HEALTH, EDUCATION AND OUTPUT GROWTH IN WEST AFRICA

JOY ELEOJO EBEH
Economics Department, Prince Abubakar Audu University, Anyigba, Kogi State
Corresponding Author: ebeh.je@ksu.edu.ng, +2348030621766

FRIDAY OJONUGWA GODWIN
Economics Department, Prince Abubakar Audu University, Anyigba, Kogi State
godwin.fo@ksu.edu.ng, +2347082332723

ANTHONY ADEJOH OKPANACHI
Development Bank of Nigeria, Abuja
tokpanachi@hotmail.com

ABSTRACT

Economic growth in West Africa has been hindered by insufficient investment in human capital, as highlighted by prior studies. Although previous research has examined the link between human capital and economic outcomes, the influence of gender has often been overlooked. This study investigated the gender-differentiated effects of education and health investments on output growth across 11 West African countries, utilizing panel data from the World Development Indicators. It applied the Panel Fully Modified Ordinary Least Squares (FMOLS) method and validated the results using Common Correlated Effects Mean Group (CCEMG) estimators and Driscoll-Kraay standard errors to ensure robustness. The analysis revealed that enrollment at the primary and tertiary education levels significantly and positively contributes to output growth, while secondary education enrollment, though positive, does not show a statistically significant effect. Additionally, increased life expectancy at birth was found to have a strong and significant positive impact on economic growth. Importantly, the study revealed that investments targeting the education and health of girls yield higher returns in terms of output growth compared to those targeting boys. In light of these findings, the study recommends that West African governments should prioritize expanding access to quality education across all levels through scholarships and financial support, enhance healthcare systems, and implement targeted programs that promote female empowerment.

Keywords: Fully Modified OLS, Human Capital, Life Expectancy, Primary School Enrollment, Secondary School Enrollment, Tertiary School Enrollment

JEL Codes: I15, I25, O47, O5

1. INTRODUCTION

Health and education are key foundations for developing human capital and they both play a major role in a country's economic growth. They are also considered vital components of the United Nations' Sustainable Development Goals (SDGs). SDG 3 promotes good health and well-being, while SDG 4 supports inclusive and quality education for everyone (United Nation Development Program, 2024). Health means more than just being free of illness; it includes a full state of physical, mental, and social well-being (World Health Organization (WHO), 2024). Education develops intellectual abilities and practical skills that affect life outcomes (Adesemowo & Sotonade, 2022; Bamisaiye, 1989, Senke, Atemnkeng, & Oumar, 2023). Both

areas are critical for improving productivity, reducing inequality, and fostering long-term economic growth (Bashir et al., 2024; Ayeni & Akeju, 2023; Ogundari & Awokuse, 2018).

Despite their importance, health and education indicators in West Africa remain below global standards. In 2023, the average life expectancy at birth in the region was just 57.6 years, far lower than the global average of 73 years. The mortality rates for adult females and males were alarmingly high at 286 and 321 per 1,000 respectively, far exceeding global figures of 176 and 113 per 1,000 for females and males (World Bank, 2024). These figures show a long-standing lack of investment in healthcare, with the region spending only 1.54% of GDP compared to the global average of 6.5%. Similarly, the region's educational outcomes are poor despite slightly higher spending (3.99% of GDP compared to the global average of 3.8%). Only 67% of children finish primary school, and adult literacy stands at around 60%, while developed regions report over 88% and 99% respectively. The gap is even clearer when comparing West African countries to wealthier nations. Countries like Canada and Switzerland have life expectancies above 80 years, while some West African countries such as Nigeria, Mali, and Benin are still significantly below the global average. Cabo Verde is a regional exception, with a life expectancy over 75 years. These differences reveal the structural obstacles to developing human capital in the region (World Bank, 2024). Economic performance reflects these issues. In 2023, the average GDP per capita in West Africa was $1,937, compared to a global average of $13,169. Some countries, including Niger and Burkina Faso, reported figures below $1,000. Although Cabo Verde had the highest GDP per capita in the region at $4,850, this was still much lower than global standards (World Bank, 2024).

Studies link these outcomes to weak investments in education and health (Awoyemi et al., 2024; Olakunle et al., 2025; Abaneme & Ajibola, 2025). However, findings are mixed. Some research indicates a strong positive impact of education spending on growth (Wirajing et al., 2023; Akinlo et & Oyeleke, 2020), while other studies found that health spending was either insignificant or negatively related to economic performance (Ogunjobi et al., 2024; Obasuyi & Ovenseri-Ogbomo, 2022; Nwokoye et al., 2020), highlighting the need to investigate this relationship further in the West African Sub-Region, which drives the motivation for this research. This study examined how education and health affect output growth in selected West African countries, particularly focusing on gender-specific effects. A key contribution of this study is that it compares the growth potential of education and health for boys and girls. The aim is to recommend inform gender-sensitive policies that can improve human capital and boost regional development. While some studies suggest that investing in female education may bring higher economic returns than male education (Some et al., 2019; Nyanzi & Killimani, 2018), such evidence is limited in the context of West Africa, which further motivates this research.

The rest of this paper is organized as follows: Section 2 reviews related literature, Section 3 outlines the theoretical framework, data sources, and methodology, Section 4 discusses the empirical findings, and Section 5 concludes with policy recommendations.

2. LITERATURE REVIEW

2.1 Theoretical Literature

The theoretical foundation for examining the relationship between human capital and economic growth draws on three main theories: Human Capital Theory, Endogenous Growth Theory, and Amartya Sen's Capability Approach. These theories collectively emphasize the multifaceted role of education and health in driving development outcomes, particularly in developing regions like West Africa.

The Human Capital Theory proposed by Schultz (1961) and Becker (2009) emphasizes that individuals invest in areas such as education, health, and training to enhance their productivity. Much like physical capital investments, these investments yield returns by boosting an individual's productive potential and overall economic output. Schultz and Becker emphasized that improved health, along with higher education attainment, results in more capable and efficient human capital, which directly supports productivity. This perspective is reinforced by studies such as Mankiw et al. (1992), who included human capital in the Solow growth model and found it to be a key factor in explaining income differences between nations. Scholars such as Bloom et al. (2004) and Ogundari and Abdulai (2014) highlight the crucial role of health, arguing that a healthier workforce is more active, mentally alert, and better equipped to adopt technologies that drive growth. These insights are particularly relevant for West Africa, where poor healthcare systems and high disease burdens severely hinder labor productivity.

Building on this, the Endogenous Growth Theory extends the classical Solow model by asserting that long-term economic growth primarily stems from internal factors like knowledge creation, innovation, and the accumulation of human capital. Romer (1986, 1990) emphasizes the role of human capital in generating new ideas and supporting technological advancement. In his view, a skilled and educated population is vital for innovation, which in turn drives sustained growth. Similarly, Lucas (1988) considers human capital both as an input in production and as a driver of knowledge diffusion. According to Lucas, economies with higher education levels benefit from greater opportunities for learning and sharing experiences, thereby accelerating growth. Empirical evidence from Odhiambo (2024) and Wilfred and Mbonigaba (2019) aligns with these theories, showing that educational attainment is closely linked to productivity and economic output. Ogunjobi et al. (2024) also confirm that both education and health are critical to growth in Sub-Saharan Africa, which underscores the relevance of the endogenous growth framework for countries in West Africa.

Complementing these economic-centric models is Amartya Sen's Capability Approach, which provides a broader, human-centered lens. While human capital and endogenous growth theories focus on the instrumental role of health and education in enhancing productivity, Sen (1993) argues that development should be about expanding individuals' capabilities and freedoms to live the kind of lives they value. In his framework, health and education are not merely inputs for economic gain but are intrinsic components of human well-being and agency. Education enables individuals to participate meaningfully in social, political, and economic life, while good health allows them to exercise their choices and pursue goals. This approach is especially relevant in the West African context, where systemic inequalities often restrict access to quality services, limiting individual freedoms and long-term development. Sen's ideas are supported by Glewwe et al. (2014) and Aka and Dumont (2008), who advocate for the inclusion of both health and education in human capital models to avoid biased estimates and gain a fuller understanding of their effects. Thus, policies promoting education and health should not only target GDP growth but also aim to enhance individual capabilities especially for marginalized populations so that development outcomes are more inclusive and sustainable.

2.2 Empirical Literature

The link between human capital development through education and health and economic growth has been widely studied in African countries. However, the findings vary. Different methods and contexts contribute to these mixed results. Cross-country studies show varied effects. Wirajing et al. (2023) used the System Generalized Method of Moments (GMM) on data from 48 African countries between 2000 and 2019. They found that investments in education and health significantly boost economic growth. In the same vein, Ogundari and Awokuse (2018) used System GMM for 35 SSA countries from 1980 to 2008. They reported

similar positive effects, noting that health investment had a stronger impact on growth than education. Ayodeji et al. (2025) analyzed data from 20 SSA countries with the Pooled Mean Group estimator. Their results showed that human capital indicators positively and significantly affect inclusive growth. Senke et al. (2023) employed the GMM method on 38 countries using data from 1998 to 2018, concluding that the positive effect of human capital on economic growth can diminish in the presence of high-income inequality. Similarly, Akinlo and Oyeleke (2020) also employed GMM on 36 SSA countries and found education and health to be positive and significant on the productivity of the selected countries. However, they confirmed that the impact depends on the level of economic development of the country. However, Eggoh et al. (2015), using a two-step GMM on 49 African countries from 1996 to 2010, found that public spending on education and health negatively affected economic growth, even though human capital stock had an insignificant positive effect. A similar result was confirmed in a more recent study by Ogunjobi et al. (2024) who found the impact of school enrollment and government health spending to be insignificant on economic growth of 20 selected African countries from 1987 to 2023.

In West Africa, panel-based studies typically show positive outcomes. Awoyemi et al. (2024) used Panel OLS, Fully Modified OLS, and Dynamic OLS on data from Nigeria, Ghana, Burkina Faso, and Benin Republic. They confirmed significant positive impacts from government spending on education and health. Usman and Adeyinka (2019) and Lawanson (2015) also documented similar results while studying ECOWAS countries with Fully Modified OLS and Difference GMM, respectively. However, Obasuyi and Ovenseri-Ogbomo (2022), using Fixed and Random Effects models on six WAMZ countries from 2001 to 2019, noted that while education spending supported growth, health expenditure had a negative effect. Nwokoye et al. (2020), employing a Panel ARDL approach, found a positive but statistically insignificant effect of human capital on industrial and economic growth.

Country-specific studies show even more differences. In Nigeria, Ubaka et al. (2022), using the Vector Error Correction Model (VECM) on data from 1986 to 2019, found that health indicators, like life expectancy, positively impacted growth, whereas education-related variables had a negative effect. Ibrahim (2025) applied the ARDL technique and reported both secondary and tertiary school enrollment had positive and significant effects on Nigeria's economic growth using data from 1989 to 2023. Similarly, Obialor (2017), using time-series data from 1980 to 2013, found positive effects in Nigeria and South Africa but a negative effect in Ghana. Keji (2021) found a long-run relationship between variables of human capital and economic growth in Nigeria using the VECM approach on time series data spanning from 1981 to 2017.

Studies on education and output growth highlight the importance of education level and quality. Wilfred and Mbonigaba (2019) used System GMM and Least Squares Dummy Variable techniques on 30 SSA countries from 1980 to 2015 and found that higher education is positively linked to growth. Bekele et al. (2024) employed the augmented mean group approach on panel data of 30 countries in SSA and found human capital to have negatively and significantly affected economic sustainability among the countries and they therefore stressed that education quality should be given more priority than education access. Odhiambo (2024), employing GMM on 28 SSA countries from 2002 to 2018, found secondary education positively and significantly affects growth, while primary education did not. Nyanzi and Killimani (2018), also using GMM on panel data from 1995 to 2016, emphasized the significant role of female education on economic growth among 36 Sub-Saharan African countries. They noted that secondary education had a greater impact on growth than other education levels.

In West Africa, Ahamefule (2018) and Sannoh (2021) used VECM and ECM, respectively, confirming positive long-term effects from government education spending. However, Awolusi (2022) and Adeniyi et al. (2021), using ARDL models, found that primary education negatively affected growth and stressed that education quality, rather than quantity, was more important for economic growth, suggesting the need to improve education standards. Salami et al. (2025) found that government education spending significantly boosted the growth of five Anglophone countries: Sierra Leone, Liberia, Ghana, Gambia, and Nigeria, using the Feasible Generalized Least Squares (FGLS) estimation on data from 1990 to 2023.

Regarding health and growth, Some et al. (2019) applied panel regression on 48 African countries from 2000 to 2015. Their findings showed that health indicators, such as maternal and child mortality, negatively impact growth. Akinbode et al. (2021), using System GMM on 41 SSA countries from 2000 to 2018, found significant positive effects from improved health outcomes. Country-specific studies in Nigeria (Abaneme & Ajibola, 2025; Onisanwa, 2014; Lawanson & Umar, 2021; Nweze, 2015), using cointegration, FMOLS, and OLS, consistently showed that health spending and life expectancy significantly enhance growth. However, Lawal et al. (2023), using ARDL from 1981 to 2021, reported a negative effect from health spending despite positive outcomes for life expectancy. In Ghana, studies by Baochie (2017) and Frimpong et al. (2017), using time-series techniques, confirmed the positive link between health and growth.

While numerous empirical studies have explored the relationship between human capital development through education and health and economic growth in Africa, the findings remain mixed and context-dependent. Most existing research focuses on either cross-country analysis across Sub-Saharan Africa or country-specific cases such as Nigeria, Ghana, or South Africa. Furthermore, although several studies highlight the positive role of education and health investments on economic performance, others report insignificant or even negative effects, particularly with respect to health spending.

In the context of West Africa, studies have largely examined aggregate effects of education and health on growth, often neglecting critical structural factors such as gender differences. There is limited empirical evidence on how the economic returns to education and health investments differ between boys and girls, despite increasing recognition that gender disparities in access and outcomes may have significant implications for long-term growth and development. While some studies (Some et al., 2019; Nyanzi & Killimani, 2018) highlight the growth-enhancing potential of female education in broader SSA contexts, this evidence is scarce in West Africa, a region with unique socio-economic dynamics and persistent gender disparities. Therefore, this study fills a crucial gap by investigating gender-specific impacts of education and health on economic performance in West Africa. It also compares the relative growth contributions of human capital investments in girls versus boys. Providing evidence to inform gender-sensitive policy interventions that can promote inclusive and sustainable growth in the region.

3. METHODOLOGY

3.1 Theoretical Framework

This study adopted the endogenous growth theory (EGT) popularized by Paul Romer in 1986. The theory came as a result of the shortcomings of the neo-classical growth model. The neo-classical growth model developed by Harrod (1930), Dormar (1946), Solow (1956), generally assumes that technological progress is exogenous (externally determined), and factors like capital accumulation and labour force growth are the brain behind productivity growth. The theory states that investment in human capital, innovation and knowledge contribute significantly to output growth through the creation of new technology thereby making

production more efficient (Metu et al., 2017). Economic growth depends on technological progress, which in turn depends on innovation and human capital that are considered internal to an economy and not exogenous as given in Equation 1

$Y = A(R)\ f\ (Ri, Ki, Li)$ ----------[1]

Where: Y is aggregate output, A is knowledge, Ri is the stock of results from expenditure on research and development by firm i, Ki and Li are capital and labour stock of firm i respectively. An improvement in effective labour is determined by the acquisition of knowledge overtime through education, research and development. Romer see technology as endogenous by improving labour that is a factor within the model through investment in education and health. Even though the economy is in a steady state in the long run as assumed by the neoclassical growth model, production can still increase through investment in education, health, research and development that can enhance the effectiveness of labour.

3.2 Model Specification

The model for this study is based on the endogenous growth theory proposed by Romer (1986). According to this theory, production depends on human capital. In our study, human capital includes various health and education indicators such as government education and health spending, school enrollment, life expectancy at birth, adult mortality rates, literacy rates, and the primary completion rate. We adapted the model from Awoyemi et al. (2024) and Usman and Adeyinka (2019). Human capital was measured using five variables: government education expenditure, government health expenditure, school enrollment, life expectancy at birth, and adult mortality rates.

Output growth was represented by Gross Domestic Product Per Capita (GDPPC). We chose these explanatory variables based on Romer's (1990) theory, where economic growth is linked to human capital, which can be divided into investments in education and health. Government spending on education and school enrollment are the education indicators, while government health expenditure, life expectancy, and adult mortality rates are the health indicators. We disaggregated the variables by gender because this study aims to compare the impact of gender-based education and health on output growth. Specifically, we want to determine which type of investment holds more economic potential between male and female.

Given this rationale, the functional form of the model for this study is provided in equation (2).

GDPPC $=f$ (GEEX, GHEX, SEPM, SEPF, SEPT, SESM, SESF, SEST, SETM, SETF, SETT, LEXF, LEXM, LEXT, AMRM, AMRF) ---------- [2]

The Econometric form of the model is stated in Equation [3]

$$LnGDPPC = \beta_0 + \beta_1 GEEX_{it} + \beta_2 GHEX_{it} + \beta_3 SEPM_{it} + \beta_4 SEPF_{it} + \beta_5 SEPT_{it} + \beta_6 SESM_{it} + \beta_7 SESF_{it} + \beta_8 SEST_{it} + \beta_9 SETM_{it} + \beta_{10} SETF_{it} + \beta_{11} SETT_{it} + \beta_{12} LEXF_{it} + \beta_{13} LEXM_{it} + \beta_{14} LEXT_{it} + \beta_{15} LnAMRM_{it} + \beta_{16} LnAMRF_{it} + \mu_i + \varepsilon_{it}$$ ---------- [3]

where: β_0 is the constant term, while β_1 to β_{16} are the coefficients of the explanatory variables. i represents the cross-sectional units (the countries in West Africa), t denotes the time periods, μ_i represents the country specific effect while εit is the error term.**Table 1 Description of Variables**

Var.	Description	Unit of Measurement	Source	Expected Sign
GDPPC	Gross domestic product per capita	US Dollars	WDI, 2023	-
GEEX	Government Education Expenditure	(% of GDP)	WDI, 2023	(+ve)
GHEX	Government Health Expenditure	(% of GDP)	WDI, 2023	(+ve)
SEPM	School Enrollment Primary, Male	% of Gross	WDI, 2023	(+ve)
SEPF	School Enrollment Primary, Female	% of Gross	WDI, 2023	(+ve)
SEPT	School Enrollment Primary, Total	% of Gross	WDI, 2023	(+ve)

SESM	School Enrollment Secondary, Male	% of Gross	WDI, 2023	(+ve)
SESF	School Enrollment Secondary, Female	% of Gross	WDI, 2023	(+ve)
SEST	School Enrollment Secondary, Total	% of Gross	WDI, 2023	(+ve)
SETM	School Enrollment Tertiary, Male	% of Gross	WDI, 2023	(+ve)
SETF	School Enrollment Secondary, Female	% of Gross	WDI, 2023	(+ve)
SETT	School Enrollment Tertiary, Total	% of Gross	WDI, 2023	(+ve)
LEXM	Life Expectancy at Birth Male	Years	WDI, 2023	(+ve)
LEXF	Life Expectancy at Birth Female	Years	WDI, 2023	(+ve)
LEXT	Life Expectancy at Birth, Total	Years	WDI, 2023	(+ve)
AMRM	Adult Mortality Rate Male	(Per 1000 Male Adults)	WDI, 2023	(-)
AMRF	Adult Mortality Rate Female	(Per 1000 Female Adults)	WDI, 2023	(-)

Source: Authors' Compilation, 2024

The decision to break down the indicators into Male and Female allows us to compare the growth potential of education and health for girls with that of boys in West Africa.

3.3 Sources of Data

To examine how education and health affect output growth in West Africa, this study used panel data from 11 West African countries. These countries are Burkina Faso, Cabo Verde, Cameroon, Nigeria, Guinea, Ghana, Gambia, Benin, Niger, Sierra Leone, and Ivory Coast. The data covers the years 2000 to 2022. We obtained information on government education spending, government health spending, school enrollment, life expectancy at birth, and adult mortality rates from the World Bank (2023).

3.4 Estimation Technique

To examine how education and health affect output growth in West Africa, this study used the fully modified ordinary least squares (FMOLS) regression method. The fully modified OLS was employed due to the nature of our dataset. For instance, the panel includes a moderate number of countries (N = 11) over a fairly long-time frame (T = 23) and all the variables were found to be I(1) and cointegrated. FMOLS are particularly suitable for these conditions because they correct for serial correlation and endogeneity in long-run relationships. Additionally, we employed the Common Corrected Effects Mean Group (CCEMG) and Driscoll-Kraay Standard Errors for a robustness check because they help to provide a more robust estimates in the presence of cross-sectional dependence and potential panel heterogeneity among the countries.

4. PRESENTATION AND ANALYSIS OF RESULT

4.1 Pre-Estimation Test

4.1.1 Test for Cross-Sectional Dependence

Cross-sectional dependence (CSD) is a critical concern in macro panel datasets, particularly when countries may be exposed to common shocks, regional integration, or policy spillovers. To verify whether such dependence exists in our panel of 11 West African countries over the period 2000–2022 (T = 23), we applied two widely used diagnostic tests: Pesaran's CD test (Pesaran, 2004) and the Breusch-Pagan LM test (Breusch & Pagan, 1980). Both tests examine the null hypothesis of no cross-sectional dependence in the residuals of the panel data model.

Table 2: Cross-Sectional Dependence Test Results

Test	**t-statistics**	**p-value**	**Decision**
Pesaran CD Test	5.8642**	0.0000	Fail to Reject H_0
Breusch-Pagan LM Test	18.223**	0.0001	Fail to Reject H_0

*** & ** represent stationarity at 1% and 5% respectively.
Source: Authors' Computation, 2024

Form Table 2, since the p-values of both the Pesaran CD statistic and Breusch Pagan LM statistic are less than 5%, we fail to reject the null hypothesis and conclude that there is cross sectional dependence among the countries within the observation.

4.1.2 Unit Root Test

The unit root test based on the Levin Lin Chu (LLC), Ims Persaran and Shin (IPS) and Fisher's ADF revealed that all the variables are non-stationary at levels but stationary after first difference. Hence the variables have an I (1) order of Integration.

Table 3: Summary of Levin Lin Chu, Ims Pesaran and Shin and Augmented Dickey Fuller Statistics

Variables	LLC Statistic		IPS Statistic		ADF Statistic	
	Level	Ist Diff.	Level	Ist Diff.	Level	Ist Diff.
LOGGDPPC	-1.113	-3.38***	-1.262	3.22***	12.94	25.32***
GEEX	-1.221	-3.47***	-1.183	4.24***	11.18	20.65***
GHEX	-1.394	-5.24***	-1.908	-3.453***	13.927	24.23***
SEPM	0.538	-5.43***	-1.277	-4.108***	9.92	19.14***
SEPF	0.351	-3.21***	-1.231	-4.421***	13.835	25.11***
SEPT	-1.319	-3.12***	-1.298	-4.509***	11.955	23.12***
SESM	-0.999	-3.11***	0.498	-4.13***	8.994	17.13**
SESF	-1.251	-3.398***	0.221	-4.14***	10.299	21.18***
SEST	0.299	-2.393**	0.211	3.891***	8.251	17.10**
SETM	0.499	-1.976**	0.321	-2.08**	10.283	18.30**
SETF	0.592	-1.958**	-0.315	-3.181**	13.212	27.21***
SETT	-0.651	-2.38**	-0.213	-3.151**	8.195	18.11**
LEXM	-0.312	2-.94***	-0.21	-3.21**	14.07	22.07***
LEXF	0.218	-2.50**	1.231	-3.13**	13.82	26.11***
LEXT	0.218	-4.51***	-1.051	-3.62**	14.089	28.09***
LOGAMRM	0.956	-4.21***	0.396	-2.59**	15.42	30.10***
LOGAMRF	0.431	-2.61***	-0.299	-3.57**	12.12	26.09***

*** & ** represent stationarity at 1% and 5% respectively.
Source: Authors' Computation, 2024

4.1.3 Cointegration Test

Table 4 Cointegration Test

Kao Test	Statistic	Values
Modified Dickey-Fuller t	-12.151***	0.000
Dickey-Fuller t	-13.651***	0.000
Augmented Dickey-Fuller-t	-5.761***	0.000
Unadjusted modified Dickey-Fuller-t	-12.452***	0.000
Unadjusted Dickey-Fuller t	-11.671***	0.000
Pedroni Test	**Statistic**	**Values**
Modified Philips-Perron–t	-4.882***	0.000
Philips- Perron-t	-2.24**	0.020
Augmented Dickey-Fuller	-2.11**	0.040

*** & ** represent stationarity at 1% and 5% respectively.
Source: Authors' Computation, 2024

The Pedroni (1999) and Kao (1999) cointegration test carried out showed evidence of long-run relationship between education and health indicators and output growth in West Africa. We may therefore proceed to estimate the Panel FMOLS regression.

4.2 Model Estimation

The impact of education and health on economic performance was analysed using the Fully Modified Ordinary Least Squares (FMOLS) and the result is presented in Table 5. To ensure the reliability and validity of the empirical findings, this study conducted robustness checks using two alternative estimation techniques: the Common Correlated Effects Mean Group (CCEMG) estimator and Driscoll–Kraay standard errors. These methods were specifically chosen to account for potential cross-sectional dependence and unobserved heterogeneity in panel data, consistent with the methodological recommendations of Pesaran (2006), Driscoll and Kraay (1998), and more recent applications such as Akinola et al. (2024).

Table 5 Result of Panel FMOLS, Common Correlated Effects Mean Group (CCEMG) estimator and Driscoll–Kraay standard errors

Variables	FMOLS Coefficient	(CCEMG) Coefficient	Driscoll-Kraay Coefficient
GEEX	-0.0161	-0.0893	-0.1312
	(-0.6336)	(-4.973***)	(-3.905***)
GHEX	0.0932	0.1038	0.1594
	(2.1962**)	(2.681***)	(3.881***)
SEPM	0.0247	0.1314	0.2246
	(4.6763***)	(7.902***)	(5.114***)
SEPF	0.0581	0.0967	0.2099
	(3.2924***)	(3.925***)	(4.681***)
SEPT	0.0709	0.1273	0.1012
	(3.4458***)	(6.312***)	(3.948***)
SESM	0.0076	0.0985	0.1333
	(1.2233)	(1.723*)	(3.752***)
SESF	0.0003	0.1342	0.1742
	(0.0440)	(3.118***)	(2.294**)
SEST	0.0035	-0.0031	-0.0029
	(0.5928)	(-0.571)	(-0.197)
SETM	-0.0198	-0.0624	-0.2982
	(-1.1264)	(-1.812*)	(-1.9531*)
SETF	0.0578	0.1325	0.1936
	(3.1488***)	(3.482***)	(4.2921***)
SETT	0.0618	0.1014	0.0973
	(3.0079***)	(3.527***)	(3.7626***)
LEXM	-0.1655	-0.0218	-0.0235
	(-0.6595)	(-0.693)	(-1.031)
LEXF	0.2268	0.2193	0.0874
	(4.8037***)	(4.934***)	(5.865***)
LEXT	0.1285	0.1419	0.1062
	(2.0757**)	(2.611**)	(2.382**)
LOGAMRM	-0.1421	-0.1085	-0.2448
	(-2.0781**)	(-2.191**)	(-2.143**)
LOGAMRF	-0.3682	-0.1971	-0.3197
	-(2.9703***)	(-3.403***)	(-4.723***)
$\mathbf{R^2}$	0.9143		

t-statistic in parenthesis

***, ** & * represent statistical significance at 1%, 5% and 10% respectively.

Source: Authors' Computation, 2024

4.3 Discussion of Result and Policy Implications

This study examined the effects of education and health on output growth in West Africa, with a particular focus on gender-based differences. Using Fully Modified Ordinary Least Squares (FMOLS) estimations, key findings were discovered. Government spending on education has a negative and statistically insignificant impact on output growth. This result is consistent with studies by Eggoh et al. (2015), Ayodeji, et al (2025), Olakunle, et al (2025) and Ogunjobi et al. (2024), but contradicts the positive effects found by Wirajing et al. (2023), Ayodeji et al. (2025), and Senke et al. (2024). The negative outcome may reflect inefficiencies in how education budgets are managed in West Africa. Misallocation of resources, corruption, and excessive spending on non-instructional areas such as administration rather than improving classroom learning or teacher training likely weaken the intended impact of educational investment. To address this, policymakers must not only increase the level of funding but also ensure greater efficiency, transparency, and alignment of spending with educational needs.

Despite the weak impact of overall education spending, primary school enrollment shows a strong and statistically significant positive effect on output. A one-unit increase in primary enrollment is associated with a 7% rise in economic output. This highlights the vital role of basic education in developing human capital and stimulating long-term growth. Policy strategies should therefore prioritize expanding access to primary education by removing financial obstacles, upgrading school infrastructure, and offering targeted support to low-income families.

Secondary school enrollment, on the other hand, produces a positive but statistically insignificant effect on output growth, with only a 0.3% increase per unit. This finding supports the results of Bekele et al. (2024) but differs from Odhiambo (2024), who reported a significant effect. The insignificant effect may be due to the poor quality of secondary education in the region and therefore suggests that increasing enrollment alone is insufficient to drive growth. Instead, attention should be given to improving the quality of education at the secondary level. Policies should focus on curriculum development, teacher's training, and the creation of a more supportive and effective learning environment.

Tertiary education has a strong positive effect on output growth, with a one-unit increase in enrollment leading to a 6% rise in output. This supports previous findings by Wilfred and Mbonigaba (2019), Ahamefule (2018), Sannoh (2021), Senke et al. (2023), and Ayodeji et al. (2025), who identified higher education as a key driver of economic growth in sub-Saharan Africa. Based on this, governments should increase investment in universities and vocational institutions while expanding access through scholarships and financial aid programs. Strengthening the capacity and quality of higher education institutions is essential for producing a skilled workforce that can meet the demands of a modern economy.

Health indicators also show a significant and positive relationship with output growth. Government health expenditure is associated with a 9% increase in output for every unit of spending. Likewise, life expectancy at birth leads to a 13% increase in output growth per unit increase. These findings are supported by the research of Some et al. (2019), Akinbode et al. (2021), Onisanwa (2014), Lawanson and Umar (2021), Nweze (2015), Baochie (2017), and Frimpong et al. (2017). These results reinforce the importance of public health spending as a tool for economic development. Policymakers should prioritize investments in health infrastructure, expand access to essential medical services, and implement programs focused on disease prevention, maternal and child health, and improved nutrition.

Gender-specific analysis reveals that female education plays a particularly important role in economic growth. Female primary school enrollment has a more positive effect on output than male enrollment, and female tertiary education results in a 6% increase in output, while male tertiary enrollment has an insignificant and slightly negative impact. These outcomes are in line with the studies of Nyanzi and Killimani (2018), Ibrahim (2025) and Some et al. (2019),

which emphasize the high returns of investing in women's education. Educated women are more likely to contribute to family welfare and community development, multiplying the economic benefits. Therefore, governments should design policies that promote girls' education by offering scholarships, raising awareness about its value, and ensuring safe and inclusive school environments.

Health outcomes for women also demonstrate a stronger impact on growth than those for men. A 1% reduction in the female adult mortality rate contributes to a 0.36% increase in output, compared to just 0.142% for males. Similarly, a unit increase in female life expectancy leads to a 22.7% rise in economic growth, whereas male life expectancy does not show a significant effect. These findings point to the need for gender-targeted health policies. Governments should invest in programs that reduce maternal and child mortality, improve prenatal and postnatal care, expand immunization coverage, and support nutritional health. Ensuring affordable and accessible healthcare services for women and children is essential for building a healthy and productive workforce.

Finally, the model used in the study explains 91% of the variation in output growth ($R^2 = 0.91$), indicating strong predictive power and reliability of the results. Although the model yields a high R-squared value (0.91), which typically indicates a good fit, this must be interpreted with caution due to the relatively small sample size. High R-squared values in small samples may reflect overfitting rather than true explanatory power. To mitigate this concern, the study incorporated robustness checks using CCEMG and Driscoll-Kraay standard errors, to confirm the consistency of the core results.

Robustness Checks

The two alternative estimation techniques yielded coefficient, signs and significance levels that are nearly consistent with those obtained from the baseline FMOLS model with the exception of secondary school enrollment female which shows a positive and statistically significant impact on output growth suggesting the need for policy to be more centered towards the education of girl child in West Africa. These consistent outcomes across different estimation techniques suggest that the baseline results are robust to alternative model specifications and are not driven by cross-sectional dependence or heterogeneity across countries in the panel. Thus, the conclusions drawn regarding the importance of targeted investment in female education, health services, and early education enrollment remain valid and relevant for policymaking.

5. CONCLUSION AND POLICY RECOMMENDATIONS

This study assessed how education and health influence output growth across 11 West African countries, with a focus on gender-specific impacts. The findings confirm that improvements in human capital particularly through primary and tertiary education, along with better health outcomes positively affect economic performance. Primary school enrollment had a strong and statistically significant effect on growth, while tertiary education also contributed substantially. However, secondary school enrollment showed only a marginal and statistically insignificant effect, suggesting that simply increasing numbers at this level is not enough without addressing issues of educational quality.

Female education proved especially impactful, with greater returns at both the primary and tertiary levels compared to male enrollment. This highlights the broader societal benefits of investing in girls' education, such as increased household welfare and community development. On the health side, longer life expectancy and lower adult mortality especially among women were significantly associated with higher output growth, underlining the importance of a healthy workforce.

Based on these findings, the study recommends targeted policy action. Education ministries should promote gender equality through scholarships, improved infrastructure, and support for girls in disadvantaged areas. Efforts should also focus on enhancing the quality of secondary education via curriculum reform and teacher training. Health ministries should expand maternal and child healthcare services, invest in underserved regions, and scale up preventive programs like vaccinations and nutrition.

Public spending in both sectors must increase and be efficiently managed, with transparency and accountability in fund usage. Ministries of finance and planning should collaborate to ensure this. Regional institutions like ECOWAS should coordinate cross-border policy efforts, while civil society and NGOs can assist through grassroots advocacy and local implementation. Altogether, investing in gender-responsive education and health systems is crucial for sustainable economic growth in West Africa.

REFERENCES

Abaneme, E. N., & Ajibola, J. O. (2025). Government health expenditure and inclusive growth in Nigeria: The role of institutions. *Journal of Economics and Allied Research, 10(1),* 225–244. https://jearecons.com/index.php/jearecons/article/view/509.

Adesemowo, P. O., & Sotonade, O. A. T. (2022). Basic of education: The meaning and scope of education (pp. 1–2).

Aka, B. F., & Dumont, J. C. (2008). Health, education and economic growth: Testing for long-run relationships and causal links in the United States. *Applied Econometrics and International Development, 8(2),* 101–110.

Akinola, A. T., Awolaja, O. G., & Onakoya, A. B. (2024). Effect of human capital flight on economic growth in Sub-Saharan Africa. *Journal of Economics and Allied Research, 9(1),* 90–104. https://jearecons.com/index.php/jearecons/article/view/373.

Ayodeji, A. O., Ovikuomagbe, O., & Sheriffdeen, T. (2025). Human capital and inclusive growth in Sub-Saharan Africa: The case for health. *Journal of Economics and Allied Research, 10(1), 23–36.* https://jearecons.com/index.php/jearecons/article/view/493.

Bamisaiye, R. (1989). A practical approach to philosophy of education. Ibadan: AMD Publishers.

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.

Ibrahim, M. (2025). An analysis of the impact of human capital development on economic growth in Nigeria. *Journal of Economics and Allied Research, 10(1),* 374–384. https://jearecons.com/index.php/jearecons/article/view/518.

Keji, S. A. (2021). Human capital and economic growth in Nigeria. *Future Business Journal, 7(1),* 49. https://doi.org/10.1186/s43093-021-00095-4.

Lawanson, A. O. (2015). Economic growth experience of West African region: Does human capital matter. *International Journal of Business and Social Science, 6(12),* 127–137.

Lawanson, O. I., & Umar, D. I. (2021). The life expectancy–economic growth nexus in Nigeria: The role of poverty reduction. *SN Business & Economics, 1(10),* 127. https://doi.org/10.1007/s43546-021-00119-9

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

Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *Quarterly Journal of Economics, 107(2),* 407–437.

Nweze, N.P. (2015). The Impact of Health Programmes on Economic Growth in Nigeria. *Global Journal of Applied, Management and Social Sciences, 9,* 32-43.

Nwokoye, E. S., Chukwuka, S. M., Ozoh, J. N., Onugha, C. B., & Odebode, O. K. (2020). Human capital development and industrial sector performance: The West Africa

experience. *International Journal of Economics, Commerce and Management, 8(2),* 14–32.

Obialor, M. C. (2017). Effect of government human capital investment on economic growth in Sub-Saharan Africa: Evidence from Nigeria, Ghana and South Africa. *International Journal of Asian Social Science, 7(4),* 328–339. https://doi.org/10.18488/journal.1/2017.7.4/1.4.328.339

Odhiambo, N. M. (2024). Education and economic growth in Sub-Saharan African countries: Does governance quality matter? *Research in Globalisation, 8,* 1-8 https://www.sciencedirect.com/journal/research-in-globalization.

Ogundari, K., & Abdulai, A. (2014). Determinants of household's education and healthcare spending in Nigeria: Evidence from survey data. *African Development Review, 26(1),* 1–14.

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

Olakunle, I. S., Philips, B. B., & Aworinde, O. B. (2025). Education, poverty and economic growth nexus in Anglophone West African Countries. *Journal of Economics and Allied Research, 10(1), 590–604.* https://jearecons.com/index.php/jearecons/article/view/533

Onisanwa, I. D. (2014). The impact of health on economic growth in Nigeria. *Journal of Economics and Sustainable Development, 5(9),* 159–166.

Pesaran, M. H. (2004). General diagnostic tests for cross-section dependence in panels. Cambridge Working Papers in Economics, 0435. Faculty of Economics, University of Cambridge.

Pesaran, M. H. (2006). Estimation and inference in large heterogeneous panels with cross-section dependence. *Econometrica, 74(4),* 967–1012.

Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of Political Economy, 94(5),* 1002–1037.

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

Schultz, T. (1961). Investment in human capital. *The American Economic Review, 51,* 1–17.

Sen, A. (1993). Capability and well-being. In M. Nussbaum & A. Sen (Eds.), The quality of life (Vol. 30, pp. 1–445). Oxford University Press.

Senke, N. L., Atemnkeng, J. T., & Oumar, S. B. (2023). Does income inequality matter in the contribution of health capital to economic growth? Evidence from Sub-Saharan African countries. *Journal of Economics and Allied Research, 8(3),* 1–17. https://jearecons.com/index.php/jearecons/article/view/320.

Some, J., Pasali, S., & Kaboine, M. (2019). Exploring the impact of healthcare on economic growth in Africa. *Applied Economics and Finance, 6(3),* 45–57. https://doi.org/10.11114/aef.v6i3.4110.

Ubaka, C. K., & Nwaonuma, N. D. (2022). Impact of human capital development on economic growth: Evidence from Nigeria. *Economic and Business Review, 3(3),* 32–53.

United Nations Development Programme. (2024). Sustainable Development Goals. https://www.undp.org/sustainable-development-goals.

World Health Organization. (2024). Constitution of the World Health Organization. https://www.who.int/about/governance/constitution.

World Bank. (2024). World Development Indicators. The World Bank Group. https://databank.worldbank.org/source/world-development-indicators.