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Human Capital and Economic Growth in Sub-Saharan African Countries: A Panel Data Analysis

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Abstract:

Purpose: This study examined the empirical relationship between human capital and economic growth across eight Sub-Saharan African (SSA) countries from 1990 to 2022.

Theoretical Framework: This study examined the relationship between human capital and economic growth by applying the Cobb-Douglas production function within the framework of the neoclassical Solow growth model. The study considers fixed assets as a measure of physical capital and school enrollment as a proxy for human capital.

Design/Methodology/Approach: This study employed the pooled mean group (PMG) estimator within a panel autoregressive distributed lag (ARDL) approach to analyze human capital variables' short- and long-run impacts on economic growth in SSA countries.

Findings: The findings provided strong empirical evidence of significant short- and long-term relationships between the variables. The long-run analysis demonstrates that human capital positively influences economic growth. Additionally, in the short-run, fixed assets, human capital, and labor were found to positively and significantly impact economic growth.

Research Implications: This study emphasizes the importance of focusing on education and skill training sectors to enhance human capital development in emerging African countries.

Originality/Value: This study demonstrates that human capital variables positively impact economic growth in SSA countries in both the short- and long-run. Consequently, this study underscores the role of human capital as a critical and influential factor in promoting economic growth in emerging SSA countries. It also contributes valuable insights for policymakers and adds to the existing literature in this area.

Keywords: Human Capital; Economic Growth; Pooled Mean Group; ARDL; Sub-Saharan Africa.

JEL Classification: C32, I15, I22, O4,

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1. Introduction:

Human capital is one of the most significant contributors to economic growth in theoretical literature. It influences growth through two primary pathways: directly contributing to output and promoting technological advancement. Thus, human capital plays a crucial role in economic development, innovation, and the adoption of new technologies, as emphasized by endogenous growth theory (Matashu, 2022). Bekele et al. (2024) highlighted that the global policy agenda has prioritized human capital development as a key component of sustainable economic growth. Enhanced human capital in research, education, and management can boost productivity, social welfare, equality, and innovation. The relationship between human capital and economic growth is strong; human capital contributes to economic growth by increasing the skills and knowledge of the workforce. Theoretical growth literature widely acknowledges human capital as a fundamental input. From an economic perspective, high-quality, sustainable education is a long-term investment in workers' knowledge, skills, and abilities, leading to higher productivity, income, and quality of life. At the macro level, a well-trained workforce is essential for achieving higher productivity, innovation, and long-term economic growth (Bashir, 2024). Investing in human capital is crucial in the context of global economic competition among countries. Previous studies, such as those by Grant (2017) and Psacharopoulos (1984), found that economic growth cannot be attained solely by upgrading physical infrastructure; the knowledge and skills accumulated by workers and manufacturers are also vital for economic development. Most development economics literature views human capital as a key factor in economic progress (Ogundari & Awokuse, 2018). Investing in human capital has the potential to increase worker productivity, making it a critical topic for African development strategy. However, the concept of human capital is complex and multifaceted. Human capital theory posits that individuals are essential to economic growth and are integral to the production process (Sajoh, 2021). Furthermore, Ngouhouo et al. (2021) indicated that countries with more developed human capital are more resilient to economic shocks.

Structural reforms and prioritizing public spending on health, education, and social services have stimulated per capita gross domestic product (GDP) growth in recent decades, particularly in Sub-Saharan African (SSA) countries that have recently emerged from civil wars that hindered their development (Calamitsis et al., 1999). However, the socioeconomic outlook for Africa remains challenging. The International Labour Organization (ILO) (2021) reported that between 25 and 35 million people were living in extreme poverty in 2021, down from 110 to 125 million in 2020. Despite this progress, the accumulation of human capital is essential for achieving inclusive and sustainable development by promoting advancement, raising living standards, and creating suitable employment opportunities for all (World Bank, 2020).

Endogenous growth theory suggests that allocating resources toward human capital is crucial for fostering innovation and fully adapting to new technologies, thereby enhancing productivity and economic growth. Unlike other regions, SSA struggles with insufficient investment in education. Gyimah-Brempong et al. (2006) confirmed significant inequality in primary education investment between countries in Asia, South America, and SSA. Glewwe et al. (2014) noted a decline in education investment in SSA between 1980 and 2000, as evidenced by a decrease in the primary gross enrollment rate from 80% to 77%. In contrast, other regions, including East Asia, Latin America, the Middle East, and South Asia, either saw increases or

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remained stable in their enrollment rates, with approximate figures of 111%, 127%, 87%, and 98%, respectively (Glewwe & Kremen, 2006). Despite Africa's relatively higher per capita income compared to South Asia and other continents, the United Nations Development Program (UNDP) underscores persistent disparities in human development in its Human Development Report.

Africa's growth rate continues to lag behind other developing regions, particularly in secondary education. It has been shown that secondary education positively impacts manufacturing productivity. Therefore, poor performance in this area may have severe consequences, hindering Africa's participation in the global marketplace. Increased investment in secondary education can mitigate some challenges posed by globalization and technological innovation (Sajoh, 2021). However, SSA countries struggle to achieve the level of institutional and human capital needed to boost economic growth. According to the World Bank's Human Capital Index, the average human capital level in the SSA region is 0.42, with Chad at a low of 0.293 and Seychelles at a high of 0.678, compared to a global average of 0.57 (Baize, 2023).

The World Bank (2022) reported that SSA's GDP growth rate fell from 3.41 in 2000 to 2.844 in 2015. Moreover, GDP growth in the region dropped significantly between 2019 and 2020, from 2.577 to –2.012, respectively. A similar decline was observed in North African nations, where GDP growth fell from 6.789 to –3.98 in 2020. The primary cause of 2020's negative GDP growth was the COVID-19 pandemic. Bloom et al. (2020) argue that low rates of higher education enrollment in Africa contributed to the low GDP growth rates observed between 1975 and 1990 and in the early 21st century. In response to Africa's poor human capital development ratings, the World Bank launched a strategy to increase investment in the region's future labor force. The study found that Africa's low levels of human capital negatively impacted productivity due to high rates of mortality and stunting combined with poor learning outcomes (World Bank, 2020b).

Several factors contribute to poor educational attainment, according to Shobowale et al. (2023). One major factor is the large percentage of Africa's population under 15 years old, which presents a challenge for governments attempting to educate an increasing number of school-age children while operating under tight budget constraints. Furthermore, children from impoverished households often prioritize work over education, as the struggle for survival takes precedence. In extreme poverty, children may contribute up to 40% of household income (World Bank, 2022). Shobowale et al. (2023) also emphasized that SSA nations face similar demographic challenges, including high poverty rates and low living standards. These issues are fundamental to the human development index and are crucial for development. Despite education being widely recognized as a key factor in fostering socioeconomic growth, Africa has the lowest higher education enrollment rates globally.

This study explores the relationship between human capital and economic growth in SSA, making significant contributions to the literature in several ways. First, it introduces new cross-national data to the relatively limited research on the relationship between human capital and economic growth in SSA countries. Second, it covers a longer period than previous studies, broadening the scope of the investigation.

Third, it adds value to the ongoing discussion on how human capital affects economic growth by employing a dynamic panel technique adapted to the SSA region.

The primary goal of this study was to empirically examine the relationship between economic growth and human capital in selected SSA countries. The study investigated the short- and long-term effects of labor, human capital, and fixed capital on economic growth and offered policy recommendations to promote and sustain economic growth.

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The rest of the study is organized as follows: Section 2 provides a summary of the theoretical framework related to the relationship between human capital and economic growth. Section 3 describes the model formulation and data sources used in this research. Section 4 presents the study's empirical findings and discussion. Finally, Section 5 concludes with the study's limitations.

2. Literature Review and Hypothesis Development:

This section reviews the related literature on the relationship between human capital and economic growth in developing countries, particularly African nations. It focuses on the key issues, methodologies, and findings of these studies.

Adeleye et al. (2022) investigated the role of robust institutions in the dynamic between human capital and income inequality. The study employed data from 2010 to 2019, covering 46 SSA countries, utilizing indicators such as the Gini index (representing income inequality), human capital, and institutional quality measures. The findings revealed that investment in human capital and institutional development disparities are central to income inequality, both presently and in future generations. Although interactions between information and communication technology and economic growth were found to reduce inequality, they could simultaneously exacerbate disparities. Consequently, the study emphasizes the importance of building robust institutions and ensuring universal access to basic education to mitigate the hereditary transmission of income inequality.

Bekele et al. (2024) employed the augmented mean group technique to explore the link between economic sustainability and human capital development in SSA countries. Their results indicated that human capital development negatively and significantly affects the economic sustainability of these nations. The study also identified several factors positively correlated with economic sustainability, including domestic investment and policy initiatives. Conversely, natural resource endowment, government spending, and financial development were found to hurt the region's economic sustainability.

Bekele and Mersha (2023) analyzed the relationship between economic growth and human capital development in 36 SSA countries using annual data from 1980 to 2017. They employed a dynamic common correlated effects estimator to address common econometric issues in cross-country analyses. Their findings highlighted that human capital, capital stock, and lagged economic growth positively and significantly influence economic growth. The study also found that while human capital contributes more to economic growth than capital stock, lagged economic growth negatively impacted growth rates, indicating conditional convergence. The authors suggested that SSA countries should prioritize investments in human capital development by expanding educational opportunities.

Mose (2023) examined the relationship between economic growth and human capital development in East Africa through a quantitative study. The findings demonstrated a significant positive impact of human capital development on the region's economic growth. Similarly, Bazie (2023) explored the relationship between human capital, institutional capital, and growth in developing countries. The study found that while source countries experienced decreased economic growth, destination countries benefited from human capital reflows. The study underscores the importance of developing institutional frameworks to ensure high returns from human capital investment and to promote its accumulation for economic growth.

Wirajing et al. (2023) investigated how human capital affects economic growth in 48 African countries between 2000 and 2019. They addressed potential endogeneity using the system generalized method of moments (GMM) methodology. The study concluded that human capital development significantly boosts economic growth in Africa, with contributions from both male and female human capital. The report also highlighted the synergistic effects of foreign direct investment and internet penetration on economic growth. The study recommends increased government funding for health and education sectors, emphasizing the critical role of human capital development in ensuring sustained economic growth across Africa.

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Shobowale et al. (2023) analyzed human capital development trends in SSA countries from 1981 to 2020. The study considered variables such as economic growth rates, Human Development Index, technology through research and development, private investment as a proportion of GDP, government expenditure, trade openness, physical infrastructure (measured by the Physical Infrastructure Index), and labor force input. The results indicated that human capital development in SSA countries mirrored regional groupings or development levels, with changes occurring over the long term rather than the short term. The study revealed that SSA countries share common demographic challenges, including poor healthcare infrastructure and low-quality education, resulting in poorly equipped graduates and a low standard of living.

Matashu and Skhephe (2022) focused on the long-term relationship between SSA countries' human capital and economic growth. Their findings showed that while secondary education has a notable, albeit limited, influence on economic growth in both the short- and long-term, elementary education had a negligible impact. The study also found that physical capital positively influences economic growth in the short term but has a negligible effect in the long run. Based on these results, the study recommends that SSA governments prioritize secondary school enrollment and improve elementary education standards to foster sustainable economic growth.

Matashu (2022) further investigated the connection between economic growth, human capital creation, and education in SSA countries from a conceptual standpoint. Their theoretical and empirical research demonstrated that education significantly impacts SSA's human capital development and economic expansion. Wang et al. (2021) explored the relationship between healthy human capital and the poverty trap in SSA countries using the autoregressive distributed lag model. Their findings indicated that while healthy human capital significantly reduces poverty in the short term, it has little long-term impact on

poverty reduction, highlighting the complex relationship between poverty and healthy human capital in SSA.

Abdouli and Omri (2021) identified a two-way causal relationship between economic growth and human capital in 19 Asian countries from 1985 to 2017. Their findings emphasized the importance of education in developing human capital and accelerating economic development. Sajoh (2021) examined the impact of health and education, as metrics of human capital, on economic growth in 35 SSA countries using panel data from 1986 to 2018. The results indicated that health and education positively and significantly affect economic growth, underscoring the importance of considering both metrics when assessing human capital.

Oyinlola et al. (2021) explored the relationship between human capital, innovation, and inclusive growth in 17 SSA countries from 1998 to 2014. Their analysis revealed that most factors positively influence inclusive growth, except for school enrollment, which showed a positive trend but did not have a significant impact. Akinlo and Oyeleke (2020) investigated the relationship between human capital and economic growth in 36 SSA countries from 1986 to 2018, considering different levels of economic development. Using dynamic GMM and static estimators, their findings demonstrated that human capital positively impacts economic growth, with the relationship varying according to the degree of economic development.

Buyinza (2019) examined the relationship between gender disparity in human capital and economic growth in 27 SSA countries from 1990 to 2015 using data from the World Bank's World Development Indicators (WDI) and Barro and Lee's (2013) dataset. The study found that improvements in education quality for both males and females are linked to higher GDP growth rates, while gender disparity is associated with poorer economic growth outcomes. The results suggest that policies promoting human capital accumulation should balance the interests of men and women, considering the distribution and composition of human capital.

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Tapuwa et al. (2019) used a panel econometric approach to analyze how human capital influences economic growth in nine SSA countries from 1980 to 2016. Their findings showed that human capital had little to no impact on economic growth in the sample countries. However, when variables such as foreign direct investment and government expenditure were included, the interaction between urbanization and human capital significantly influenced economic prospects. Ogundari and Awokuse (2018) investigated the impact of health and education on economic growth in SSA countries using a dynamic model derived from the GMM system to evaluate balanced panel data from 35 countries between 1980 and 2008. Their findings indicated that health and education positively impact economic growth, with health having a relatively greater influence. This highlights the importance of considering both components of human capital in economic growth.

Borojo and Yushi (2015) examined the impact of human capital on economic growth in Ethiopia from 1980 to 2013. Their findings demonstrated that public expenditure on health and education, particularly primary and secondary school enrollment, positively and significantly affects economic growth in both the short- and long-run. Conversely, tertiary school enrollment had an insignificant effect on economic growth in both the short- and long-run.

In conclusion, numerous studies have examined the economic impact of human capital on economic growth in developing African countries using panel data. However, the literature on this topic needs to be more extensive. The present study aims to fill this gap and provide valuable policy implications to foster economic growth in developing African countries.

3. Methodology :

3.1 Model Specification:

This research examined the empirical relationship between human capital and economic growth in a panel of eight SSA nations from 1990 to 2022. The study applied the Cobb-Douglas production function framework within the context of the neoclassical Solow growth model. The model is depicted as follows:

$$Y = f(K, L, H) \quad (1)$$

Where Y denotes real *GDP*, K represents fixed assets, L stands for the labor force participation rate, and H denotes the level of human capital. Accordingly, the Cobb-Douglas function used in this study to determine the relationship between these selected variables is formulated as follows:

$$Y_{it} = \alpha_0 + \beta_1 K_{it} + \beta_2 L_{it} + \beta_3 H_{it} + \varepsilon_{it} \quad (2)$$

Where α_0 represents the constant term; β_1, β_2 and β_3 are the coefficients; ε_{it} denotes the error term; i represents the panel countries; and t refers to the period of this study.

The correlation between the white noise term and the mean-differenced independent variables introduces an intrinsic bias in panel data models with individual effects, making it challenging to manage with traditional Autoregressive Distributed Lag (ARDL) estimation techniques. However, combining the ARDL model with the Pooled Mean Group (PMG) estimator, as proposed by Pesaran et al. (1999), provides a practical solution. To address this issue, this study employs the PMG-ARDL approach recommended by Sarkodie and Strezov (2018).

$$Y_{it} = \theta_i ECT_{it} + \sum_{j=0}^{q-1} \Delta lX_{it} \delta_{ij} + \sum_{j=1}^{p-1} \gamma_{ij} * \Delta ly_{it-j} + \varepsilon_{it} \quad (3)$$

$$ECT_{it} = y_{it-1} + X_{it} \vartheta \quad (4)$$

The explanatory variables (K, H, and L) are represented by X in the equation, with an equal amount of delays q across each cross-sectional unit. The dependent variable, real GDP, is denoted by y. The term i represent the individual cross-sectional unit, t denotes time, θ is the adjustment coefficient, Δ indicates the difference operator, ϑ represents the long-run coefficient, which yields estimates of β and δ after convergence, and ε stands for the error term.

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3.2 Data Collection:

We collected macroeconomic data from eight SSA countries: Ethiopia, Nigeria, Rwanda, Sudan, South Africa, Uganda, Zimbabwe, and Zambia. This country sample was chosen to identify patterns of human capital accumulation in developing African economies. The study period of 1990–2022 was selected based on the availability of secondary data obtained from World Development Indicators (World Bank, 2024). Table 1 describes the variables and their data sources.

Table 1. Description of variables

Variables	Symbol	Definition
Real GDP	*Y*	($US in constant price)
Fixed assets	*K*	($US in constant price)
Human capital	*H*	(Number of employments)
Labor force	*L*	(Rate of enrollment in school)

Source: World Bank

4. Results:

4.1 Descriptive Analysis:

Quantitative measures of central tendency and dispersion are typically used to support descriptive statistics, which characterize the properties of a dataset. Table 2 presents the level of statistical significance for each parameter, including the mean, median, maximum, minimum, standard deviation, kurtosis, and skewness of the distribution. Y, H, L, and K mean values were 24.305, 9.652, 16.135, and 22.896, respectively. The standard deviations for Y, H, L, and K were 1.461, 8.127, 1.270, and 2.0189, respectively. Descriptive statistics provide a foundation for further analysis.

Table 2. Descriptive statistics

	Y	H	L	K
Mean	24.30568	9.652320	16.13511	22.89689
Median	23.89790	5.039652	16.04039	23.02803
Maximum	27.00616	25.30104	18.10969	26.27681
Minimum	20.97135	3.819726	3.265114	17.67597
Std. dev.	1.461652	8.127846	1.270025	2.018977
Skewness	0.165740	1.163663	-3.752074	-0.148453
Kurtosis	2.085071	2.405898	40.58366	1.877805
Jarque-Bera	10.41671	63.46340	1615.28	14.82222
p-value	0.005471	0.000000	0.00000	0.000604
Sum	6416.699	2548.213	4259.670	6044.779
Observations	264	264	264	264

4.2 Heterogeneity of Slope Test:

Slope coefficient heterogeneity must be considered to avoid inaccurate estimates and biased conclusions. To address this, the Pesaran and Yamagata (2008) test was applied, and Table 3 shows that the alternative hypothesis of slope coefficient heterogeneity was accepted. Based on these findings, robust estimators were employed to account for heterogeneity and cross-sectional dependence.

Table 3. Result of Slope Heterogeneity

Test Statistics	Value	*p*-value
Delta tilde (Δ)	26.633	0.000***
Adj. Delta tilde (Δ)	28.914	0.000***

Note: *** indicates significance at 1% level.

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4.3 Cross-sectional DependenceTests:

This study employed three cross-sectional dependence (CSD) tests namely Breusch-Pagan test, Pesaran scaled, and Pesaran CD test to explore potential linkages between eight emerging African nations (Breusch & Pagan; Pesaran, 2007, 2021). The analysis closely examined factors such as economic growth, fixed capital, human capital, and labor force participation rates. The results of all three CSD tests, presented in Table 4, were statistically significant, confirming the presence of CSD. Consequently, the null hypothesis (H_0), which posited no evidence of CSD in any part of the dataset, was decisively rejected. This finding underscores the presence of CSD among the variables under investigation, indicating that economic disruptions in one SSA countries could have cascading effects on neighboring countries.

Table 4. Cross-sectional Analysis

CSD-tests	Statistics	*p*-value
Breusch-Pagan	164.492	0.000***
Pesaran Scaled	18.239	0.000***
Pesaran-CD	4.970	0.000***

Note: *** indicates significance at 1% level

4.4 Panel Unit Root Test Results:

After identifying any CSD issues in the dataset, it is essential to confirm the stationarity of each variable. This step is crucial, particularly when employing second-generation methods, to ensure the appropriateness and accuracy of the regression estimation strategy. When variables and panels exhibit both heterogeneity and CSD, the covariate-augmented Dickey-Fuller (CADF) and cross-sectional augmented IPS (CIPS) unit-root tests are highly effective. These tests are known for their reliable coefficients of determination (Chen et al., 2022; Pesaran, 2007, 2021; Westerlund & Hosseinkouchack, 2016). The results of the panel stationarity tests, presented in Table 5, indicate that for all variables, the null hypothesis—which proposed the absence of CSD—was decisively rejected. Furthermore, the null hypothesis that a time series remains unchanged at level $I(0)$ was refuted for all variables, as evidenced by these unit root tests. This indicates that, unlike other variables, these variables are stable at the first difference, $I(1)$.

Table 5. Panel Unit Root Tests

Variables	CADF		CIPS	
	I(0)	I(1)	I(0)	I(1)
Y	-1.471	-3.234***	-1.027	-3.953***
K	-1.082	-3.224***	-1.073	-4.760***
H	-1.196	-3.026*	-0.935	-4.089***
L	-1.156	-2.449**	-1.029	-2.815***

Note: ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively

4.5 Cointegration Test Results:

The long-term relationship between the variables was assessed using the cointegration test developed by Westerlund and Edgerton (2007). After analyzing the test statistics Gt, Gα, Pt, and Pα, the alternative hypothesis was accepted at various levels of significance. The strong *p*-value, as shown in Table 6, provided compelling evidence of cointegration and formed the basis for this conclusion.

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Table 6. Long-run Relationship Test

Statistic	Value	*p*-value	Robust *p*-value
Gt	-2.759	0.058**	0.008***
Ga	-3.384	0.999	0.655
Pt	-7.462	0.027**	0.070*
Pa	-4.273	0.915	0.428

Note: ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively

4.6 Long-run and Short-run Analysis:

Table 6 presents the results of the PMG-ARDL analysis, which detail the long- and short-run elasticities between economic growth (Y) and key variables: fixed assets (K), labor force participation rate (L), and human capital (H). These findings confirm the presence of both short- and long-term cointegration among the SSA countries under study. In the long-term analysis, fixed capital is positively correlated with economic growth at a 5% significance level, with a coefficient of 0.106. This implies that a 1% increase in fixed capital results in a 10% rise in economic growth. These findings are consistent with the work of Matashu and Skhephe (2022), and Wang et al. (2021). Moreover, the study's results align with those of Ahumada and Villarreal (2020), who conducted a panel analysis across 52 countries and found that human capital significantly influences economic growth. Further analysis revealed that human capital is directly linked to economic growth in the long run, with a coefficient of 0.335 and a *p*-value of 0.043, both indicating statistical significance at the 5% level. The labor force participation rate also shows a strong positive relationship with economic growth, as evidenced by a coefficient of 1.229 and a *p*-value of 0.000. In response to short-term shocks, the error correction term indicates a gradual return to equilibrium, confirming the existence of cointegration. Additionally, Table 7 provides short-run estimates, showing that fixed assets, human capital, and labor force participation rate all have a significant positive impact on economic growth at the 1% and 10% significance levels. Specifically, in the short-run, a 1% increase in human capital and labor force participation rate leads to increases in economic growth of 0.39% and 1.03%, respectively. These findings are supported by the research of Bekele et al. (2024), Matashu and Skhephe (2022), and Wirajing et al. (2023).

Table 7. Short-run and Long-run Effects

Variables	Coeff.	Std. error	T-test	Prob.
Long-run estimation				
Dependent variable: Y				
K	0.106	0.047	2.223	0.026**
H	0.335	0.165	0.029	0.043**
L	1.229	0.080	15.325	0.000***
Short-run estimation				
ECT (-1)	-0.014	0.023	-0.618	0.537
K	0.059	0.042	1.423	0.156
H	0.391	0.159	2.453	0.014**
L	1.039	0.583	1.781	0.076*
Heteroscedasticity				
Breusch–Pagan	0.11		0.7419	

Note: ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

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5. Conclusion and Limitation:

5.1 Conclusion:

This study examines the relationship between economic growth and human capital in eight SSA nations from 1990 to 2022. The study focuses on two primary components of capital: school enrollment, as a measure of human capital, and fixed assets, representing physical capital. Economic growth is proxied by real GDP. Despite a growing body of literature in this field, studies on the long-term effects of human capital on economic growth in emerging African nations remain limited. To address the macroeconomic factors influencing economic growth in both the short- and long-run, the study employs PMG and ARDL techniques.

The findings indicate that human capital has a statistically significant impact on economic growth. There is a positive and statistically significant correlation between GDP and all independent variables. This research contributes to the ongoing discussion on the role of human capital in economic growth by focusing specifically on the SSA region and utilizing a dynamic panel approach. The study underscores the generally positive and statistically significant influence of human capital on economic growth in the SSA region, aligning with the broader literature. These results support the concept of human capital development, emphasizing the critical role of education in fostering sustained economic growth.

5.2 Limitation:

Macroeconomic variable fluctuations over time may stem from policy changes, while variances among cross-sectional units can lead to heterogeneity in panel data estimations. This suggests that period- and country-specific effects must be considered when calculating. Ignoring these differences could result in inaccurate estimation outcomes, ultimately affecting the conclusions of the analysis. To address this, the study incorporates year dummies to account for temporal effects and country dummies to account for country-specific effects when evaluating the role of human capital in economic growth across SSA countries. However, a significant limitation of this research was the availability of data for only 8 out of the 46 countries in the SSA region. This limitation raises concerns about the generalizability of the findings to the entire SSA region, making broad conclusions potentially questionable and subject to debate. Future research should explore other proxies for health and education if feasible.

Authors Declaration:

Conflicts of Interest: None

-We Hereby Confirm That All The Figures and Tables In The Manuscript Are Mine and Ours. Besides, The Figures and Images, which are Not Mine, Have Been Permitted Republication and Attached to The Manuscript.

- Ethical Clearance: The Research Was Approved by The Local Ethical Committee in The University.

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