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Human Development and Economic Growth Through Education in Developing Regions

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ABSTRACT: Human development, a cornerstone of sustainable development, encompasses improvements in the quality of life for both present and future generations. Beyond addressing basic needs, it includes access to education, healthcare, security, and freedoms. This paper adopts a distinctive approach to examining the interplay between human development and economic growth in developing countries, with a particular emphasis on education as a pivotal driver. Using a theoretical overlapping generations model and an empirical analysis of African and Asian developing countries from 2000 to 2021, we employ the two-way panel estimation that captures within-country variations over time while isolating the effects of global shocks and unobserved heterogeneity. The findings reveal that education has a positive impact on economic growth in both areas, even when considered separately. These results align with the literature but also prompt discussions on prioritizing education quality over quantity, reducing inequalities, improving financing mechanisms, integrating technology, and aligning education systems with labor market demands to foster sustainable growth.

KEYWORDS: education, human development, labor market, economic growth

1. Introduction

Human development (HD) is central to the concept of sustainable development. This connection is particularly significant about the social pillar, one of the three interdependent pillars underpinning sustainable development: social, economic, and environmental. The focus on the human element highlights the importance of envisioning development for both the present generation and future generations. In an era characterized by pandemics, economic crises, conflicts, and global warming, it is crucial to consider the implications for human well-being and the quality of life on Earth. This awareness necessitates an understanding of how sustainable economic development can impact human development (HD). The concept of human development itself is not a novel idea within development studies; even before the contemporary emphasis on sustainability, both the economic and social dimensions of development have been central concerns for

policymakers. This enduring interest is reflected in classical economic literature, with seminal thinkers such as Adam Smith, Karl Marx, and Thomas Malthus exploring these themes. Human Development (HD) has long been acknowledged as a cornerstone of societal progress. However, in recent times, the emphasis on HD has diminished, eclipsed by a focus on market production and financial market expansion. HD extends beyond the mere provision of resources to meet basic needs. It encompasses access to health and education systems, personal security, political and cultural freedoms, and the opportunity to cultivate interests and develop productive and creative potential. Fundamentally, HD reflects the process by which a society enhances the quality of life for its members through sustainable economic development.

This paper assesses the current state of developing economies, investigates the underlying causes, and explores pathways for achieving sustainable development. It follows from studies examining the determinants of economic growth across countries through the lens of empirical growth models, with a primary focus on the roles of capital accumulation, human capital, and conditional convergence. The analysis explores the interplay between endogenous factors and HD, highlighting the bidirectional relationship between GDP per capita and human development. Although sustainable development comprises three fundamental pillars—economy, social dimension, and environment—we will restrict our analysis to the relationship between the social dimension and the economic one.

This study employs a robust two-way panel estimation technique to address gaps in existing literature and account for unobserved heterogeneity across countries. The research focuses on African and Asian countries, regions marked by distinct challenges and opportunities. Sub-Saharan Africa (where we have most of the African countries in our sample), characterized by rich cultural diversity and abundant natural resources, faces rapid population growth and education system reforms. While geographically and demographically distinct, Southeast Asia contends with challenges, including climate change, political instability, and rising inequality.

The dataset spans the years 2000–2021, encompassing significant global initiatives such as the Millennium Development Goals (MDGs) and the Sustainable Development Goals (SDGs). By analyzing the interplay between education and sustainable economic growth, this study provides actionable policy insights to promote HD. The remainder of this paper is structured as follows: Section 2 reviews the literature, providing a theoretical overview. Section 3 presents the economic model, primarily based on the overlapping generations model. Section 4 details the regression analysis using the two-way panel estimation. Finally, Section 5 discusses the results and their implications, offering practical guidance for policymakers and researchers.

2. Literature

Sustainable thinking is no longer optional; ensuring that future generations can enjoy all opportunities is essential. Sustainability demands a universal approach, balancing the rights of future generations with addressing the pressing needs of today's less privileged populations (Anand & Sen, 2000). Economic growth (EG) and human development (HD) have a strong, bidirectional relationship. Economic growth provides the resources necessary for sustained improvements in human development (HD), while HD enhances the capabilities of individuals who drive economic growth. This relationship is reflected in various strands of literature, including the impact of economic growth on human development in basic needs studies and the role of improved labor quality in the human capital literature (Ranis & Stewart, 2005). Health is pivotal in economic growth, but its positive impact depends on countries meeting minimum health benchmarks. In low-income countries, fostering economic growth requires a comprehensive strategy that includes education enhancement, productivity improvements, entrepreneurship promotion, and health initiatives. For countries with satisfactory health outcomes, investments in research and development can further promote sustainable economic growth (Chakroun, 2024).

At the macro level, higher income levels are often associated with improved Human Development (HD) indicators, such as increased life expectancy, lower infant mortality, and higher literacy rates, all of which contribute to a higher Human Development Index (HDI) (Anand & Sen, 2000). Beyond being valuable in its own right, human development (HD) enhances creativity and productivity, contributing to economic growth through higher labor productivity, technological advancements, increased foreign direct investment, and higher exports (Ranis & Stewart, 2005). Improved education and health also play a dual role as intrinsic contributors to quality of life and as drivers of economic prosperity (Anand & Sen, 2000). Theoretical frameworks, such as the Solow model and new growth theories, emphasize the role of human capital in economic growth. Lucas (1988) highlights education as a catalyst for innovation and increased capital productivity, while Romer (1990) and Grossman and Helpman (1991) underscore education's role in driving technical progress and R&D. Also, Barro's regression models show that the impact of education on growth varies by a country's development stage, with primary education being crucial for low-income countries and secondary/tertiary education driving growth in higher-income countries (Barro, 1991). Countries with a high level of human capital relative to GDP per capita experience faster growth, lower fertility rates, and higher investment ratios. However, this accumulation of human capital through schooling deserves particular attention from developing countries. The role of improving school enrolment, a central element of most development strategies, has become

controversial, as increasing educational levels have not guaranteed improved economic conditions. Cognitive skills play a crucial role in promoting economic well-being when examining the impact of the quality and quantity of schools. There is strong evidence that the cognitive skills of the population, rather than simply the level of education, are closely linked to individual income, income distribution, and economic growth (Hanushek & Woessmann, 2008).

In Africa, research highlights the significance of higher education for economic development. While tertiary education can accelerate technological diffusion and reduce poverty (Bloom et al., 2014), inefficiencies in public education and health expenditure have been linked to weak growth outcomes (Eggoh et al., 2015). The variation in the impact of education across African nations suggests a need for tailored, human capital-focused policies to strengthen these linkages (Matashu, 2021). In South Asia, human capital formation consistently demonstrates a positive relationship with economic development. Higher education exhibits a long-term causal relationship with economic growth, whereas primary and secondary education play a more significant role in East Asia. Government investments in education and health have a positive influence on growth, with bidirectional causality between health expenditure and GDP growth, and unidirectional causality from education expenditure to GDP growth (Siddiqui & Rehman, 2017; Islam, 2020). Overall, the literature emphasizes the necessity of investing in education and health to maximize economic growth potential, tailoring strategies to regional and developmental contexts.

3. Economic model

We consider an economic model in the firm and household. Firstly, let's consider a firm with two technologies available, the first is traditional technology. For simplicity, we assume a linear function of unskilled labor:

$$Y_t = AL_{T,t}, \tag{1}$$

where Yt is the output level and $L_{T,t}$ is the amount of unskilled labor used for the traditional technology. Owing to a zero-profit condition, the wage rate of unskilled labor is equal to the technological level of traditional technology:

$$w_{u,t} = A \tag{2}$$

Where $w_{u,t}$ is the wage rate of unskilled labor. The second is the modern technology:

$$Y_t = BZ_t^{\alpha} L_{M,t}^{1-\alpha} \tag{3}$$

where $0 < \alpha < 1$. Z_t is the intermediate goods, and $L_{M,t}$ is the amount of unskilled labor used for modern technology. When both the traditional and modern technologies are simultaneously used, it holds that $L_t = L_{T,t} + L_{M,t}$, in which Lt is the amount of unskilled labor in the economy. The intermediate goods are produced by

$$Z_t = K_t^{\beta} H_t^{1-\beta} \tag{4}$$

where $0 < \beta < 1$. Kt is the capital stock and Ht is the amount of skilled labor. Therefore, we assume capital-skill complementarity, which suggests that capital enhances skilled labor's productivity. This assumption is fundamental to our economic model.

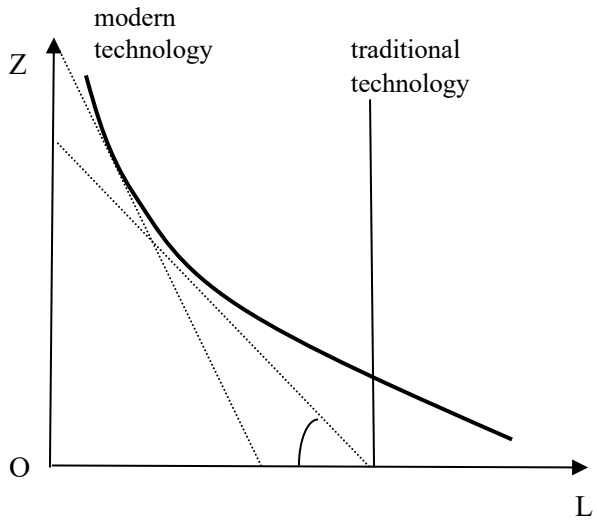

Figure 1: Isoquants and the ratio of factor prices

Figure 1 presents Isoquants and the ratio of factor prices when both technologies are used. Traditional technology uses only unskilled labor, represented by the vertical isoquant. Modern technology utilizes both Z and L by Kobb-Douglas functions; when the ratio of intermediate goods prices to the unskilled labor wage rate is reached, both technologies can be employed. The availability of both technologies depends on the slope's level. Only modern technology can be used when the wage rate of unskilled labor increases because traditional technology is expensive. In this model, we consider two stages of economic development; in the first one, both traditional and modern technologies are used, and in the second stage, only modern technology is used. Those stages of economic development depend on a threshold $\hat{z}$.

The FOC concerning unskilled labor is as follows:

$$\frac{\partial Y_t}{\partial L_t} = B(1-\alpha)z_t^{\alpha} = w_{u,t} \tag{5}$$

when $z_t = Z_t / L_t$. Because $w_{u,t} = A$, it holds that

$$\hat{z} = \left(\frac{A}{B(1-\alpha)}\right)^{\frac{1}{\alpha}} \tag{6}$$

Using this, the FOC concerning the capital stock is

$$\frac{\partial Y_t}{\partial K_t} = B\alpha\hat{z}^{\alpha-1}\beta\left(\frac{K_t}{H_t}\right)^{\beta-1} = R_t \tag{7}$$

where R_t is the gross interest rate. We assume that capital depreciates for one period. Namely, R = 1 + r, in which r is the net interest rate.
The FOC concerning skilled labor is

$$\frac{\partial Y_t}{\partial H_t} = B\alpha\hat{z}^{\alpha-1}(1-\beta)\left(\frac{K_t}{H_t}\right)^{\beta} = w_{s,t.} \tag{8}$$

Where $w_{s,t}$ is the wage rate of skilled labor. The role of technology in the labor market is pivotal. Using traditional and modern technologies (first stage) depends on the condition $z_t \leq \hat{z}$. However, if $z_t > \hat{z}$, only modern technology is employed (second stage) due to the high wage rate for traditional technology. This underscores the profound impact of technology on the labor market, a critical insight of our model.

Secondly, we consider Households a three-period OLG model incorporating education, work, and consumption over three generations. In the first period, an individual receives education if their parents can afford it. In the second period, the individual works. An individual who gets an education works as skilled labor. An individual who does not receive an education works as unskilled labor. In the third period, the individual consumes from their savings. The utility function of a parent who is born in period $t-1$ is as follows:

$$U\left(c_t^y; I_{t+1}^c; c_{t+1}^o\right) = \delta lnc_t + \gamma lnI_{t+1}^c + (1-\delta-\gamma)lnc_{t+1}^o \tag{9}$$

where $0 < \delta < 1$, $0 < \gamma < 1$, and $0 < \delta + \gamma < 1$. c_t^y and c_{t+1}^o are the consumption levels in periods t and t + 1 when they are young and old, respectively. I_{t+1}^c is the income level of their child. The budget constraints of a parent are

$$I_t^p = c_t^y + e + s_t \tag{10}$$

$$c_{t+1}^o = R_{t+1}s_t \tag{11}$$

Where I_t^p is the parental income level. e is the fixed amount of education investment. We assume the indivisibility of education investment. s_t is the savings. R_t+1 is the gross interest rate in period t + 1. The income level of a child is as follows:

$$I_{t+1}^c = \begin{cases} w_{s,t+1} & When\ e > 0, \\ w_{u,t+1} & When\ e = 0. \end{cases} \tag{12}$$

We examine the incentive compatibility for education investment (IC_t). If $IC_t > 0$, parents can afford education for their children. We assume that in the initial period, skilled workers can afford education for their children while unskilled workers cannot afford education for their children:

$$w_{s,0} > \hat{I}_0^p \ and\ w_{u,0} < \hat{I}_0^p \tag{13}$$

Intergenerational mobility is a crucial indicator of an economy. The wage rate of unskilled labor has a significant influence on it. If this rate does not increase, there will be no intergenerational mobility from poor to rich people. This highlights the

crucial role of wage rate dynamics in fostering intergenerational mobility, a key factor in driving economic growth.

Equilibrium[1]

We assume that the initial ratio of skilled labor is $\lambda_0 = \lambda$ and that of unskilled labor is $1 - \lambda_0 = 1 - \lambda$. Namely, $L_0 = 1 - \lambda$ and $H_0 = \lambda$. In the first stage of economic development

$$z_t \leq \hat{z} \tag{14}$$

This occurs when traditional technology's productivity is high while modern technology's is low. Here, both traditional and modern technologies are utilized simultaneously. The wages for both skilled and unskilled labor remain stagnant, and the capital stock does not experience growth. The savings in period t form capital stock in period $t + 1$, which is constant. Consequently, the economy is caught in a poverty trap as long as the following holds:

$$Z = \left(\frac{K}{H}\right)^{\beta} \leq \hat{z} \tag{15}$$

In the second stage

$$z_t > \hat{z} \tag{16}$$

This can be realized when the productivity of modern technology rises by policies. The wage rate of unskilled labor is

$$w_{u,t+1} = B(1-\alpha)z_t^{\alpha} \tag{17}$$

Therefore, the wage rate of unskilled labor increases with an increase in z_t, namely, capital accumulation. Using $w_{u,t}$, the wage rate of skilled labor is

$$w_{s,t} = B\alpha z_t^{\alpha-1}(1-\beta)k_t^{\beta} = w_{u,t}\frac{\alpha}{1-\alpha}(1-\beta)\frac{1}{H_t} \tag{18}$$

Under no intergenerational mobility, the amount of skilled labor is $H_t = \lambda$. The capital stock in period $t + 1$ is

$$K_{t+1} = \lambda\frac{1-\delta-\gamma}{1-\delta}\left(w_{s,t} - e\right) + (1-\lambda)\frac{1-\delta-\gamma}{1-\delta}w_{u,t} \tag{19}$$

Therefore, the wage rate of skilled labor also increases with capital accumulation. The wage gap between skilled and unskilled labor remains unchanged. If the wage rate of unskilled labor sufficiently rises to exceed the threshold for education investment:

$$w_{u,t} > \hat{I}_t^p \tag{20}$$

then all individuals can receive education, which implies no existence of unskilled labor. The production function is assumed to be

[1] The population size is normalized to one.

$$Y_t = BK_t^{\beta} H_t^{1-\beta} \tag{21}$$

When all workers are educated, the amount of skilled labor increases:

$$H_t = \lambda + (1 - \lambda) = 1 \tag{22}$$

The wage rate of skilled labor is

$$w_{s,t} = B(1-\beta)(\frac{K_t}{H_t})^{\beta} \tag{23}$$

The capital stock in period t + 1 is

$$K_{t+1} = w_{s,t} = B(1-\beta)K_t^{\beta} \tag{24}$$

Note that $H_t = 1$. The steady-state capital stock

$$K^* = [B(1-\beta)]^{\frac{1}{1-\beta}} \tag{25}$$

The wage rate of skilled labor increases with capital accumulation.
The productivity of traditional technology increases the wage rate of unskilled labor. However, it may disrupt the transition to sustained growth. If the productivity of modern technology increases, the economy can move to sustained growth. When $z_t > \hat{z}$, skilled and unskilled labor wage rates can increase with capital accumulation. If the wage rate of unskilled labor sufficiently increases, unskilled workers can afford education for their children. This implies increasing savings, which in turn leads to economic growth.

4. Regression analysis

4.1. Data

We examine the relationship between human development, through the accumulation of human and physical capital, and economic development to ensure its sustainable dynamics. As mentioned earlier, we are following the work on endogenous growth. Human capital accumulation is approached by education, and physical capital accumulation is approached by investment. Our dataset comprises an unbalanced panel of countries spanning the period from 2000 to 2021. Variables were taken from World Development Indicators to estimate the impact of education on economic growth in Africa (Botswana, Cameroon, Egypt, Ethiopia, Ghana, Kenya, Morocco, Namibia, Rwanda, Senegal, Tanzania, Tunisia, Uganda) and Asia (Brunei, Cambodia, Indonesia, Lao, Malaysia, Philippines, Thailand, Vietnam, Timor). The GDP per capita measures the dependent variable. The independent variables are the investment share of GDP, also known as (I/GDP), education measured by School enrollment, primary (% net), and population growth measured by population growth (annual% %).

4.2. Methodology

This study employs two-way panel estimation to account for country-specific and time-invariant characteristics, as well as time-specific country-invariant shocks, which could bias the results. This approach ensures that the analysis captures within-country variations over time while isolating the effects of global shocks and unobserved heterogeneity.
The model is then specified as follows:

$$lny_{i,t} = \alpha_i + \beta_1 lninv_{i,t} + \beta_2 lnedu_{i,t} + \beta_3 lnpop_{i,t} + v_t + u_{i,t} \quad (26)$$

Where ln is the log of variables, $y_{i,t}$ is the dependent variable GDP per capita. $inv_{i,t}$ represents the investment rate (I/GDP), reflecting physical capital investment in our model, while $edu_{i,t}$ represents the education level, serving as a proxy for human capital investment. $pop_{i,t}$ is population growth.

5. Results and Discussions

Table 1: Estimation results

	(26)	AFRICA	ASIA
Variable	RE	FE	FE
Investment	.458***	.474***	.454***
	(0.000)	(0.000)	(0.004)
Education	2.011***	2.466***	1.025**
	(0.000)	(0.000)	(0.026)
Population	-.433***	-.233*	-.603***
	(0.000)	(0.070)	(0.000)
Constant	-2.740***	-5.025***	1.917
	(0.007)	(0.000)	(0.355)

**** p<.01, ** p<.05, * p<.1*

Table 1 presents the results of the two-way panel estimation, which also displays the fixed or random effects[2] for both regions together and separately. For both regions, the coefficients in the full model indicate that education and investment are positively and statistically significantly related to explaining GDP per capita. The population growth is also statistically significant but negative. This confirms that these variables stimulate GDP per capita. Indeed, a one-unit increase in education variable (School enrollment, primary (% net)) is associated with an increase of 2.011 percentage points in GDP per capita. The results for the region separately confirm those results. Therefore, the current debates that gave rise to this study motivate our discussion. In particular, the difference between the

[2] The choice for the fixed or random effect is based on the random test

quantity and quality of education. Indeed, the quality of education is just as essential as access to education itself. The allocation of resources must be directed towards improving teacher training, developing more effective curricula, and ensuring equitable access to quality educational resources (laboratories, libraries).

This is becoming increasingly essential due to the growing importance of new technologies and the evolving skills of workers, as highlighted in our economic model. Botswana, for example, invests heavily in education, with high literacy rates and public spending on education. However, economic diversification is limited, with a heavy reliance on diamond mining. Even with well-trained workers, opportunities outside the mining sector are rare (Schilirò, 2022). Despite significant improvements in education, growth could stagnate without structural transformation, as the economy cannot absorb skilled labor in various sectors. The result could be unemployment among the educated (World Bank, 2014). The same applies to unemployment; although it is necessary to keep it low, it is also important to ensure the quality of workers' skills. In Cambodia, for example, unemployment rates are low due to the significant contribution of the informal sector and the country's agriculture-based economy (Economic Institute of Cambodia, 2006). However, low unemployment may not translate into higher growth, as many workers remain trapped in low-productivity jobs that contribute little to GDP. Low unemployment can coexist with sluggish growth if workers are underemployed or if productivity gains are limited in subsistence agriculture or informal work (Dalis, 2014). Consequently, even with low unemployment, economic growth can remain sluggish if productivity gains are minimal. These cases underscore a critical insight: educational quality and economic structure must align to translate human capital investments into tangible economic growth. Simply increasing access to education or reducing unemployment does not guarantee development. Instead, policy efforts must match workers' skills to sectoral demands while fostering structural transformation to create diversified, high-productivity employment opportunities. This study contributes to the broader discourse on human capital development and its role in sustainable growth by linking the quantity-quality education debate to structural economic factors.

6. Conclusion

This paper examines the relationship between human development and economic development, with a focus on the sustainable nature of economic development through its interaction with human development. To achieve this, we first presented an economic model that highlights the conditions for sustainable economic development, considering the behaviors of firms and households within an economy with two available technologies, within an overlapping generations framework. We then employed a two-way panel estimation to analyze the role of human and physical capital accumulation in driving economic growth across 13

African and 9 Asian countries from 2000 to 2021. GDP per capita served as the dependent variable, with education as a proxy for human capital accumulation, and Gross capital formation (% of GDP) for physical capital accumulation. This was also related to the literature on population. Our findings reveal a positive relationship between economic growth, education, and investment, while population growth is negatively associated with growth when analyzing the regions collectively. These results align with the existing literature. Still, they also raise questions about the existence of paradoxes in certain regions, such as structural barriers, limited economic diversification, and the translation of investments in human and physical capital into sustainable development outcomes, implying that accompanying measures are necessary to ensure these impacts are consistent and sustainable. Tackling these obstacles is essential to ensure inclusive and sustainable economic development in these countries. The integration of the environmental dimension will motivate our future research.

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