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The Nexus Between Human Capital and Economic Growth: Empirical Evidence From Sub-Saharan African Countries

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The present study examines the role of human capital in the growth of per capita income in Sub-Saharan African (SSA) countries. The findings show that human capital has a substantial positive effect on the growth of per capita income in SSA countries, whereas inflation and malaria cases have an unfavourable effect on per capita income. Policymakers should improve access to education and the quality of health care to boost the per capita income of SSA countries.

I. Introduction

Education and health are among the most essential elements in promoting inclusive economic growth, reducing poverty, creating jobs, increasing workers' productivity, and generating more income for households and the government (Afzal et al., 2012). Lucas (1988) and Romer (1990) expanded the Solow model by including technology as an endogenous variable. Their idea contrasts with that of Solow (1956), who considered technology an exogenous factor outside the control of the internal economy. Since technology is a function of education, it sparked significant debate on the interaction between education and economic growth among policymakers and macroeconomists. Human capital is modelled as a production factor that increases aggregate production possibilities and the marginal product of physical capital, thereby boosting the long-run growth rate (Sieng & Yussof, 2014). According to Eigbiremolen & Anaduaka (2014), human capital development refers to acquiring and increasing the number of persons with the skills, education, and experience that are critical for the economic growth and development of a country's economy.

Human capital development and economic growth are highly related in the sense that the advancement of one will lead to the advancement of the other and vice versa (Karambakuwa et al., 2020). When a country's education is developed, it will generate a quality workforce capable of operating advanced and complicated physical capital and technologies. The higher productivity of workers will significantly increase the production of goods and services in a given state over a given period. Many pieces of research show that human development is the pivot for sustainable development. For example, the study by Ranis et al. (2000) stated that policy reforms prioritising economic growth are more likely to fail. Therefore, countries should prioritise the health sector, which increases the productivity of the labour force, leads to longer life expectancy and greater innovation capabilities, produces more entrepreneurs and creative managers, creates a healthier workforce, abiding citizens, and good governance that guarantees sustainable economic growth. Countries with high economic growth and low human development are more likely to make poor decisions that can negatively affect their economy (Ranis et al., 2000).

The existing literature on SSA countries discusses natural, human, and physical resources, and the growth path in many SSA countries has fluctuated between 4 and 6 percent over past decades (Ekpo, 2020). Some studies also examine the role of financial inclusion in the growth of SSA countries and find that financial inclusion has a positive effect on the growth of SSA countries (Jallow et al., 2024; Mohammed et al., 2024). Based on past studies, it was found that some studies report a significant correlation between human capital development and economic growth (Afzal et al., 2012; Eigbiremolen & Anaduaka, 2014; Fashina et al., 2018; Sieng & Yussof, 2014).

Despite the widely existing theoretical and empirical evidence that human capital contributes directly to economic growth through its effect on productive labour, technological innovation, etc., there is still doubt about their functional connection (Saidi & Mongi, 2018). As indicated by Bashir et al. (2012), investment in education not only benefits individuals through income but also benefits the economy as a whole through skilled labour who increase com-

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petition and economic growth. The total productivity of capital increases with the level of education of the labour force because highly educated people are more inclined to innovate, which affects everyone's productivity. Higher education produces skilled labourers who attract both local and foreign investors to invest their capital in an economy (Sarwar et al., 2019). This increases the foreign direct investment level of a country, which creates more jobs and promotes quality education, adequate health expenditure, and high aggregate consumption. This will also improve a country's balance of payments by substituting imported items with locally produced items.

The present study provides several novelties. First, from the existing literature, it was found that much research has been conducted to show the connection between economic growth and the development of human capital, but few of those were dedicated to Africa. The present study addresses this gap by examining the role of human capital in economic growth. Secondly, it is recognised that Sub-Saharan Africa is the poorest region in the world and continues to face serious calamities such as hunger, diseases, instability, poor policies, wars, high rates of illiteracy, corruption, poor health facilities, etc., which put most of the countries into a vicious cycle. To measure the effect, the study incorporates recent data on education, health, and other significant factors, such as physical capital, inflation, and trade openness, to examine their relationship with per capita income growth through empirical testing. Thirdly, the study uses the generalised method of moments (GMM) model, which is a panel two-step system, taking into consideration over-identification and autocorrelation issues with the help of the Sargan and Hansen tests. Finally, the study provides new evidence to support the argument about the relationship between human capital and economic growth.

The structure of the rest of the paper is as follows. Section II discusses data and methodology used in this study. Section III presents the main findings. Lastly, Section IV provides some concluding remarks.

II. Data and Methodology

A. Data

The present study uses panel data from Sub-Saharan African countries for the period 2000 to 2020, sourced from the World Development Indicators (WDI) published by the World Bank. The selection of countries is strictly based on data availability. The variables employed in this study are GDP per capita ($GDPpc$), government expenditure on education (*GEE*), government expenditure on health (*GEH*), malaria cases (*MAL*); however, other variables such as *inflation*, *openness*, and physical capital (*PC*) are also included as control variables. Pupil-teacher ratio (*PTR*) and student enrolment ratio (*SER*) are used as proxies for human capital. The variables are defined in Table 1.

B. Methodology

The estimation procedure utilized in this study is based on the System GMM methodology introduced by Blundell & Bond (1998). The GMM model is used because it incorporates the complete set of country-specific effects in the case of explanatory variables. Additionally, it addresses the problem of endogeneity that arises from the independent variables by including the lagged dependent variable in the model. Thus, our model takes the following form:

$$\begin{aligned} LnGDPpc_{it} = \alpha_0 + \gamma_i + \lambda_t + \beta_0 LnGDPpc_{it-1} \\ + \beta_1 SER_{it} + \beta_2 TPR_{it} + \beta_3 GEE_{it} \\ + \beta_4 GEH_{it} + \beta_5 MAL_{it} + \beta_6 X_{it} + \varepsilon_{it} \end{aligned} \quad (1)$$

Here, $LnGDPpc$ represents the natural logarithm of GDP per capita in constant 2015 US dollars, and $LnGDPpc_{it-1}$ denotes the first lag of $GDPpc$. X stands for control variable vectors related to $GDPpc$, while α and βs represent unknown parameters that need to be estimated. The term γ_i reflects unreported country-specific effects, and λ_t represents time effects. ε is the error term, with i indicating countries $(i = 1, 2, 3, \ldots, 22)$ and t representing years $(t = 1, 2, 3, \ldots, 21)$. Roodman (2009) pointed out that the GMM method can become problematic if there are too many instruments, particularly as the time dimension increases; this may bias parameter estimates and invalidate specification tests. To mitigate this issue, Roodman proposed two methods for reducing the number of instruments, both of which we have applied in our analysis.

To maintain the consistency of System GMM estimators, four key conditions must be satisfied. First, the error term should exhibit no serial correlation, which can be assessed using Arellano & Bond (1991) AR(1) and AR(2) tests. Second, Hansen (1994) test of over-identification is employed to verify that the instruments used in estimation are uncorrelated with the error terms. Third, additional moment conditions outlined by Blundell & Bond (1998) must be met; these can be evaluated through the Difference-in-Hansen test. Finally, as recommended by Roodman, the number of instruments should not surpass the number of groups in the regression to prevent over-fitting.

III. Empirical Findings

Before proceeding to the empirical analysis, we first examine the summary statistics of the variables, which are presented in Table 2. This table provides an overview of the main characteristics of the study's variables.

According to Table 2, the mean government expenditure on education and health as a percentage of GDP is 3.63% and 1.44%, respectively. These figures are significantly lower than those of OECD countries, which average 5.00% for education and 6.89% for health over the same period. Student enrollment ratios have increased over time, with values ranging from a low of 32.36 to a high of 149.31, and a mean of 98.41. This mean is just 1.59 below the targeted 100% enrollment ratio, suggesting substantial progress. Achieving universal school enrollment would boost literacy rates in Sub-Saharan Africa, making the adoption of innovations easier, as literate populations can adapt more readily. The number of students per teacher ranged from a minimum of 26.6 to a maximum of 72.12 over the study period. The pupil-teacher ratio can be improved by recruiting more teachers and constructing additional schools to accommodate the rapidly growing population and to maintain man-

Table 1. Description of Variables

Variable	Description
PTR	The pupil-teacher ratio is the number of students per teacher. The data are transformed by taking the log of the data and then finding the inverse of the result to get the teacher-pupil ratio (*TPR*)
SER	The student enrolment ratio is the percentage of children age group going to school
GEE	Government expenditure on education as a percentage of GDP
GEH	Domestic government expenditure on health as a percentage of GDP
MAL	Incidents of malaria cases per 1000 people
PC	Gross fixed physical capital accumulation as a percentage of GDP
Inflation	Percentage change in the consumer price index
Openness	The ratio of imports and export to GDP
GDPpc	GDP per capita (constant 2015) is the dependent variable

Note: This table provides detail descriptions of the variables used in this study.

Table 2. Descriptive statistics

Variable	Mean	Std. Dev	Minimum	Maximum
LnGDPpc	6.795	0.688	5.628	8.745
SER	98.410	23.132	32.360	149.310
PTR	44.517	9.851	26.600	72.120
GEE	3.629	1.454	0.620	8.140
GEH	1.442	0.932	0.120	5.350
MAL	263.000	164.742	0.200	724.57
PC	20.996	7.424	2.780	59.72
Inflation	6.795	10.468	-11.880	100.61
Openness	59.636	23.348	20.960	175.80

Note: This table reports summary statistics of all variables used in the study. Std. Dev indicates standard deviation.

ageable class sizes for effective teaching and learning. On the other hand, the mean number of malaria cases is 263 per 1,000 people (26.3%), indicating that malaria remains a serious issue that may hinder GDP per capita growth in Sub-Saharan Africa. The average investment in physical capital stands at 21% of GDP, while the countries in this region are highly open to international trade, with trade averaging 59.63% of GDP. However, the inflation rate is high, 6.8% on average, compared to other regions, which reduces purchasing power and poses serious challenges for the economy. Since most goods in the region are imported, the benefits of inflation accrue abroad, while the region bears the negative effects, further hurting per capita income.

Table 3 presents the results of the two-step GMM model, which reveal that both the student enrollment ratio and the pupil-teacher ratio have a positive and significant effect on GDP per capita. Specifically, a 10% increase in the student enrollment ratio and in the pupil-teacher ratio leads to an increase in GDP per capita of 0.5% and 23.2%, respectively. This finding aligns with Eggoh et al. (2015). In contrast, government expenditure on education (as a percentage of GDP), malaria cases, and inflation each have a negative and significant impact on GDP per capita. A 10% increase in government expenditure on education, malaria cases, and inflation causes GDP per capita to decline by 0.174%, 0.020%, and 0.010%, respectively. The negative coefficient for malaria is consistent with economic theory: reducing malaria cases would boost GDP per capita, as malaria reduces productivity and working hours, ultimately lowering income. Improved access to quality health facilities would help decrease malaria cases and increase per capita income in the region. Other variables included in the analysis do not show a significant relationship with GDP per capita in the region. Overall, the results indicate that human capital has a positive effect on GDP per capita in Sub-Saharan African countries. Interestingly, the negative coefficient for openness is contrary to standard economic theory, which generally suggests that increased openness to international trade should promote economic growth, as argued by Adam Smith, David Ricardo, Gunnar Heckscher, and Bertil Ohlin. However, in Sub-Saharan Africa, increased openness appears to hurt GDP per capita. This may be due to a high reliance on imported goods and the export of primarily low-value raw materials, which discourages the development of domestic manufacturing. Such a situation may inhibit job creation and exacerbate inflation, ultimately impeding economic growth.

Table 3. Determinants of *GDPpc* using SSA (System GMM model)

Variables	Coefficient	p > |z|
Dependent - *LnGDPpc*		
LnGDPpcL1.	0.725*** (0.184)	0.000
SER	0.05** (0.002)	0.025
PTR	2.317** (1.324)	0.080
GEE	-0.017** (0.009)	0.075
GEH	-0.022 (0.038)	0.571
MAL	-0.002*** (0.000)	0.005
PC	0.002 (0.002)	0.501
Inflation	-0.001** (0.000)	0.064
Openness	-0.002 (0.001)	0.450
Ar(1) Ar(2) Sargan test Hansen Test	0.126 0.847 0.491 0.643	

Note: This table presents the regression-based results of the various determinants of GDP per capita. *** and ** denotes statistical significance at 1% and 5% levels, respectively, *p* stands for the *p-values*

IV. Conclusion

This study aimed to investigate the connection between economic growth and human capital in Sub-Saharan African nations by using the System GMM model. The study utilises existing data and explores how human capital and economic growth are linked, accounting for the presence of other control variables in these countries. The results indicate that there is a positive relationship between human capital and per capita growth in SSA countries, demonstrating that human capital has played an important role in the region's economic growth. On the other hand, malaria and government expenditure on education significantly hurt per capita income. Based on our analysis, several policy implications emerge. Governments in Sub-Saharan Africa should increase effective expenditure on education to promote long-run per capita economic growth. Policies aimed at achieving full enrolment, recruiting more teachers, and reducing malaria cases will positively contribute to rapid GDP per capita growth in the region. The pupil-teacher ratio, which serves as a proxy for quality education, is the only variable with an elastic coefficient; therefore, policymakers in the region should focus more on achieving quality education rather than merely increasing quantity.

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References

Afzal, M., Malik, M. E., Begum, I., Sarwar, K., & Fatima, H. (2012). Relationship among education, poverty and economic growth in Pakistan: An econometric analysis. *Journal of Elementary Education*, *22*(1), 23–45.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, *58*(2), 277–297. https://doi.org/10.2307/2297968

Bashir, S., Herath, J., & Gebremedhin, T. G. (2012). *An Empirical Analysis of Higher Education and Economic Growth in West Virginia*.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, *87*(1), 115–143. https://doi.org/10.1016/S0304-4076(98)00009-8

Eggoh, J., Houeninvo, H., & Sossou, G. A. (2015). Education, health and economic growth in African countries. *Journal of Economic Development*, *40*(1), 93. https://doi.org/10.35866/caujed.2015.40.1.004

Eigbiremolen, G. S. 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. https://doi.org/10.6007/IJARBSS/v4-i4/749

Ekpo, A. H. (2020). Governance, Growth and Development in Sub-Sahara Africa: A Revisit of the Evidence. *AEA/NEA/AFEA Conference in San Diego, California, USA*.

Fashina, O. A., Asaleye, A. J., Ogunjobi, J. O., & Lawal, A. I. (2018). Foreign aid, human capital and economic growth nexus: Evidence from Nigeria. *Journal of International Studies*, *11*(2), 104–117. https://doi.org/10.14254/2071-8330.2018/11-2/8

Hansen, B. E. (1994). Autoregressive conditional density estimation. *International Economic Review*, 705–730. https://doi.org/10.2307/2527081

Jallow, S., Sahoo, P. K., & Mahapatra, B. (2024). Promoting Financial Inclusivity, a Route to Economic Growth: An Empirical Analysis from Sub-Saharan African Countries. *Bulletin of Monetary Economics and Banking*, *27*, 59–74. https://doi.org/10.59091/2460-9196.2159

Karambakuwa, R. T., Ncwadi, R., & Phiri, A. (2020). The human capital–economic growth nexus in SSA countries: what can strengthen the relationship? *International Journal of Social Economics*, *47*(9), 1143–1159. https://doi.org/10.1108/IJSE-08-2019-0515

Lucas, R. E., Jr. (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

Mohammed, S. S., Kassem, G. M., & Ali, M. (2024). Financial Inclusion, Institutional Quality and Economic Growth in Sub-Saharan African Countries. *Energy Research Letters*, *5*(3). https://doi.org/10.46557/001c.77903

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, Part 2), S71–S102. https://doi.org/10.1086/261725

Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GMM in Stata. *The Stata Journal*, *9*(1), 86–136. https://doi.org/10.1177/1536867X0900900106

Saidi, K., & Mongi, C. (2018). The effect of education, R&D and ICT on economic growth in high income countries. *Economics Bulletin*, *38*(2), 810–825.

Sarwar, S., Alsaggaf, M. I., & Tingqiu, C. (2019). Nexus among economic growth, education, health, and environment: dynamic analysis of world-level data. *Frontiers in Public Health*, *7*, 307. https://doi.org/10.3389/fpubh.2019.00307

Sieng, L. W., & Yussof, I. (2014). Human capital accumulation and economic growth in Malaysia-Investigating the long run nexus. *Jurnal Ekonomi Malaysia*, *48*(1), 155–165. https://doi.org/10.17576/JEM-2014-4801-13

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