that output is irrelevant. It is a claim that output is not a sufficient condition for development, and that dimensions such as health, education, and basic economic security belong in the account (Todaro & Smith, 2020).

The Human Development Index, proposed by Mahbub ul Haq in 1990 on the conceptual foundation Sen had laid, gave this argument an operational form. The index combines a long and healthy life, measured by life expectancy at birth, access to knowledge, measured through schooling and literacy, and a decent standard of living, measured by gross national income per capita, into a single score between zero and one (United Nations Development Programme [UNDP], 2024b). It has been published annually since 1990 and has become the standard alternative to output-based measures of national progress.

Its strength as a communication device is also its weakness as a research instrument. By compressing three dimensions into one number, the index makes countries comparable at a glance but makes it impossible to say which dimension is doing the work in any given relationship. A study that regresses growth on the composite index can establish that human development and growth move together; it cannot say whether the association runs through health, through education, through income, or through some combination whose components operate over different time horizons. For a government allocating a constrained budget between hospitals, schools, and income support, that distinction is the whole of the practical question.

Two recent findings make the question more pressing rather than less. Puttitanun and Lerskullawat (2025), applying system generalised method of moments estimation to a large country panel, found that human development exerts a positive and statistically significant effect on economic growth in middle- and high-income countries, but no significant effect in low-income countries. If that conditionality holds, the growth case for human development investment is weakest precisely where human development is lowest, which would be a discouraging result for countries in Nigeria's position. Separately, Ogundari and Awokuse (2018), using system GMM on a panel of sub-Saharan African countries, found that both health and education raise growth but that the contribution of health is the larger of the two. Whether that ordering holds within individual African economies, and whether it survives when the income dimension is estimated alongside health and education rather than omitted, has not been established for Nigeria.

The Nigerian context gives these questions particular force. The country holds substantial crude oil deposits alongside zinc, lead, gold, and uranium, and its resource base is in principle capable of financing the roads, electricity supply, water systems, hospitals, and schools on which human development depends. Yet Nigeria's HDI value stood at 0.548 in 2022, placing it in the low human development category despite a 22% improvement over the preceding two decades, and inequality reduces that value by a further 32.7% when the inequality-adjusted measure is applied (UNDP, 2024a). The 2022 national Multidimensional Poverty Index survey found that 63% of the population, some 133 million people, are multidimensionally poor, with the incidence rising to 72% in rural areas against 42% in urban areas, and with two thirds of children deprived across multiple dimensions (National Bureau of Statistics [NBS], 2022). Recent policy changes, notably the removal of the fuel subsidy and reform of the foreign exchange regime, have raised the domestic price level sharply while their longer-term welfare effects remain unresolved.

Evidence on whether human capital drives Nigerian growth is substantial but unsettled. Keji (2021), using vector error correction and Johansen cointegration methods on data from 1981 to 2017, found that human capital indicators exert a significant long-run effect on Nigerian economic growth, with student enrolment and labour participation emerging as important determinants. Adeyemi and Ogunsola (2016) reached a similar conclusion using an ARDL specification, and Eigbiremolen and Anaduaka (2014) found human capital development positively related to growth. Dauda (2010) found education investment growth-enhancing over the long run, and Onisanwa (2014) reported a positive contribution of health to Nigerian output. Against these, Amassoma and Nwosa (2011) found no causal link between human capital investment and economic growth in Nigeria using vector error correction and pairwise Granger causality techniques. Keji (2021) attributes the lack of consensus partly to measurement, noting that studies differ in which indicators they treat as capturing human capital, and partly to method.

That diagnosis points directly to the approach adopted here. Much of the Nigerian literature proxies human capital by government expenditure on education and health, or by enrolment ratios, rather than by the outcomes those inputs are intended to produce. Expenditure measures what is spent, not what is achieved, and in a setting where the efficiency of public spending is itself contested, the distinction is not trivial. Life expectancy, literacy, and income per capita are outcome measures, and they are the dimensions from which the HDI is constructed.

The direction of the relationship examined here requires a word of explanation, because both directions have support. One tradition holds that growth must precede human development, on the reasoning that rising income supplies the resources with which governments and households invest in health and education. A second holds that the relationship is mutually reinforcing, since healthier and better

educated populations are more productive, which raises output, which in turn funds further social investment (Ranis et al., 2000). This study tests the second direction, treating human development as the explanatory factor and economic growth as the outcome, which is the specification most closely aligned with endogenous growth theory (Lucas, 1988; Romer, 1990) and the one on which Nigerian policy guidance most directly depends.

Three specific objectives follow. The first is to determine the effect of a long and healthy life, proxied by life expectancy at birth, on economic growth in Nigeria. The second is to evaluate the effect of access to knowledge on economic growth. The third is to examine the effect of a decent standard of living on economic growth. The corresponding null hypotheses are stated in Section 2.4.

The study period runs from 2000 to 2024 and is chosen deliberately. It opens with the adoption of the Millennium Development Goals in 2000 and spans their conclusion in 2015 and the subsequent adoption of the Sustainable Development Goals with their 2030 horizon, which allows human development performance to be observed across two successive international frameworks. It also covers a period of substantial macroeconomic turbulence, including the oil price boom of the mid-2000s, the global financial crisis, the 2016 and 2020 recessions, two major currency adjustments, the removal of the fuel subsidy, and the emergence and intensification of insurgency in the north east.

The paper offers three contributions. First, it disaggregates the Human Development Index rather than treating it as a single construct, which allows the relative growth relevance of health, knowledge, and living standards to be compared directly within one specification, and which permits a direct test of the health-over-education ordering that Ogundari and Awokuse (2018) report for the region as a whole. Second, it supplies single-country evidence on the income-level conditionality identified by Puttitanun and Lerskullawat (2025), since Nigeria sits at the lower end of the income distribution where their panel results suggest the human development effect may not operate. Third, it applies the ARDL bounds testing procedure, which accommodates regressors of mixed integration order and performs reliably in small samples (Pesaran et al., 2001), and which separates short-run from long-run effects. That separation proves consequential, because the two horizons carry opposite signs for two of the three dimensions.

The remainder of the paper is organised as follows. Section 2 reviews the conceptual, theoretical, and empirical literature and develops the hypotheses. Section 3 describes the data and methodology. Section 4 presents the results. Section 5 discusses them. Section 6 concludes and sets out the policy implications, limitations, and directions for further research.

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LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Conceptual Review

Human Development and the Human Development Index

Human development refers to the process of enlarging people's choices and expanding the capabilities available to them, of which the most fundamental are to lead a long and healthy life, to be knowledgeable, and to command the resources needed for a decent standard of living (Sen, 1999; Todaro & Smith, 2020; UNDP, 2024a). The concept deliberately positions people rather than output as the criterion by which a country's progress is assessed.

The Human Development Index operationalises this by combining three-dimension indices through a geometric mean, producing a score between zero and one. Health is captured by life expectancy at birth. Knowledge is captured by mean years of schooling among adults aged 25 and over, together with expected years of schooling for children of school-entering age. Standard of living is captured by gross national income per capita in purchasing power parity terms (UNDP, 2024b). Countries are classified into four tiers, from low to very high human development.

The geometric mean matters conceptually. Because it penalises unevenness across dimensions, a country cannot compensate for very poor health outcomes through very high income in the way an arithmetic average would permit. This design choice embeds the judgement that the three dimensions are complements rather than substitutes, which is precisely why examining them separately is informative: if the index treats them as non-substitutable, their individual relationships with growth are worth establishing rather than assuming.

The index has recognised limitations. It is insensitive to distribution, so two countries with identical scores may differ substantially in how development is shared, a limitation the UNDP addresses partially through the inequality-adjusted HDI and one that matters acutely for Nigeria, where inequality reduces the headline value by almost a third (UNDP, 2024a). SenGupta (2024), analysing 52 African countries, found that income inequality significantly depressed life expectancy across the continent, which indicates that distributional and dimensional outcomes are themselves connected. The index also omits environmental sustainability, political freedom, and security, each of which is material in the Nigerian setting. Alternative measures have been developed in response, including the Multidimensional Poverty Index now embedded in Nigeria's medium-term national development planning (NBS, 2022), and Al Hilani (2012) argues that gender discrimination and inequality indices should be considered alongside the HDI before policy conclusions are drawn.

Economic Growth and Real Gross Domestic Product

Gross domestic product is the total market value of all final goods and services produced within a country in a given period. It measures economic output and size but does not account for distribution, so a high figure does not imply broadly shared prosperity, and it excludes the social and environmental costs of production.

Real gross domestic product adjusts this total for price changes by valuing output at the prices of a base year rather than current prices, and is obtained by dividing nominal GDP by the GDP deflator. Removing the effect of inflation means that movements in real GDP reflect changes in the actual volume of goods and services produced rather than changes in their prices, which makes the measure suitable for comparison across time (Mankiw, 2020). Economic growth in this study is measured by the annual rate of change in real GDP, which is the conventional dependent variable in the growth literature and which expresses performance in comparable terms across years of very different nominal magnitude.

Theoretical Framework

Endogenous Growth Theory

The study is anchored principally on endogenous growth theory, which holds that growth is generated within the economic system rather than arriving as an exogenous residual. Solow (1956) established the neoclassical benchmark in which long-run growth depends on exogenous technical progress. Romer (1990) modelled technological change as the outcome of deliberate investment by profit-seeking agents, while Lucas (1988) placed human capital accumulation at the centre, arguing that investment in education and skills raises not only the productivity of the individual but the productivity of those who work alongside them. The externality is what generates sustained growth: because the social return to human capital exceeds the private return, accumulation does not exhaust itself in diminishing returns. Mankiw et al. (1992) subsequently augmented the Solow framework with human capital and showed that the extended model accounts substantially better for observed cross-country income variation, a specification that has since become the standard empirical point of departure (Ogundari & Awokuse, 2018).

This supplies the direct theoretical link to the dimensions of the Human Development Index. Access to knowledge is human capital accumulation in the sense Lucas intended. Health, as Bloom et al. (2004) demonstrate within a production function framework, functions as a distinct form of human capital: healthier workers are physically more productive, lose fewer working days, and face a longer horizon over which to recoup investment in their own education. Makuta and O'Hare (2015) show for sub-Saharan Africa that the translation of health spending into health status depends heavily on

governance quality, which indicates that the health channel is institutionally mediated rather than automatic. Standard of living operates through the resource channel, since households commanding higher incomes can finance schooling, nutrition, and healthcare that raise their productive capacity.

Competing Accounts of the Direction of Causation

Three positions may be distinguished. The growth-first position holds that economic growth must precede human development, because rising income supplies the resources from which health and education are financed. On this account, the appropriate policy sequence is to pursue output growth and allow human development to follow.

The virtuous circle position, developed by Ranis et al. (2000), holds that the relationship is bi-directional and mutually reinforcing. Human development raises productivity and therefore growth, while growth generates the public revenue and household income that fund further human development. The implication is that the two chains must be maintained together, since a country strong in one and weak in the other tends to revert rather than converge.

A third position holds that the relationship is conditional rather than universal. Puttitanun and Lerskullawat (2025) found the human development effect on growth significant in middle- and high-income countries but absent in low-income ones, and Akinlo and Oyeleke (2020) reached a compatible conclusion for sub-Saharan Africa, finding that the human capital and growth connection depends on the level of economic development attained. A related threshold argument runs in the same direction: human development may need to reach a functional level before it registers in productivity, since marginal improvements in literacy or life expectancy from a very low base may not translate into measurable output effects.

The present study tests the human-development-to-growth direction. It cannot by itself adjudicate between these positions, but the pattern of its short-run and long-run coefficients bears on them, and this is taken up in Section 5.

Empirical Review

Cross-Country and Regional Evidence

Among studies treating human development as a composite, Gulcemal (2020) analysed 16 developing countries using fixed and random effects panel estimation and found a positive and significant effect of human development on economic growth. Dervis and Klugman (2011) reviewed the contribution of the human development approach in the context of debates surrounding the Commission on the Measurement of Economic Performance and Social Progress, setting out the analytical purposes the index has served since 1990. Al Hilani (2012), examining nine countries including Equatorial Guinea,

Botswana, South Africa, Gabon, Angola, and Qatar, argued that the HDI provides a credible multidimensional alternative to income-based assessment. His sample is instructive, since several of these countries combine high income per capita with modest human development outcomes, which is the divergence that motivates disaggregated analysis.

Puttitanun and Lerskullawat (2025) provide the most directly relevant recent evidence. Applying system GMM across income groups, they found human development positively and significantly associated with growth in middle- and high-income countries but not in low-income ones. Their result implies that the aggregate relationship reported in earlier composite studies may be driven by the upper part of the income distribution, and it establishes the specific empirical question this paper addresses for Nigeria.

Regional evidence for sub-Saharan Africa is more consistently positive but divides on which dimension dominates. Ogundari and Awokuse (2018), analysing 35 countries from 1980 to 2008 using system GMM, found that both health and education raise economic growth, with the contribution of health the larger of the two. Akinlo and Oyeleke (2020), covering 36 countries from 1986 to 2018 using dynamic and static estimation with alternative human capital indicators, likewise found both education and health measures positive and significant, while emphasising that the strength of the relationship varies with the level of economic development. Oyinlola et al. (2021) examined human capital, innovation, and inclusive growth across the region and found human capital central to inclusive outcomes rather than to output alone. Asongu and Odhiambo (2023), using quantile regressions, found that the health and growth relationship in sub-Saharan Africa varies across the conditional distribution of growth, which suggests that average effects conceal meaningful heterogeneity. Awad (2021), posing the same health-versus-education question for the MENA region, reached a different ordering from Ogundari and Awokuse, which indicates that the ranking of dimensions is not a general property but a regional or national one.

Nigerian Evidence

Keji (2021) examined human capital and economic growth in Nigeria between 1981 and 2017 using vector autoregressive and Johansen cointegration techniques, and found that human capital exerts a significant long-run effect on growth, with student enrolment, labour participation, and total labour force emerging as important determinants. The study also documented the absence of consensus in the prior Nigerian literature and attributed it to differences in how human capital is measured and in the econometric methods applied.

Adeyemi and Ogunsola (2016), using an ARDL specification, found human capital investment positively and significantly related to Nigerian growth in the long run, and recommended increased

education spending. Eigbiremolen and Anaduaka (2014) reached a similar conclusion. Dauda (2010) found that investment in education contributed positively to Nigerian growth, and Onisanwa (2014) reported a positive health contribution to output. Iyoha and Oriakhi (2002), in an earlier assessment of Nigerian growth performance, identified human capital deficiencies among the constraints on output.

Contrary evidence exists and is not marginal. Amassoma and Nwosa (2011), using vector error correction and pairwise Granger causality methods, found no causal relationship between human capital investment and economic growth in Nigeria. Keji (2021) notes further that studies applying the same ARDL methodology to broadly similar Nigerian data have reached opposing conclusions, which points to specification and measurement rather than to genuine instability in the underlying relationship.

A feature common to most of this work is that human capital is proxied by inputs, chiefly government expenditure on education and health or school enrolment ratios, rather than by outcomes. The distinction matters in a setting where the efficiency with which public spending converts into human development is itself in question, and it is the principal methodological respect in which the present study departs from the existing Nigerian literature.

Gaps in the Literature

Three gaps emerge. First, studies examining Nigeria have generally used composite indices or input-based proxies, leaving the relative growth contribution of health, knowledge, and living standards unresolved within a single outcome-based specification. Second, the health-over-education ordering established for sub-Saharan Africa by Ogundari and Awokuse (2018) has not been tested within individual member economies, and the contrary MENA finding of Awad (2021) suggests it should not be assumed to hold universally. Third, the income-level conditionality identified by Puttitanun and Lerskullawat (2025) and Akinlo and Oyeleke (2020) raises the question of whether human development registers as a growth driver at all in a low human development country, which single-country evidence is well placed to address and which the available Nigerian studies, predating the recent period of subsidy removal, exchange rate liberalisation, and accelerated inflation, cannot resolve.

Hypotheses

The following null hypotheses are tested:

$H_0$1: A long and healthy life, proxied by life expectancy at birth, has no significant effect on economic growth in Nigeria.

$H_0$2: Access to knowledge has no significant effect on economic growth in Nigeria.

$H_0$3: A decent standard of living has no significant effect on economic growth in Nigeria.

DATA AND METHODOLOGY

Research Design

The study adopts an ex post facto research design. The design is appropriate where the variables of interest have already occurred and cannot be manipulated by the researcher, and where relationships must be inferred from recorded historical data. All variables employed here are drawn from published official statistics covering economic activity that has already taken place.

Data Sources and Coverage

The study uses annual time series data for Nigeria covering 2000 to 2024, giving 25 observations. Data were compiled from the Central Bank of Nigeria Statistical Bulletin (Central Bank of Nigeria, 2023), National Bureau of Statistics reports (NBS, 2024), the UNDP Human Development Report series (UNDP, 2024a), and the World Bank World Development Indicators (World Bank, 2022).

Measurement of Variables

Table 1 sets out the measurement of each variable and its source.

Table 1: *Measurement of Variables*

Symbol	Variable	Type	Measurement	Source
RGDP	Economic growth	Dependent	Annual growth rate of real gross domestic product (%)	CBN; NBS
LER	Long and healthy life	Independent	Life expectancy at birth (years)	UNDP; World Bank
ATK	Access to knowledge	Independent	Adult literacy rate (%)	UNDP; UNESCO Institute for Statistics
SOL	Decent standard of living	Independent	Gross national income per capita (US$)	World Bank; UNDP
INFRATE	Inflation rate	Control	Annual change in the consumer price index (%)	CBN; NBS
EXRATE	Exchange rate	Context	Natural logarithm of the official naira to US dollar rate	CBN

Source: **Compiled by the authors.**

Three measurement points require comment. First, the dependent variable is the growth rate of real GDP rather than its level. Expressing the outcome in growth terms places it on a near-stationary footing, avoids the scale problems arising when a level series spanning a rebased national accounts framework is used, and matches the conventional dependent variable in the endogenous growth

literature (Akinlo & Oyeleke, 2020; Keji, 2021). The estimated coefficients are therefore to be read as effects on the rate of growth, not on the level of output.

Second, the three human development dimensions are measured as outcomes rather than as public expenditure inputs. Access to knowledge is captured by the adult literacy rate, which records the accumulated stock of functional literacy in the working-age population rather than the current flow of pupils into schools. This follows the construction of the HDI itself (UNDP, 2024b) and departs deliberately from the enrolment and expenditure proxies dominant in the Nigerian literature, on the reasoning that expenditure measures what is spent and enrolment measures who attends, while literacy measures what has actually been acquired. The distinction is taken up again in Section 5.2, where it accounts for part of the divergence between the present results and the regional evidence.

Third, the inflation rate is retained as a control because price instability affects real returns to investment, erodes household purchasing power, and distorts the relationship between nominal expenditure on health and education and the real services delivered. The exchange rate is reported in the descriptive and correlation analysis as macroeconomic context but excluded from the estimated model, for the reason set out in Section 4.4.

Model Specification

The functional relationship is specified as

RGDP = f (LER, ATK, SOL, INFRATE).

The long-run relationship is written as

$$RGDP_t = \beta_0 + \beta_1 LER_t + \beta_2 ATK_t + \beta_3 SOL_t + \beta_4 INFRATE_t + \varepsilon_t,$$

where RGDP is the real GDP growth rate, LER is life expectancy at birth, ATK is access to knowledge, SOL is the standard of living measure, INFRATE is the inflation rate, β_0 is the intercept, β_1 to β_4 are the long-run coefficients, ε is the stochastic error term, and t indexes the year.

The corresponding ARDL representation, following Pesaran et al. (2001), is

$$\Delta RGDP_t = \alpha_0 + \Sigma_i \alpha_i \Delta RGDP_{t-i} + \Sigma_j \gamma_j \Delta LER_{t-j} + \Sigma_k \delta_k \Delta ATK_{t-k} + \Sigma_l \theta_l \Delta SOL_{t-l} + \Sigma_m \varphi_m \Delta INFRATE_{t-m} + \lambda_1 RGDP_{t-1} + \lambda_2 LER_{t-1} + \lambda_3 ATK_{t-1} + \lambda_4 SOL_{t-1} + \lambda_5 INFRATE_{t-1} + \mu_t,$$

where Δ denotes the first difference operator, the summation terms capture short-run dynamics, and the λ coefficients capture the long-run relationship. The associated error correction representation replaces the level terms with the lagged error correction term, whose coefficient measures the speed at which deviations from long-run equilibrium are eliminated (Engle & Granger, 1987).

Estimation Procedure

The ARDL bounds testing approach of Pesaran et al. (2001) is employed. It is preferred here for three reasons. It accommodates regressors integrated of order zero and order one in the same specification, which removes the need to establish a uniform integration order. It performs more reliably than Johansen-type procedures in small samples, which matters given 25 annual observations. And it yields short-run and long-run coefficients within a single estimation, which is necessary to the argument of this paper because the two horizons differ.

Estimation proceeds in four stages. Augmented Dickey-Fuller tests first establish that no variable is integrated of order two, which would invalidate the procedure (Dickey & Fuller, 1979). The bounds F test then determines whether a long-run levels relationship exists, by comparing the computed statistic against the critical bounds tabulated by Pesaran et al. (2001). Where cointegration is confirmed, the long-run coefficients and the error correction model are estimated. Finally, diagnostic tests examine functional form, heteroskedasticity, and serial correlation.

The decision rule follows the conventional 5% significance level. A null hypothesis is rejected where the probability value associated with the test statistic falls below .05. Estimation was carried out in EViews 10.

RESULTS

Trends in the Variables

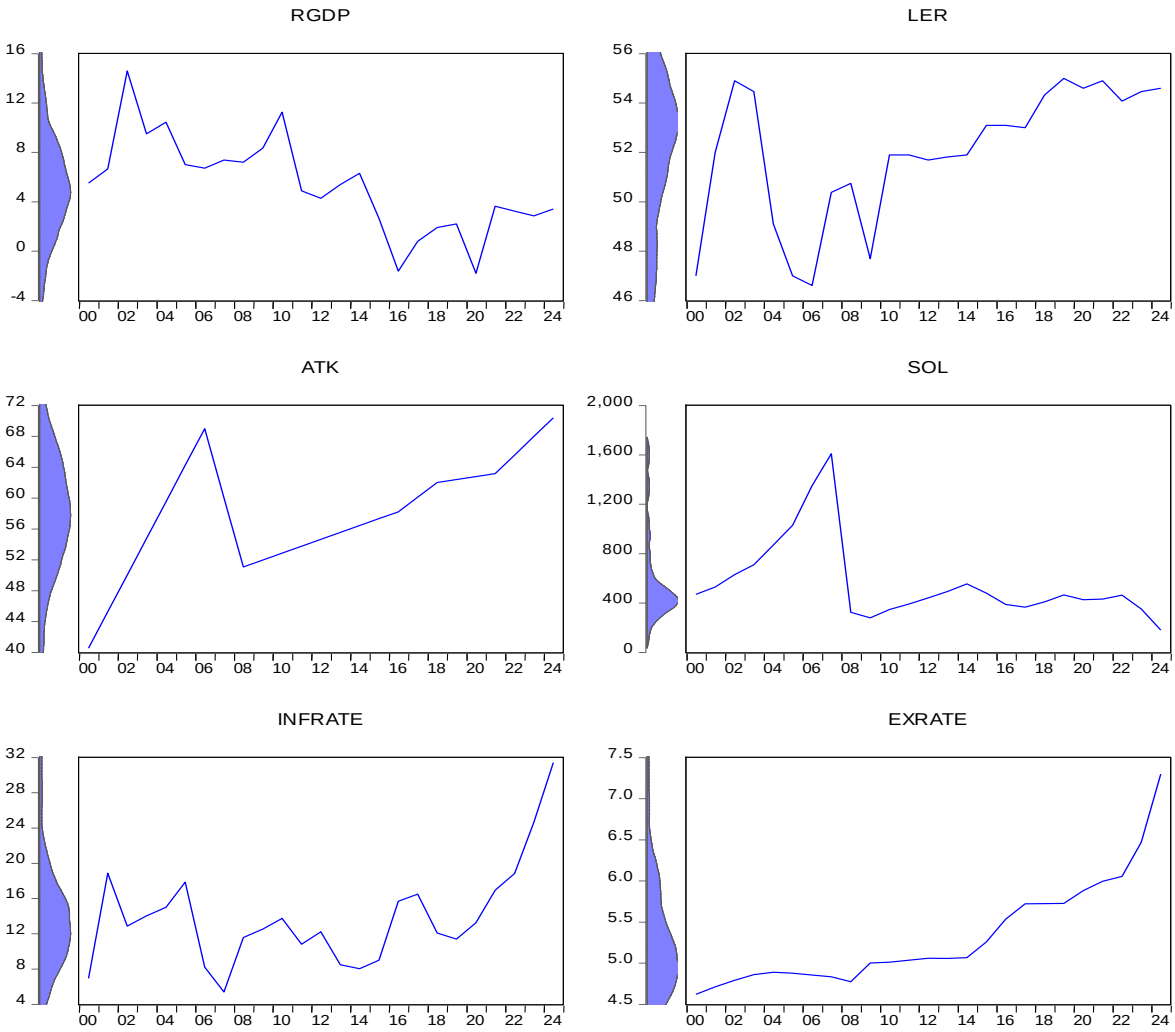


Figure 1 *Real GDP Growth and Human Development Indicators, Nigeria, 2000 to 2024*

Note. Plotted by the authors from CBN, NBS, UNDP, and World Bank data.

Between 2000 and 2004 real GDP growth rose sharply to one of its highest points in the period, while life expectancy and access to knowledge improved and the standard of living measure rose steeply through to about 2006. This reflects the recovery and expansion of the Nigerian economy following earlier instability, with human development indicators moving in the same direction as output.

From 2005 to 2009 growth became unstable and declined. Life expectancy dipped briefly before recovering, access to knowledge fell around 2007 before resuming a gradual rise, and the standard of living measure fell after 2007 and remained well below its earlier level. The period corresponds to external shocks and weaker welfare conditions.

Between 2010 and 2014 growth recovered moderately but remained volatile, while life expectancy and access to knowledge both continued their gradual upward trend and living standards improved only slightly. The divergence is notable: the slow-moving human development indicators continued improving during a period when output performance did not.

From 2015 to 2020 growth fell again, reaching its lowest values around 2016 and 2020, while inflation rose and the naira depreciated more rapidly. Living standards weakened while life expectancy and access to knowledge continued their slow ascent. Between 2021 and 2024 growth recovered modestly, access to knowledge reached its highest level in the period, life expectancy remained high, and living standards were broadly flat, while inflation accelerated and depreciation continued.

The overall pattern is that the health and knowledge dimensions follow a slow secular improvement largely independent of the business cycle, while the living standards dimension tracks macroeconomic conditions closely. This distinction anticipates the econometric results.

Descriptive Statistics

Table 2: *Descriptive Statistics*

	RGDP	LER	ATK	SOL	INFRATE	EXRATE
M	5.3157	52.0112	57.9896	560.2364	13.8591	5.3250
Mdn	5.3944	52.0000	58.2200	464.5300	12.8766	5.0582
Maximum	14.6044	55.0000	70.4100	1610.0000	31.4300	7.2991
Minimum	-1.7943	46.6100	40.5400	181.1300	5.3880	4.6220
SD	3.8474	2.6996	7.2366	331.5960	5.6993	0.6468
Skewness	0.2730	-0.7707	-0.3773	1.9230	1.2412	1.3711
Kurtosis	3.0609	2.4277	2.8961	6.1038	5.0077	4.5613
Jarque-Bera	0.3143	2.8163	0.6045	25.4428	10.6176	10.3726
p	.855	.245	.739	< .001	.005	.006
n	25	25	25	25	25	25

Source: Authors' computation using EViews 10.

Real GDP growth averaged 5.32% over the period, ranging from -1.79% to 14.60%. The standard deviation of 3.85 against a mean of 5.32 indicates highly unstable growth, with the range spanning both deep recession and rapid expansion. Life expectancy averaged 52.01 years with a standard deviation of only 2.70, the lowest relative dispersion of any variable in the model, reflecting the slow and steady character of demographic improvement.

Access to knowledge averaged 57.99 with a range from 40.54 to 70.41, a substantial improvement across the period but one that leaves a considerable share of the adult population outside. The standard

of living measure shows by far the greatest dispersion in absolute terms, ranging from 181.13 to 1,610.00 with a standard deviation of 331.60, and its skewness of 1.92 and kurtosis of 6.10 indicate a distribution dominated by the high values recorded during the oil boom years. Inflation averaged 13.86% with a maximum of 31.43%, confirming recurrent inflationary episodes.

The Jarque-Bera statistics indicate that real GDP growth, life expectancy, and access to knowledge are consistent with normality, while the standard of living measure, inflation, and the exchange rate depart from it significantly. Departures from normality in macroeconomic series exposed to discrete policy shifts and external shocks are expected and do not compromise the estimation, since the ARDL procedure does not require normally distributed regressors (Gujarati & Porter, 2009).

Correlation Analysis

Table 3: *Correlation Matrix*

	RGDP	**LER**	**ATK**	**SOL**	**INFRATE**	**EXRATE**
RGDP	1.0000					
LER	-0.3397	1.0000				
ATK	-0.4062	0.2545	1.0000			
SOL	0.3316	-0.4706	0.1848	1.0000		
INFRATE	-0.1843	0.3837	0.4496	-0.4032	1.0000	
EXRATE	-0.5874	0.6081	0.6999	-0.4447	0.7367	1.0000

Source: Authors' computation using EViews 10.

The bivariate correlations between growth and the human development dimensions are negative for life expectancy (-.34) and access to knowledge (-.41), and positive for standard of living (.33). The first two signs are the reverse of the long-run regression results reported below, and the reversal requires explanation.

It arises from the trending character of the series. Life expectancy and access to knowledge improved steadily across the period while Nigerian growth was highest in the early 2000s and lower thereafter. A simple correlation between a monotonically rising series and a declining one will be negative regardless of any underlying structural relationship. The exchange rate correlations make the point more starkly: the naira depreciated continuously, so the logged exchange rate correlates at .61 with life expectancy and .70 with access to knowledge, which no one would interpret as depreciation improving health or literacy. These are common-trend artefacts. The cointegration framework adopted below is designed precisely to separate genuine long-run relationships from such spurious co-movement (Engle & Granger, 1987), which is why bivariate correlation is an inadequate basis for inference here.

Inflation and the exchange rate correlate at .74, consistent with the documented pass-through from currency depreciation to domestic prices in an import-dependent economy (Iyoha & Oriakhi, 2002; World Bank, 2022).

Unit Root Tests

Table 4: *Augmented Dickey-Fuller Unit Root Test Results*

Specification		RGDP	LER	ATK	SOL	INFRATE	EXRATE
At level							
With constant	*t*	-2.0955	-2.5396	-1.6901	-2.1278	-1.1393	3.4933
	p	.248	.119	.422	.236	.683	1.000
With constant and trend	*t*	-3.8240	-3.7759	-3.1745	-3.1138	-1.5204	1.2725
	p	.033	.037	.114	.127	.794	1.000
Without constant or trend	*t*	-1.2826	0.1453	0.8308	-1.1754	0.6533	0.9364
	p	.178	.718	.884	.212	.850	.901
At first difference							
With constant	*t*	-5.6793	-4.5906	-3.4149	-4.7142	-5.4800	0.0920
	p	< .001	.002	.022	.001	< .001	.958
With constant and trend	*t*	-5.5808	-4.4487	-3.2710	-4.6597	-3.5090	-1.5899
	p	< .001	.009	.097	.006	.067	.764
Without constant or trend	*t*	-5.5999	-5.0904	-2.7742	-4.8150	-5.5128	0.0000
	p	< .001	< .001	.008	< .001	< .001	.850

Source: Authors' computation using EViews 10.

Null hypothesis: the series contains a unit root.

At level, the null of a unit root cannot be rejected for any variable under the constant-only specification. Including a constant and trend renders real GDP growth and life expectancy stationary at the 5% level, while access to knowledge, standard of living, inflation, and the exchange rate remain non-stationary. The level results therefore indicate series dominated by persistent long-run movement, which is characteristic of macroeconomic and development indicators (Dickey & Fuller, 1979; Enders, 2015).

At first difference, real GDP growth, life expectancy, access to knowledge, standard of living, and inflation all reject the null at the 5% level under the constant specification, confirming that these five series are integrated of order one.

The exchange rate is the exception and the reason for its exclusion from the estimated model. It fails to reject the unit root null at first difference under every specification tested, with probability values of .958, .764, and .850. A series that remains non-stationary after first differencing is integrated of order two or higher, and the ARDL bounds testing procedure is defined only for regressors integrated

of order zero or one (Pesaran et al., 2001). Including it would invalidate the critical values against which the bounds test is assessed. It is therefore retained in the descriptive and correlation analysis as macroeconomic context and excluded from estimation, and the model proceeds with four regressors.

The remaining variables present a mixture of integration orders, which is the circumstance the ARDL approach is designed to handle.

Bounds Test for Cointegration

Table 5: *ARDL Bounds Test for a Long-Run Levels Relationship*

Significance level	I(0) lower bound	I(1) upper bound
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

Note. Computed $F = 7.2635$, $k = 4$.

Authors' computation using EViews 10.

Null hypothesis: no levels relationship. Critical values from Pesaran et al. (2001).

The computed F statistic of 7.2635 exceeds the upper critical bound at every reported significance level, including 4.68 at 1%. The null hypothesis of no levels relationship is rejected decisively. Economic growth, life expectancy, access to knowledge, standard of living, and inflation therefore share a stable long-run equilibrium relationship in Nigeria, notwithstanding the short-run volatility evident in Figure 1. Changes in the human development dimensions have permanent rather than transitory effects on the Nigerian growth path, which is the empirical precondition for the long-run coefficients reported next to be meaningful.

Long-Run Coefficients and Tests of Hypotheses

Table 6: *Long-Run Coefficients (Levels Equation)*

Variable	*B*	*SE*	*t*	*p*
LER	4.5007	1.6311	2.7597	.007
ATK	10.6443	3.2457	3.2799	.002
SOL	0.1482	0.0513	2.8956	.004
INFRATE	2.2515	2.2084	1.0195	.335

Note. Dependent variable: RGDP.

Source: Authors' computation using EViews 10.

The estimated cointegrating relationship is

RGDP = 4.5007 LER + 10.6443 ATK + 0.1482 SOL + 2.2515 INFRATE + constant.

Hypothesis 1. Life expectancy carries a long-run coefficient of 4.5007, $t = 2.76$, significant at the 5% level. The null hypothesis that a long and healthy life has no significant effect on economic growth is rejected. A one-year increase in life expectancy at birth is associated with an increase of approximately 4.50 percentage points in the long-run growth rate.

Hypothesis 2. Access to knowledge carries a coefficient of 10.6443, $t = 3.28$, significant at the 1% level and the largest of the three dimensions. The null hypothesis is rejected.

Hypothesis 3. The standard of living measure carries a coefficient of 0.1482, $t = 2.90$, significant at the 5% level. The null hypothesis is rejected. The coefficient is small in absolute terms because the variable is measured in dollars rather than in index units; scaled against its standard deviation of 331.60, a one standard deviation increase corresponds to approximately 4.91 percentage points of long-run growth, placing its economic magnitude between those of life expectancy and access to knowledge.

Inflation carries a positive coefficient of 2.2515 but $t = 1.02$, which is not significant at any conventional level. Price movements do not exert a detectable long-run effect on Nigerian growth once the human development dimensions are accounted for.

Short-Run Dynamics and Error Correction

Table 7: *Error Correction Model: Short-Run Dynamics*

Variable	*B*	*SE*	*t*	*p*
Constant	-12.6645	1.5410	-8.2186	< .001
Δ(RGDP*t-1*)	-0.7349	0.1037	-7.0893	< .001
Δ(LER)	-0.2354	0.2408	-0.9773	.354
Δ(LER*t-1*)	-0.7520	0.1810	-4.1549	.003
Δ(ATK)	-0.5339	0.1613	-3.3101	.009
Δ(SOL)	0.0180	0.0028	6.4334	< .001
Δ(SOL*t-1*)	-0.0071	0.0012	-5.9481	< .001
CointEq*t-1*	-0.8944	0.0358	-25.0131	< .001

Note. Dependent variable: Δ(RGDP). $R^2 = .888$, adjusted $R^2 = .824$, *SE* of regression = 1.385, Durbin-Watson = 2.270. Authors' computation using EViews 10.

The error correction term is negative, less than one in absolute value, and highly significant, at -0.8944. This satisfies the conditions for a stable and convergent adjustment process and independently

corroborates the bounds test result. Its magnitude indicates that approximately 89% of any deviation from long-run equilibrium is corrected within a single year, which is a rapid speed of adjustment.

The short-run coefficients differ instructively from the long-run estimates. The contemporaneous change in life expectancy is not significant, but its first lag is negative and significant at -0.7520. The contemporaneous change in access to knowledge is also negative and significant at -0.5339. Both variables therefore reduce growth in the short run while raising it substantially in the long run. The change in the standard of living measure is positive and significant contemporaneously at 0.0180, though its lag is negative at -0.0071, a pattern consistent with an immediate welfare effect followed by partial correction.

The coefficient on the lagged change in growth is negative at -0.7349, indicating strong mean reversion in Nigerian output growth from year to year.

Diagnostic Tests

Table 8: *Diagnostic Tests*

Test	Statistic	*p*	Decision
Ramsey RESET (*t*)	0.2687, *df* = 8	.795	No evidence of functional form misspecification
Ramsey RESET (*F*)	0.0722, *F*(1, 8)	.795	Model correctly specified
ARCH heteroskedasticity (*F*)	0.3989, *F*(1, 20)	.535	No evidence of heteroskedasticity
ARCH heteroskedasticity (Obs × R^2)	0.4302	.512	Constant error variance
Breusch-Godfrey serial correlation (*F*)	2.2601, *F*(2, 7)	.175	No serial correlation
Breusch-Godfrey serial correlation (Obs × R^2)	9.0246	.011	Serial correlation indicated
Durbin-Watson	2.2700		No first-order autocorrelation

Note. Authors' computation using EViews 10.

The Ramsey RESET test (Ramsey, 1969) returns $p = .795$ for both statistics, so the null of correct functional form is retained. The ARCH test (Engle, 1982) returns *p* values of .535 and .512, retaining the null of constant error variance and indicating that the residuals do not exhibit volatility clustering.

The Breusch-Godfrey test (Godfrey, 1978) returns conflicting results that should not be passed over. The F form retains the null of no serial correlation at $p = .175$, while the chi-square form rejects it at $p = .011$. The Durbin-Watson statistic of 2.27 indicates no first-order autocorrelation. Divergence between the F and chi-square forms of the LM test is a known small-sample phenomenon, and with

the residual degrees of freedom available here the F form is generally the more reliable (Enders, 2015). Nonetheless, the possibility of higher-order residual dependence cannot be dismissed. Since serial correlation affects the efficiency of the estimates and the validity of the standard errors rather than the consistency of the coefficients, and since the error correction term is significant by a very wide margin, the substantive conclusions are unlikely to be overturned. The point is recorded as a qualification in Section 6.3.

DISCUSSION

The Long-Run Relationship

The central finding is that all three dimensions of human development raise economic growth in Nigeria over the long run, within a cointegrating relationship confirmed at the 1% level. Human development in Nigeria is therefore not merely a consequence of economic performance; it is a determinant of it.

This result speaks directly to the income-level conditionality reported by Puttitanun and Lerskullawat (2025), who found human development significantly growth-enhancing in middle- and high-income countries but not in low-income ones. Nigeria sits in the low human development tier with an HDI value of 0.548 (UNDP, 2024a), and on their panel evidence the relationship might have been expected to be weak or absent. It is neither. One reading is that their low-income group result reflects heterogeneity within that group rather than a uniform absence of effect, which would be consistent with the quantile evidence of Asongu and Odhiambo (2023) showing that the health and growth relationship in sub-Saharan Africa varies across the conditional distribution. A second reading is that single-country time series estimation captures within-country dynamics that cross-country panels average away. The two readings are not mutually exclusive, and both argue for more country-level work of this kind.

The findings support the mechanisms endogenous growth theory proposes. Lucas (1988) argued that human capital accumulation generates externalities that prevent growth from exhausting itself in diminishing returns, and Romer (1990) modelled technological progress as the outcome of deliberate investment. Access to knowledge, the dimension closest to human capital in the Lucas sense, produces the largest effect in the model. Life expectancy, which Bloom et al. (2004) treat as a distinct form of human capital operating through physical productivity and investment horizon, produces the second largest.

The insignificance of inflation is itself informative. It indicates that once health, knowledge, and living standards are accounted for, price movements do not determine Nigeria's long-run growth path. This should not be read as licence for inflationary policy, since inflation bears heavily on short-run stability,

real incomes, and investment decisions. It should be read as evidence that the binding long-run constraint on Nigerian growth is structural rather than monetary.

Why Knowledge Dominates, and How This Differs from the Regional Evidence

That access to knowledge carries the largest coefficient of the three dimensions is the finding with the most direct policy content, and it is notable because it reverses the ordering established for the region as a whole. Ogundari and Awokuse (2018), using system GMM across 35 sub-Saharan African countries, found both health and education growth-enhancing but health the larger contributor. The present study finds the opposite ordering within Nigeria.

Three considerations bear on the divergence. First, the studies measure the dimensions differently: Ogundari and Awokuse use enrolment-based education measures, whereas the present study uses adult literacy, an outcome measure that captures the accumulated stock of functional knowledge in the workforce rather than the current flow of pupils into schools. Where enrolment and learning outcomes diverge, as they do substantially in Nigeria, the two measures will not behave alike. Second, regional averages conceal national variation, and Awad (2021) found a different ordering again for the MENA region, which suggests that the health-versus-education ranking is a country or regional characteristic rather than a general property of the growth process. Third, Nigeria's health indicators have improved slowly and from a low base across the study period, with life expectancy varying by only 8.4 years across 25 observations, while literacy varied by almost 30 percentage points. The dimension with more variation to exploit is the dimension the estimator can more precisely identify.

The mechanism is also plausible on its own terms. The three dimensions differ in how directly they enter production. Life expectancy raises the quantity of productive life and improves the physical capacity of workers within it, but it acts on the number of effective working years rather than on the productivity of each. A decent standard of living operates through a resource channel that is indirect and lagged, and whose effect depends on how additional income is used. Access to knowledge acts directly on the productivity of labour in each period, on the capacity to adopt and adapt technology, and on the ability to move labour from low-productivity to high-productivity activity. In an economy where a large share of employment sits in low-productivity informal activity, the marginal return to raising the general level of knowledge is correspondingly high. Knowledge is also partly an input into the other two dimensions, since better educated households make more effective use of health services and allocate additional income more efficiently, which means its coefficient may embed part of the return attributed elsewhere.

The Short-Run and Long-Run Divergence

The most analytically interesting feature of the results is that life expectancy and access to knowledge carry negative short-run coefficients alongside strongly positive long-run coefficients. A reading that treats this as inconsistency would be mistaken; the pattern is what human capital investment should produce.

Investment in health and education imposes its costs immediately and delivers its returns later. Resources committed to building schools and clinics, training teachers and health workers, and keeping children in education rather than in the labour force are resources withdrawn from current production. A cohort in school is a cohort not working. Public expenditure on health and education competes against expenditure on infrastructure whose output effects arrive sooner. The negative short-run coefficients capture this opportunity cost; the positive long-run coefficients capture the return once accumulated human capital enters production. The two horizons measure different stages of the same process.

This has a direct implication for how such investment is evaluated. Any assessment of health and education spending conducted over a short enough window will find it unproductive, and will find so correctly within that window. The error lies in the window, not in the spending. Given that Nigerian budget cycles and political terms are considerably shorter than the period over which human capital investment matures, this creates a structural bias against precisely the expenditure that the long-run evidence identifies as most growth-enhancing. It may also help explain the divided Nigerian literature: studies covering shorter windows, or emphasising short-run dynamics, are more likely to recover the null or negative findings reported by Amassoma and Nwosa (2011) than the positive long-run relationships found by Keji (2021) and Adeyemi and Ogunsola (2016).

The high speed of adjustment, at approximately 89% per year, indicates that the Nigerian economy returns to its equilibrium growth path quickly following disturbance. This implies that the equilibrium path itself is what matters, and that path is determined by the long-run coefficients rather than by short-run stabilisation.

Relation to Prior Evidence

The findings corroborate Keji (2021), who found human capital exerting a significant long-run effect on Nigerian growth, and extend that work in two respects: by using outcome-based rather than input-based measures of human capital, and by identifying which dimensions carry the effect. They are consistent with Adeyemi and Ogunsola (2016), Eigbiremolen and Anaduaka (2014), Dauda (2010), and Onisanwa (2014), and with the regional evidence of Ogundari and Awokuse (2018), Akinlo and

Oyeleke (2020), and Oyinlola et al. (2021), while differing from the first of these on the ordering of health and education.

The contrast with Amassoma and Nwosa (2011), who found no causal link between human capital investment and Nigerian growth, is explicable on two grounds. Their study uses investment measures rather than human development outcomes, and the divergence between short-run and long-run coefficients found here indicates that the horizon over which the relationship is assessed materially affects the conclusion.

The findings also speak to the theoretical debate set out in Section 2.2. They do not support the strong growth-first position, since human development is shown to drive growth rather than merely to follow it. They are consistent with the virtuous circle account of Ranis et al. (2000). The conditional position of Puttitanun and Lerskullawat (2025) and Akinlo and Oyeleke (2020) receives partial support at most: the relationship is present in a low human development country, though the short-run and long-run divergence is consistent with human capital needing to accumulate before it registers in productivity.

Al Hilani (2012) argued that the HDI provides a credible multidimensional measure of development that income alone cannot supply. The present results support that argument from an unexpected direction, since the non-income dimensions of the index carry larger growth effects than the income dimension. Finally, the divergence between the negative bivariate correlations and the positive long-run coefficients reported here is a caution about inference from simple co-movement, and it reinforces the case for cointegration methods in this literature.

CONCLUSION AND IMPLICATIONS

Conclusion

This study examined the effect of human development on economic growth in Nigeria between 2000 and 2024, disaggregating the Human Development Index into its three constituent dimensions and applying the ARDL bounds testing procedure to annual time series data.

The bounds test confirmed a stable long-run relationship, with $F = 7.2635$ exceeding the upper critical bound at the 1% level. All three dimensions raised growth significantly in the long run, with access to knowledge exerting the largest effect, followed by life expectancy and then standard of living. Inflation was insignificant in the long run. The error correction term of -0.8944 confirmed rapid convergence to equilibrium.

Three conclusions follow. First, human development in Nigeria is a determinant of economic growth rather than merely a product of it, which locates the country within the virtuous circle framework and qualifies the low-income exception reported in recent cross-country work. Second, the dimensions of

human development are not interchangeable in their growth relevance, and the composite index conceals a difference large enough to matter for policy: the knowledge coefficient exceeds the life expectancy coefficient by a factor of more than two, reversing the ordering established for sub-Saharan Africa as a region. Third, the divergence between negative short-run and positive long-run effects indicates that human capital investment imposes costs before it yields returns, and that evaluation windows shorter than the maturation period will systematically understate its value.

Policy Implications

Education should receive the highest priority among human development interventions, since access to knowledge produces the largest long-run growth effect identified here. Emphasis should fall on the quality of schooling and measurable learning outcomes rather than on enrolment alone, on teacher training and retention, on digital learning access, and on technical and vocational skills aligned to the sectors where labour productivity is lowest. The divergence between this study's literacy-based finding and the enrolment-based regional evidence reinforces the point: what is measured is what gets managed, and enrolment is not learning.

Health sector investment should be sustained on growth as well as welfare grounds, since the life expectancy coefficient indicates that improvements in health outcomes raise the long-run growth path materially. The finding of Makuta and O'Hare (2015) that governance quality conditions the translation of health spending into health status implies that expenditure alone is insufficient, and that accountability mechanisms in health administration are part of the growth agenda rather than separate from it.

Measures to raise household living standards, including employment creation, income support, rural development, and access to water, housing, and electricity, are supported by the results, though their estimated effect is the smallest of the three dimensions. Given that 63% of Nigerians are multidimensionally poor (NBS, 2022) and that inequality reduces the national HDI by almost a third (UNDP, 2024a), the distributional dimension of these measures warrants particular attention.

Macroeconomic stability retains its importance for short-run management and the protection of real incomes, but the insignificance of inflation in the long-run equation indicates that price stability alone will not deliver sustained growth. It is a necessary condition, not a sufficient one.

Most importantly, the divergence between short-run and long-run effects argues for insulating health and education budgets from the short evaluation horizons of annual appropriation and electoral cycles. Multi-year expenditure frameworks with protected allocations for human development, assessed against outcome measures rather than annual disbursement, would align the appraisal period with the period over which returns actually arrive.

Limitations

Four limitations should be noted. First, the sample comprises 25 annual observations, the maximum available for the period, which leaves limited residual degrees of freedom once the ARDL lag structure is estimated. The study is therefore better suited to establishing the existence and direction of long-run relationships than to precise estimation of their magnitudes.

Second, the Breusch-Godfrey test returned conflicting F-form and chi-square-form results, and higher-order residual dependence cannot be excluded. This affects the efficiency of the estimates rather than their consistency, but it qualifies the precision of the reported standard errors.

Third, the exchange rate was excluded because it failed to achieve stationarity after first differencing. Given the importance of currency movements in Nigeria, particularly after 2015, its omission means that part of the macroeconomic environment is captured only descriptively.

Fourth, the analysis addresses aggregate relationships and is silent on distribution. Given the evidence that inequality depresses health outcomes across Africa (SenGupta, 2024) and the scale of multidimensional deprivation in Nigeria (NBS, 2022), a rise in national human development consistent with these estimates may coexist with widening regional, rural-urban, and gender disparities.

Suggestions for Further Research

Four directions follow. Inequality-adjusted human development measures should be substituted for the standard dimension indices, which would establish whether the growth effects identified here survive adjustment for how development is distributed. Gender-disaggregated analysis would establish whether the returns to health and knowledge differ by sex, which bears directly on the targeting of intervention. Structural break testing, using procedures permitting endogenously determined breaks, would establish whether these relationships are stable across the subsidy removal and exchange rate liberalisation of the recent period. Finally, explicit threshold testing would establish whether the human development dimensions influence growth only above some minimum level, which the short-run and long-run divergence suggests but does not demonstrate, and which would speak directly to the income-level conditionality reported by Puttitanun and Lerskullawat (2025).

REFERENCES

Adeyemi, P. A., & Ogunsola, A. J. (2016). The impact of human capital development on economic growth in Nigeria: ARDL approach. *IOSR Journal of Humanities and Social Science*, *21*(3), 1–7.

Akinlo, T., & Oyeleke, O. J. (2020). Human capital formation and economic growth in sub-Saharan African countries: An empirical investigation. *The Indian Economic Journal, 68*(4), 249–268. https://doi.org/10.1177/0019466220972848

Al Hilani, H. (2012). HDI as a measure of human development: A better index than the income approach? *IOSR Journal of Business and Management, 2*(5), 24–28.

Amassoma, D., & Nwosa, P. I. (2011). Investment in human capital and economic growth in Nigeria: A causality approach. *Canadian Social Science, 7*(4), 114–120.

Asongu, S. A., & Odhiambo, N. M. (2023). Health performance and economic growth in sub-Saharan Africa: New evidence based on quantile regressions. *International Journal of Social Economics, 50*(12), 1655–1671.

Awad, A. (2021). Which contributes more to economic growth in the MENA region: Health or education? An empirical investigation. *Journal of the Knowledge Economy, 12*(3), 1119–1133.

Bloom, D. E., Canning, D., & Sevilla, J. (2004). The effect of health on economic growth: A production function approach. *World Development, 32*(1), 1–13. https://doi.org/10.1016/j.worlddev.2003.07.002

Central Bank of Nigeria. (2023). *Statistical bulletin*. Central Bank of Nigeria.

Dauda, R. O. S. (2010). Investment in education and economic growth in Nigeria. *African Research Review, 4*(3), 158–169.

Dervis, K., & Klugman, J. (2011). Measuring human progress: The contribution of the Human Development Index and related indices. *Revue d'économie politique, 121*(1), 73–92.

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association, 74*(366), 427–431. https://doi.org/10.2307/2286348

Eigbiremolen, G. O., & Anaduaka, U. S. (2014). Human capital development and economic growth: The Nigeria experience. *International Journal of Academic Research in Business and Social Sciences, 4*(4), 25–35. https://doi.org/10.6007/IJARBSS/v4-i4/749

Enders, W. (2015). *Applied econometric time series* (4th ed.). Wiley.

Engle, R. F. (1982). Autoregressive conditional heteroskedasticity with estimates of the variance of United Kingdom inflation. *Econometrica, 50*(4), 987–1007. https://doi.org/10.2307/1912773

Engle, R. F., & Granger, C. W. J. (1987). Co-integration and error correction: Representation, estimation, and testing. *Econometrica, 55*(2), 251–276. https://doi.org/10.2307/1913236

Godfrey, L. G. (1978). Testing for higher order serial correlation in regression equations when the regressors include lagged dependent variables. *Econometrica, 46*(6), 1303–1310. https://doi.org/10.2307/1913830

Gujarati, D. N., & Porter, D. C. (2009). *Basic econometrics* (5th ed.). McGraw-Hill.

Gulcemal, T. (2020). Effect of human development index on GDP for developing countries: A panel data analysis. *Journal of Economics, Finance and Accounting, 7*(4), 338–345.

Iyoha, M. A., & Oriakhi, D. E. (2002). *Explaining African economic growth performance: Evidence from Nigeria* (Research Paper No. 116). African Economic Research Consortium.

Keji, S. A. (2021). Human capital and economic growth in Nigeria. *Future Business Journal, 7*, Article 49. https://doi.org/10.1186/s43093-021-00095-4

Lucas, R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics, 22*(1), 3–42. https://doi.org/10.1016/0304-3932(88)90168-7

Makuta, I., & O'Hare, B. (2015). Quality of governance, public spending on health and health status in sub-Saharan Africa: A panel data regression analysis. *BMC Public Health, 15*, Article 932. https://doi.org/10.1186/s12889-015-2287-z

Mankiw, N. G. (2020). *Macroeconomics* (10th ed.). Worth Publishers.

Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *The Quarterly Journal of Economics, 107*(2), 407–437. https://doi.org/10.2307/2118477

National Bureau of Statistics. (2022). *Nigeria multidimensional poverty index 2022*. National Bureau of Statistics.

National Bureau of Statistics. (2024). *Consumer price index and inflation report*. National Bureau of Statistics.

Ogundari, K., & Awokuse, T. (2018). Human capital contribution to economic growth in sub-Saharan Africa: Does health status matter more than education? *Economic Analysis and Policy, 58*, 131–140. https://doi.org/10.1016/j.eap.2018.02.001

Onisanwa, I. D. (2014). The impact of health on economic growth in Nigeria. *Journal of Economics and Sustainable Development, 5*(19), 159–166.

Oyinlola, M. A., Adedeji, A. A., & Onitekun, O. (2021). Human capital, innovation, and inclusive growth in sub-Saharan African region. *Economic Analysis and Policy, 72*, 609–625. https://doi.org/10.1016/j.eap.2021.10.003

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics, 16*(3), 289–326. https://doi.org/10.1002/jae.616

Puttitanun, T., & Lerskullawat, A. (2025). Human development and economic growth: Who benefits the most? *Applied Economics*. Advance online publication. https://doi.org/10.1080/00036846.2025.2558238

Ramsey, J. B. (1969). Tests for specification errors in classical linear least-squares regression analysis. *Journal of the Royal Statistical Society: Series B, 31*(2), 350–371.

Ranis, G., Stewart, F., & Ramirez, A. (2000). Economic growth and human development. *World Development, 28*(2), 197–219. https://doi.org/10.1016/S0305-750X(99)00131-X

Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy, 98*(5, Pt. 2), S71–S102. https://doi.org/10.1086/261725

Sen, A. (1999). *Development as freedom*. Oxford University Press.

SenGupta, S. (2024). Human capital impacts of income inequality: An extensive empirical analysis from the African continent. *SAGE Open, 14*(2). https://doi.org/10.1177/21582440241251472

Solow, R. M. (1956). A contribution to the theory of economic growth. *The Quarterly Journal of Economics, 70*(1), 65–94. https://doi.org/10.2307/1884513

Todaro, M. P., & Smith, S. C. (2020). *Economic development* (13th ed.). Pearson.

United Nations Development Programme. (2024a). *Human development report 2023/2024: Breaking the gridlock*. United Nations Development Programme.

United Nations Development Programme. (2024b). *Human development report 2023/2024 technical notes: Human Development Index*. United Nations Development Programme.

World Bank. (2022). *Nigeria development update: The continuing urgency of business unusual*. World Bank.