

# Economic Growth and Quality Adjusted Human Capital Equation: Moderating Role of Social Capabilities in Africa

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## Research Article

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# **Economic Growth and Quality Adjusted Human Capital Equation: Moderating Role of Social Capabilities in Africa**

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## **Abstract**

The role of human capital on economic growth across countries has over time garnered lots of discussion in economic literature. This is fundamental, given that the actual determinant of the difference in income per capita across countries or why some countries are growing faster than other countries has remained an unresolved issue. This study provides a different insight into the nexus between human capital and economic growth by accounting for the role of social capabilities in a panel framework. Specifically, the study covers 40 African countries between 1998-2019, where the General Method of Moment (GMM) was employed to estimate the model. Specifically, it was discovered that without improved legal institutions and better economic opportunities, human capital impact on the growth of income per capita across countries is insignificant though positive. The study concludes that the effectiveness of knowledge accumulation and adoption of technology in a country is hinged on the availability of an enhanced legal, social, and economic environment.

**Keywords:** Africa, human capital, General Method of Moment (GMM), quality-adjusted human capital, social capabilities

**JEL CODE:** A3, D83, E24, F63, I2

## **1. Introduction**

What determines the differences in cross-country income and long-run economic growth rate across countries remains a controversial and highly debated topic among economists (Adler et al., 2017). The global economy has witnessed tremendous growth in output per capita in the last four decades, with world average growth rate at 4.3 percent between 1987 and 2015 (United Nation Report, 2018). Despite the outstanding growth rate witnessed in the past three decades championed by the East Asian countries (China, India & Asian tigers), the growth rate in the last decades has been met with lots of economic crises and global negative shocks. This global economic crisis and shocks include the global financial crisis of 2008 to 2010 championed by the US, the European debt-crisis of 2010 to 2012 championed by Argentina, the global commodity price fluctuation or falls championed by oil-producing countries including Nigeria (2014-2016), and more recently the global negative output shock induced by Covid 19 pandemic (Joseph, 2020).

In the past three decades, empirical evidence has revealed that human capital accumulation, physical capital stock, technological adoption (machine and equipment), institutional framework, quality, and quantity of labour force are among the leading drivers of the difference in cross country income (Obialor, 2017; Izushi & Huggins, 2004; Barro, 1998, Orogwu et al, 2021). Data from International Monetary Fund (2017) revealed that machinery and intellectual properties (human capital and technology advancement) are the leading drivers of growth in most developed countries, including the US, EU, Japan, and South Korea. Although, data revealed that China's outstanding economic growth, which has lasted for decades, cannot be attributed to intellectual properties but rather accumulation and stock of physical and human capital (Tonuchi & Onyebuchi, 2019). Izushi and Huggins (2004) noted that China is enjoying technological diffusion partly necessitated by trade policies from the West.

Economic growth theories postulate that the determinant of economic growth across countries is the differences in technology adoption and human capital accumulation. Specifically, the endogenous growth model states that technological advancement is directly related to investment in human capital. Similarly, the human capital theory postulates that the higher the quantity of schooling society the higher the economic growth (state of the economy). However, available evidence revealed that the increased global quantity of education or schooling had

not yielded much impact on economic growth, especially in developing countries (IMF, 2017). Bobetko, Draženović & Funda (2017) noted that rising school enrollment worldwide did not yield much equitable income distribution, economic growth, and development, especially in Africa. Evidence revealed that the global average of school enrollment has risen by 240 percent between 1960 and 2015, while global income per capita has only grown by 19.44 percent within the same period (World Bank, 2016). The missing link here is the fact that a mere rise in school enrollment does not guarantee quality education, improved economic opportunities, and a quality workforce. It borders on the question of whether the workforce (for example university graduates) is competent and employable, given that available evidence shows that cognitive skills and institutional quality (level of economic opportunities, democratic system, and quality education) are major determinants of how effective human capital is in driving economic growth (Ali et al., 2018; Hanushek, 2013; Joseph et al, 2021). This lack of emphasis on the role of institutions and quality of education in the most empirical literature on growth as well as policy framework including the popular MDGs programme brings to limelight the huge policy lacuna in most growth and developmental policies across the globe.

To this end, this study aims to determine the role of social capabilities in the nexus between human capital and the difference in cross-country growth rate. The rest of the paper is structured in the form of a literature review, methodology, analysis, and conclusion.

## **2. Literature Review**

### **2.1 Theoretical Evidence**

The role of human capital and recently human capital interaction with social capability (role of the institution and legal framework) in driving economic growth has received substantial theoretical and empirical discussion since the work of Schultz (1961) and Becker (1962).

Solow (1956) growth model arguably appears to be the most potent first theoretical foundation explaining differences in cross-country per capita income and factors that account for the long-run economic growth of a country (Ali et al., 2018; Izushi & Huggins, 2004).

In an attempt to explain the factors responsible for the long-run economic growth and differences in cross country income per capita; Solow relies on four major variables thus:

$$Y = F(K, AL) \dots\dots\dots(1)$$

where; Y = output, K = capital stock and L = labour force and A = Labour

Effectiveness. By employing Cobb-Douglas production function, equation (1) can be re-written as;

$$Y = K^\alpha AL^{1-\alpha}, 0 < \alpha < 1 \dots\dots\dots (2)$$

To see this, we can write the output per effective labour as a function of the effectiveness of capital per labour by multiplying 1/AL all through as seen in equation (3) below.

$$y = k^\alpha = f(k) \dots\dots\dots (3)$$

Such that,  $f'(k) > 0$  and  $f''(k) < 0$ . Equation three entails that labour productivity can only be achieved through more capital deepening, that is, increasing capital intensity (Izushi & Huggins, 2004). Overall, the assumption of diminishing returns to capital entails that output per effective worker does not increase indefinitely with an increase in capital, so long as individuals save a constant fraction of their income ( $s$ ), and depreciation occurs on capital investment ( $\delta$ ). Where ' $n$ ' represents population growth and ' $g$ ' represent knowledge growth rate, such that the rate of increase in capital ( $k$ ) can be written as;

$$\frac{\Delta k}{\Delta t} = sf(k) - (n + g + \delta)k \dots\dots\dots (4)$$

$$\text{when } \frac{\Delta k}{\Delta t} = 0; sf(k) = (n + g + \delta)k \dots\dots\dots (5)$$

$$\text{Or, } f(k) = (n + g + \delta)k/s \dots\dots\dots (6)$$

Equations (5) and (6) are the key equation of the Solow neoclassical model. The equation states that the derivative of  $k$  is the difference between the per unit of actual investment per labour and the amount of investment that must be done to keep capital per unit of effective labour ( $k$ ) at that point (Romer, 2012). Solow concludes that regardless of where the economy starts, the economy will converge where output per worker ( $y$ ) will be growing at the rate  $g$ . Meaning that knowledge or technological progress is the only source of growth in such an economy (Ludema, 2014; Barro, 1998).

However, following the work of Mankiw et al. (1992), equation (1) can be rewritten by assuming that technology progress ( $A$ ) does not enter the model multiplicatively to capture the current state of technological knowledge as given in equation (7);

$$Y = F(A, K, L) \dots\dots\dots (7)$$

Thus, if we assume that productivity increases over time at a constant rate  $g$ , equation (2), can be rewritten as;

$$Y = A_0 e^{gt} K^\alpha L^{1-\alpha}, \text{ where } A = A_0 e^{gt} \dots\dots\dots (8)$$

If we substitute equation (8) with the knowledge of equation into Cobb-Douglas production function, we have the estimated Solow Growth model as given below;

$$\text{Ln} \left[ \frac{Y}{L} \right] = \text{Ln} A(0) + gt + \frac{\alpha}{1-\alpha} \text{Ln}(s) - \frac{\alpha}{1-\alpha} \text{Ln} (n + g + \delta) \dots\dots\dots (9)$$

The central hypothesis of the Solow growth model is that the steady-state level of per capita income is determined by initial stock of technology  $A(0)$ , savings rate ( $s$ ) equal ratio of investment to GDP, labour force growth rate ( $n$ ), depreciation ( $\delta$ ), capital share ( $\alpha$ ) (and technology parameter (Mankiw et al., 1992). This means that if labour and capital stock is growing at the same rate output per worker will surely grow so long technical progress ( $A$ ) is higher than zero.

The traditional Solow model has been severely criticized, the most prominent criticism of the Solow model is the inability of the model to explain the causes of technological progress. While the model was able to explain that the source of economic growth across countries can be attributed to technological progress, the model did not explain how technological progress is attained (Ali et al., 2018; Holden & Biddle, 2016). As Sapkota (2014) argued, Solow set the rate of technological progress at ‘ $g$ ’ but fails to explain how it relates to other variables in the models. In response, to the above Criticism, Mankiw, Romer & Weil (1992) in the modified version of Solow model noted that technological progress originates from knowledge generated from learning institutions and Research and Development (R&D) base (universities, Non-Government Organisations, and Public and private research institutes) that operate outside the domain of the economic system.

However, technological progress cannot be ruled away from economic agents' economic decisions like the capital accumulation decision. Economic agents are always looking for an opportunity to exploit and produce a new idea in order to maximise profit. Thus knowledge-creating process should be incorporated into the growth model. This implies that technological progress should be endogenized in the growth equation (Holden & Biddle, 2016). Thus, Solow growth model has been modified by Mankiw et al. (1992) to incorporate human capital as a factor of production where average secondary school attainment has been a popular variable

used along others to capture human capital in the production function. The modified augmented Solow Growth model is given as;

$$Y = K^\alpha H^\beta AL^{1-\alpha-\beta}, 0 < \alpha + \beta < 1 \dots\dots\dots (10)$$

where; H is the stock of human capital, the  $\beta$  share of human capital in the country GDP other variables remain as defined earlier. As in the traditional Solow model,  $\alpha + \beta < 1$  is based on the assumption of decreasing returns to scale, contrary to endogenous growth theory. Following the assumption Mankiw et al. (1992), let  $s_k$  equal share of output invested in physical capital and  $s_h$  equals the share of output invested in human capital. Such that, the growth of income per capita will be given as;

$$\frac{\Delta k}{\Delta t} = s_k f(k) - (n + g + \delta)k = s_k (k^\alpha) h^\beta - (n + g + \delta)k \dots\dots\dots (11a)$$

$$\frac{\Delta h}{\Delta t} = s_h f(k) - (n + g + \delta)h = s_h (k^\alpha) h^\beta - (n + g + \delta)h \dots\dots\dots (11b)$$

where;  $h = H/AL$  and others remain as earlier defined. Substituting (11a) and (11b) into (10), we have;

$$\ln\left[\frac{Y}{L}\right] = \ln A(0) + gt - \frac{\alpha+\beta}{1-\alpha-\beta} \ln(n + g + \delta) + \frac{\alpha}{1-\alpha-\beta} \ln(s_k) + \frac{\beta}{1-\alpha-\beta} \ln(s_h) \dots (12)$$

Following equation (12) above, theoretically, capital share ( $\alpha$ ) = 1/3, where the elasticity of per capita output with respect to  $s$  and  $(n + g + \delta)$  equal to 0.5 and -0.5, any deviation from this point is assumed not significant or accurate modeling (Mankiw, et al., 1992).

One major theoretical issue in human capital theory is whether every aspect of investment in education (teaching, training, and learning) should be considered human capital development regardless of whether it increases the individual's productivity. Another challenge is the inability of the theory to explain the high unemployment witnessed currently all over the world except a few developed countries. Of course, the recent trade war among leading developed countries like USA, Europe, and China is partly the quest to solve unemployment in their respective country despite the high stock of human capital and technological advancement. In developing countries, especially in sub-Saharan African countries like Nigeria. There seems to be an increase in average secondary and tertiary school attainment, yet the unemployment level is still rising, and economic growth is still performing poorly, among other indicators contradicting the human capital theory.

## **2.2 Empirical Evidence.**

Several empirical works have investigated the impact of human capital on cross-country income differences. In summary, human capital theory attributes knowledge as the most potent driver of economic growth across countries (Ali et al., 2018; Ludema, 2014; Barro, 1998; Shultz, 1961).

One of the earliest literature to investigate human capital and economic growth across countries is Barro (1991). Barro employed a series of human capital variables with emphasis on the quantity of education and growth rate per capita income. Using OLS, Barro (1991) found that school enrolment rate is positively related to the growth rate of income per capita for a given level of initial per capita income using data from 100 countries. Barro (1998) later re-examined the relationship between human capital and economic growth using the same data set but made a series of modifications to the data used and assumption. For instance, Barro disaggregates the data for school enrollment to males and females to check whether gender influences the extent the human capital impacts economic growth. The result revealed that male school attainment at level has a significant positive impact on the growth rate of income per capita across countries while female school attainment does not have any significant impact.

In response to criticism of using school enrolment as measure of human capital that ignores quality, in 1998, Barro further examined whether school quality has any significant impact on how human capital influences the cross-country economic growth rate. He employed students' scores in science to achieve this, which positively impacted the human-economic growth rate nexus. Mankiw et al. (1992) investigated both Solow growth model and the augmented Solow model, where they introduce human capital variables in the model using panel data. They model the growth rate of income per capita as a function of income per capita at level, population growth rate, real investment ratio, average secondary school attainment as human capital variables, and other variables. They argued that the addition of the human capital variable in the model was able to explain the disparity in the growth rate of income per capita among different countries of the world. They argue that there will be convergence in the long run as more developing countries invest more in human capital accumulation. These countries will be able to successfully imitate the technological advancement of the developed countries. They used the lag one of the per capita growth rate to determine Solow conditional convergence.

Benhabib & Spiegel (1994) investigated the applicability of the Mankiw et al. (1992) augmented Solow model. The authors first duplicated the Mankiw model using Cobb-Douglas production function where human capital captured as years of secondary school enrolment was used as input in the production function. It was revealed from the findings that human capital used as part of input in the production function does not have a significant positive impact on the difference in income per capital across countries, contrary to the significant positive impact found by Mankiw et al. (1992). In a second model, the researcher investigated the endogenous model that argued that human capital does not directly enter the growth equation but through innovation and technological diffusion. The authors modeled technological diffusion and innovation using total factor productivity as a function of human capital. It was discovered that human capital has a significant positive relationship with technological diffusion and innovation based on the data set used to estimate the relationship. Therefore, the authors concluded that human capital surely impacts the difference in cross-country income through technological diffusion and innovation and not directly on the income as treated by Mankiw et al. (1992).

Similarly, Caselli et al. (1996), following Mankiw et al. (1992) estimated the growth rate income per capita determinant across the country using cross-country panel data in the framework of generalized method of moment (GMM). The authors like Islam (1995) criticize the methodological approach employed by Mankiw et al. (1992) on the ground that one at least of the explanatory variables might be endogenous, leading to a wrong prediction of convergence between developing countries and developed countries in the long run. In dealing with endogeneity and estimation bias issues, the author recommended the use of GMM as the appropriate estimation technique. They argue that time-invariant of country-specific effect and the lagged dependent variables, OLS, and fixed-effect (within the group) might lead to upward bias and possibly generate an upward correlation between the lagged dependent variables and the country-specific effect. This will make OLS (Mankiw et al., 1992) bias and inconsistent. Using the General method of moment (GMM) as suggested to estimate the model, they found that real income per capita converges to a steady-state in the long run by at least 10 percent per annum.

A critic of Caselli et al.. (1996) methodological approach is that of Bond, Hoeffler, & Temple (2001) using cross-country panel data. The authors criticize Caselli et al. (1996) first difference estimation in terms of precision and bias. They argue that the first difference estimator has a large finite downward bias, basically because of the small sample period. The view is that

Caselli et al.. (1996) first difference estimation in GMM framework might perform poorly due to the weak instrument. As such, Bond et al. (2001) recommended the application of system GMM instead of the first difference GMM as applied by Caselli et al.. Since system GMM has the original equation, it improves efficiency and reduces the level of finite sample bias.

Sunde & Vischer (2015) further examined the factor responsible for the weak empirical effect of human capital on growth rate per capita among most cross countries literature. They argued on the issues with the neoclassical growth model, which ignores most of the important variables through which human capital impact the economic growth of a country affects the models. The authors employed cross-country panel data for 80 countries using three different data set for capturing average years of schooling (channels through which human capital impacts growth rate per capita). Using school enrolment average, international student scores, and mean years of schooling measure human capital on economic growth. They argued that human capital, when controlled for measurement error and heterogeneity, has a significant impact on GDP growth across countries.

Recent, literature tends to account for social capabilities interaction with human capital in explaining the existing nexus between human capital and economic growth. As argued by Ali et al. (2018), the social capabilities within a country impact the growth process by influencing the quality and effectiveness of the normal production factors, including human capital. As noted by the author, social capabilities encompass formalized institutions' role, like rule of law, court system, political liberation, democracy prevalence in enhancing human capital. This prompted Ali et al. (2018), to argue that institutional factors should be incorporated in the growth equation, if the exact influence of human capital on the growth rate across countries will be extracted. Several measures have been used in literature to measure the influence of social capability as it interacts with human capital and economic growth across country. It was revealed that human capital significantly impacts income per capita growth rate when there are better opportunities and high-quality legal institutions are available.

### **3. METHODOLOGY**

#### **3.1 Data and Sources**

All data are either sourced from World Bank Development Indicators (WDI), Penn World databank, v8.0, and Economic Freedom Data set of Fraser Institute<sup>1</sup>. The most common human

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<sup>1</sup> <https://www.fraserinstitute.org/economic-freedom/>

capital proxy used in literature is secondary and primary school enrolment (Barro, 1998) data available in Barro & Lee (2011). However, given the recent argument in literature that human capital proxy based on school enrollment does not provide a good description of a country educational system, the researcher employed a robust human capital index that captured years of schooling, quality of education, and returns on education at Penn World database as a proxy for human capital. Social capabilities indices will be sourced from the economic freedom data bank. The three leading social capability indices include political freedom (captured by democracy index), economic opportunities (captured by property and legal right), and freedom to trade locally and internationally (captured by trade openness). The index score is between 0 & 10 where 10 represents the highest level of freedom and 0 represents the lowest level of freedom. For instance, a well-established democratic setting improves the legal institution of a country through effective check and balances, reduces abuse of power, reduce corruption and increase investment since the investor believes in government accountability. Democracy is said to guarantee more equitable redistribution of income which is capable of reducing unrest, violence, and social revolution, which have a negative relationship with investment cum economic growth. Again, the legal and property right is also a component of the economic freedom index that is made up of factors relating to the prevailing quality of legal institutions.

### 3.2 Model Specification

To understand how human capital impacts the output per capital across the country. We model the equation following the work of Ali et al. (2018), and Benhabib & Spiegel (1994) by employing a simple Cobb-Douglas production function in an augmented Solow model framework as in equation (13),

$$Y_{i,t} = A_{i,t} K_{i,t}^{\alpha} L_{i,t}^{\eta} H_{i,t}^{\theta} \varepsilon_{i,t} \dots\dots\dots (13)$$

where; Y represents the growth rate of GDP per capita at current PPP, L represents labour force employed at age 15 and above (Cohen & Soto, 2007), K represents the stock of physical capital at current PPP, A represents the technological progress, and H is the vector of human capital variables and  $\varepsilon$  is the error term. Taking the log of equation (13) as in equation (14).

$$\ln y_{i,t} - \ln y_0 = (\ln A_{i,t} - \ln A_0) + \alpha(\ln K_{i,t} - \ln K_0) + \eta(\ln L_{i,t} - \ln L_0) + \theta(\ln H_{i,t} - \ln H_0) + (\varepsilon_{i,t} - \ln \varepsilon_0) \dots\dots\dots (14)$$

Equation (14) can be written in its difference form as;

$$\Delta \ln y_{i,t} = \Delta \ln A_{i,t} + \alpha \Delta \ln K_{i,t} + \eta \Delta \ln L_{i,t} + \theta \Delta \ln H_{i,t} + \Delta \varepsilon_{i,t} \dots \dots \dots (15)$$

Most empirical literature reviewed often employed lagged dependent variables among the covariate to account for simultaneity bias, mostly resulting from the unobserved effect from experience and qualification in H. It is also used to check for Solow conditional convergence (Mankiw et al., 1992). One lagged is used since, the unobserved is mostly reflected in output after a time lag (Ali et al., 2018), as such, one period of lag will be used in the covariates. Equation (15) can be modified to introduce the human capital in level form, incorporating this and the issue of simultaneity, equation (15) can be re-written as;

$$\Delta \ln y_{i,t} = \beta_0 + \beta_1 \ln A_{i,t} + \alpha \Delta \ln K_{i,t} + \eta \Delta \ln L_{i,t} + \theta \Delta \ln H_{i,t} + \beta_2 \ln H_{i,t} + \beta_3 \ln y_{i,t-1} + \lambda_i + \Delta \varepsilon_{i,t} \dots \dots \dots (16)$$

where  $\lambda_i$  capture the country-specific characteristics. To see if accounting for social capabilities changes the Solow conditional convergence and the nexus between human capital and economic growth, equation (16) will be modified to include a number of institutional and social capabilities variables.

$$\Delta \ln y_{i,t} = \beta_0 + \beta_1 \ln A_{i,t} + \alpha \Delta \ln K_{i,t} + \eta \Delta \ln L_{i,t} + \theta \Delta \ln H_{i,t} + \beta_2 \ln H_{i,t} + \beta_3 \ln y_{i,t-1} + \beta_4 \ln TO_{i,t} + \beta_5 \ln DDI_{i,t} + \beta_6 \ln LP_{i,t} + \lambda_i + \Delta \varepsilon_{i,t} \dots \dots \dots (17)$$

TO represents trade openness, DDI represents democracy index, and LP represents the prevailing legal and property rights. It is expected that the three social capabilities variables shall have a positive relationship with economic growth holding other determinants constant and will improve the rate of conversion and technological diffusion.

We further modified equation (17) by interacting human capital with the social capabilities variables to see whether the relationship will still hold and be significant as in equation (18). The argument is that a well-functioning institution and legal environment provides more political and economic opportunities to the citizens thereby reinforcing investment knowledge accumulation.

$$\Delta \ln y_{i,t} = \beta_0 + \beta_1 \ln A_{i,t} + \alpha \Delta \ln K_{i,t} + \eta \Delta \ln L_{i,t} + \theta \Delta \ln H_{i,t} + \beta_2 \ln H_{i,t} + \beta_3 \ln y_{i,t-1} + \beta_4 \ln TO_{i,t} + \beta_5 \ln DDI_{i,t} + \beta_6 \ln LP_{i,t} + \beta_7 \ln TO_{i,t} * \ln H_{i,t} + \beta_8 \ln DDI_{i,t} * \ln H_{i,t} + \beta_9 \ln LP_{i,t} * \ln H_{i,t} + \lambda_i + \Delta \varepsilon_{i,t} \dots \dots \dots (18)$$

where  $\beta_7$  to  $\beta_9$  are the parameter estimate of the moderating factors between human capital - economic growth nexus. The parameter estimate of the moderating factors is expected to positively correlate with economic growth since the above factors theoretically enhance human capital capabilities and productivity.

### **3.3 Estimation Procedure**

The panel data will be subjected to a stationarity test to ensure the data are free from unit root. In a panel framework, the stationarity test developed over time can generally be grouped into the first generation that imposes the restriction that the time series in the panel data has cross-sectional independence. Such an assumption is necessary to satisfy Lindberg-Levy central limit theorem and easily obtain asymptotic normal distribution test (Im, Pesaran and Shin test, 2003; Mandala & Wu, 2000; Hadri, 2000). While the second generation tried to overcome the assumption made by the first generation to allow for the situation where the time series in the panel data have cross-sectional dependence (Bai & Ng, 2004; Moon and Perron, 2004). This article adopted the first-generation panel unit root test as the study maintains the assumption of independent cross-sectional correlation.

To estimate the models, this study shall rely on General Methods of Moments (GMM). Most growth models explained the impact of human capital on the differences in income per capita across countries using panel OLS (Barro, 1991), panel fixed and random effect (Islam, 1995), First difference GMM (Caselli et al., 1996). Fixed effect, for instance, allow the estimation of the unobserved country-specific effect  $\lambda_i$  as in equations (16) to (18), this is based on the several advantages it has – reduces measurement errors among others.

As compared to fixed effect and random effect, GMM offered more robust estimation advantages over the other estimation techniques in panel data estimation. The argument is that time-invariant of country-specific effect and the lagged dependent variable, OLS, and Fixed-effect (within the group) might lead to an upward bias. This will make OLS (Mankiw et al., 1992) and fixed effect (Islam, 1995) bias and inconsistent. Also, it enables the correction of endogeneity common in growth equation by adding lagged of the independent variables as instruments in the equation. In the study following Dansasi (2013), Bond et al. (2001) employed system GMM to investigate the relationship since it improves efficiency and reduces the level of finite sample bias. The first difference GMM will not be used considering the argument of Bond et al. (2001), who noted that first difference estimation in GMM framework might perform poorly due to the weak instrument.

The GMM is an econometric approach that combines observed time series alongside information in the population moment conditions to generate parameter estimate of the economic relationship. It relies on population information on the first four moment, mean, variance, skewness and kurtosis. To see this clearly, in a dynamic framework, the growth equation can be written as follow in (19);

$$y_{it} = \alpha + \gamma_1 \ln y_{it-1} + \beta' [X]_{it} + \lambda_i + \varepsilon_{it} \quad \dots\dots\dots (19)$$

where;  $y_{it}$  is the output per capita as the dependent variable and  $\ln y_{it-1}$  is the lagged explained variable and  $X_{it}$  is the vector of independent variables including the human capital and the social capability (moderating variables),  $\varepsilon_{it}$  error term that has constant means,  $E [\varepsilon_{it}] = 0$ . other variables remain as defined earlier. And  $i = 1, \dots\dots N.$ , and  $t = 2, \dots\dots, T$ . also,  $[\lambda_i + \varepsilon_{it}]$  is the standard error component. We assume that,  $E [\lambda_i] = 0$ ,  $E [\varepsilon_{it}] = 0$   $[\lambda_i + \varepsilon_{it}] = 0$ . If we take the first difference of equation (19) as in (20);

$$\Delta y_{it} = \alpha + \gamma_1 \Delta \ln y_{it-1} + \beta' [X]_{it} + \lambda_i + \Delta \varepsilon_{it} \quad \dots\dots\dots (20)$$

From equation (20), lagged dependent variable  $\Delta y_{it}$  correlates with the error term  $\Delta \varepsilon_{it}$ , this implies that there is a potential endogenous problem that may render parameter estimates from equation (20) not consistent, as such, instrument cannot sufficiently be used to address potential issues in the model. Therefore, a system GMM becomes the only option to address the potential endogeneity problem in the equation. Following the first difference estimation in equation (20) above, the following moment of the dynamic GMM can be developed;

$$E[y_{it-s}(\varepsilon_{it} - \varepsilon_{it-1})] = 0; \text{ for } t=4, \dots\dots\dots T, s \geq 3, \dots\dots\dots (21)$$

$$E[X_{it-s}(\varepsilon_{it} - \varepsilon_{it-1})] = 0; \text{ for } t=4, \dots\dots\dots T, s \geq 3, \dots\dots\dots (22)$$

The above equation (21) and (22) can be summarized in the matrix form.

$$M = \begin{bmatrix} y_{i1} & 0 & 0 & \dots\dots & 0 & \dots\dots & 0 \\ 0 & y_{i1} & y_{i1} & \dots\dots & 0 & \dots\dots & 0 \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ 0 & 0 & 0 & \dots\dots & y_{i1} & \dots\dots & y_{i,T-2} \end{bmatrix}$$

M = is the matrix corresponding to the endogenous variables.

#### 4. Result and Discussion

The study started by conducting a correlation matrix as presented in table 1. Variables remain as defined earlier.

**Table 1: Correlation Matrix**

Variables	GDP	K	L	A	H	TO	DD	LP
GDP	1							
K	0.687***	1						
L	0.616***	0.481***	1					
A	0.275***	0.290***	-0.0552	1				
H	0.3897**	0.0858*	-0.164***	0.365***	1			
TO	-0.287***	-0.270***	-0.181***	-0.106**	-0.0339	1		
DD	0.347***	0.0605	-0.196***	0.564***	0.408***	-0.112***	1	
LP	0.128***	0.00185	-0.0661	0.268***	0.308***	0.00613	0.443***	1

Note: Significance is indicated as follows: \*\*\*, \*\* and \* for 1%, 5% and 10% respectively.

The correlation matrix was conducted to ensure that the analysis variables do not exhibit near-perfect correlations among each other. A situation where changes in one of the explanatory variables can influence the changes in another variable leads to a situation of bias estimate. As seen, there is no evidence of multicollinearity in the series.

Having established that our model is free from multicollinearity, we proceed to estimate the panel unit root test using the first-generation approach. The study employed both the Fisher-based unit root test and Im, Pesaran & Shin (IPS) to check for stationarity because of their superiority to other first-generation tests.

Variables	IPS @ Level	IPS @ 1 <sup>st</sup> Difference	Fisher @ Level	Fisher @ First Difference
Fffgg	Statistics/P-value	Statistics/P-value	Statistic/P-value	Statistics/ P-value
LGDP/Lny	4.5457 (1.0000)	-12.2639 (0.0000)***	-3.2752 (0.9995)	-16.9932 (0.0000)***
LnK	7.8551 (1.0000)	-5.3780 (0.0000)***	-4.9545 (1.0000)	-6.0923 (0.0000)***
LnL	3.2121 (0.99993)	-9.4363 (0.0000)***	-1.7284 (0.958)	-13.0225 (0.0000)***
LnH	4.5287 (1.0000)	-3.0082 (0.0000)***	-1.1205 (0.8688)	-5.3467 (0.0000)***
LnA	2.3452 (1.0000)	-6.5636 (0.0000)***	0.0713 (0.4716)	-13.5987 (0.0000)***
LnTO	-1.5944(0.0554)**	-13.8831 (0.0000)***	-2.0222 (0.0216)***	-18.9747 (0.0000)***
LnDD	3.4453 (0.9995)	-3.4982 (0.0000)***	-3.1757 (0.0009)***	-23.8688 (0.0000)***

**LnLP**            -3.1631(0.0008)\*\*\*    -21.9424 (0.0000)\*\*\*    -5.5125 (0.0000)\*\*\*    -37.323 (0.0000)\*\*\*

**Table 2: Panel Unit Root test Using IPS and Fisher Approach/ AIC Criteria**

**Notes:** The P-value is enclosed in the parentheses. All variables are logged and significance is indicated as follows: \*\*\*, \*\* and \* for 1%, 5%, and 10%, respectively.

We could see from the panel unit root test in table 2 that none of the model's key variables is stationary at level in both IPS and Fisher-based approach except for the institutional variables. Of course, judging by the fact that our model's time dimension is relatively small with  $N > T$  and the data are strongly balanced unit root should not be an issue for the study. However, to ensure there is no room for any doubt on our estimated parameters, the study proceeded to further differentiate the variables following the suggestion of Bai & Ng (2004) and Moon & Perron (2004).

The study employed the Westerlund co-integration test to check for the existence of long-run relationship.

**Table 3: Westerlund Co-integration test**

Results for H0: no co-integration: With 40 series and 1 covariate

<b>Statistics</b>	<b>Value</b>	<b>Z-value</b>	<b>P-value</b>
<b>Gt</b>	-3.442	-11.715	0.0000
<b>Ga</b>	-13.465	-7.346	0.0000
<b>Pt</b>	-21.952	-12.871	0.0000
<b>Pa</b>	-15.912	-16.642	0.0000

From the Westerlund result presented in table 4.3 above, it is evident that all the series categories from Gt to Pa are significant at 1% level of significance. This implies that null hypothesis of no co-integration is rejected.

Having validated that there is a long-run relationship between the variables of interest, the study, therefore, estimated the relationship between the variables using the General Method of Moment (GMM). Following Roodman (2009) argument, it is important to choose between system GMM and difference GMM on certain statistics. Following Bond et al. (2001) rule of thumb approach, it can be revealed that the difference GMM coefficient is close and less than the fixed effect coefficient, which indicates a negative downward bias of the difference GMM

due to weak instruments as seen in table 4, thereby leaving us with system GMM as the best estimation technique.

**Table 4: Decision Making Criteria**

	<b>Pooled OLS</b>	<b>Fixed Effect</b>	<b>Difference GMM</b>	<b>System GMM</b>
<b>Lny_1</b>	-0.001828	-0.901180	-0.884942	-0.88063
<b>Remark</b>	1.82%	90.1%	88.4%	88.0%

**Source:** Author computation from Stata output

The estimate for the three key model is as presented in table 5.

**Table 5: System GMM result**

<b>Variables</b>	<b>Fixed Effect (Model 1) Coeff./P-value</b>	<b>System GMM (Model 2) Coeff./P- value</b>	<b>System GMM/ (Model 3) Coeff./P-value</b>	<b>System GMM/ (Model 4) Coeff./P-value</b>
<b>Lgdp_1</b>	-0.9012(0.000)***	-0.8806 (0.000)***	-0.8962 (0.000)***	-0.8968 (0.000)***
<b>ΔLk</b>	0.4330(0.000)***	0.3935 (0.000)***	0.4073 (0.000)***	0.4121 (0.000)***
<b>ΔLL</b>	0.5873 (0.000)***	0.6100 (0.000)***	0.6456 (0.000)***	0.7179 (0.001)***
<b>ΔLA</b>	0.2691 (0.272)	0.3322 (0.085)*	0.1575 (0.057)**	1.3804 (0.002)***
<b>ΔLH</b>	0.6486 (0.065)*	0.6203 (0.056)*	0.4437 (0.051)**	0.9416 (0.000)***
<b>LLH</b>	0.6586 (0.057)*	0.6403 (0.051)**	0.7437 (0.000)***	0.9416 (0.000)***
<b>LTO</b>			-0.0459 (0.884)**	0.0228 (0.017)***
<b>LDD</b>			0.0253 (0.027)**	0.0484 (0.0107)***
<b>LLP</b>			0.0009 (0.0957)*	0.0215 (0.064)*
<b>LH*TO</b>				0.0285 (0.002)***
<b>LH*DD</b>				0.0111 (0.006)***
<b>LH*LP</b>				0.0423 (0.001)**
<b>Observations</b>	880	880	880	880
<b>Number of c_id</b>	40	40	40	40
<b>AR(2)</b>		0.978	0.799	0.882
<b>Hansen test</b>		0.153	0.148	0.116
<b>F-stat; P- value</b>	(0.000)***	(0.000)***	(0.000)***	(0.000)***

**Notes:** The P-value is enclosed in the parentheses. All variables are logged and significance is indicated as follows: \*\*\*, \*\* and \* for 1%, 5% and 10% respectively.

**Source:** Author computation from Stata output

As seen in Table 5, when the model was estimated using fixed effect and without accounting for social capabilities, only two variables labour and capital is significant at 5 percent level of significance judging by the p-value. Both human capital at difference and level is only significant at 10 percent with the expected sign. However, when the model were estimated with

GMM, human capital at level became significant though, human capital at difference and knowledge are both insignificant at 5 percent. Specifically, it was discovered that a 1 percent rise in the human capital development index across countries will lead to an increase in income per capita by at least 64.03 percent at 5 percent level of significance. Other variables are also significant with an expected sign except for knowledge and human capital at difference that only became significant at 10 percent. The findings also reveal that the popular Solow conditional convergence holds as the lag endogenous variable has a negative sign and is consistent with previous studies like Mankiw et al. (1992) and that of Sunde & Vischer (2015).

It was discovered also that when we introduced social capabilities in the model, the impact of human capital on the growth rate across countries improved by at least 10.33 percent. Similarly, other variables in the model including labour, capital, and knowledge all witnessed an improved impact on the difference in cross-country growth rate in per capita income. For instance, labour increased by at least 3 percent, capital by 1 percent, and human capital by 10 percent. However, the introduction of the social capabilities did not change the Solow conditional convergence but rather reinforce its impact.

According to Sunde & Vischer (2015), Solow conditional convergence states that, even if countries differ in their saving rates, population growth rates, and production function (due to unequal access to technology) they will converge to a steady-state with different capital-labour ratio and different standards of living in the long-run. In a last-ditch, the study further interacts human capital with social capabilities, as expected all the interactive variables positively impact the growth rate of per capita income across country. And the impact of human capital on economic growth became even stronger with the interaction of social capabilities. For instance, the introduction of social capabilities in the model increases human capital's impact on income per capita by 20.13 percent from the initial impact when social capabilities have not been introduced in the model. The result is expected as an improved democratic system where laws and policy are adhered to and the existence of checks and balances among the alms of government individuals rights – political, economic, and property are respected thereby improving the human capital impact in driving the necessary economic growth. Again, economic openness offers the citizens a wider market for their products and services, facilitates technological diffusion in developing countries like Africa.

The f-test p-value equally reveals that all the explanatory variables have a significant relationship with economic growth across the country since the p-value (0.0000) is much less

than a 1 percent level of significance. Looking at the Arellano-Bond test of higher-order serial correlation in Table 4.6, the AR2 p-value is 0.978, which is much higher than the 10 percent level of significance as such we cannot reject the null hypothesis of serial correlation. We, therefore, conclude that the model is free from serial autocorrelation and is fit for analysis. Also, the model is checked for over-identification and validity of instruments using Hansen-Sargan test. As seen in Table 4.6 above, the probability value of the Hansen validity test for instrument validity is 0.153, which is greater than 1 percent level of significance, indicating that the instrument used are valid.

## **5. Conclusion and Policy Recommendations.**

This study has investigated human capital, social capabilities, and economic growth across countries. The empirical findings revealed that human capital has a significant impact on the growth rate of income per capita across countries. We discovered that without accounting for social capabilities the impact of human capital on growth though positive is weakly significant. But accounting for social capabilities rekindles the impact of human capital in driving the growth rate across nations.

The finding is not surprising giving the fact that when the labour force has access to a working legal system that respects individuals' rights and freedom and increased economic opportunity, they will intend to invest more in themselves and their future (human capacity building). An improved democratic system of government and respect for the rule of law will lead to an improved educational system, better job opportunities that will instill the hard work spirit and working institution will decrease the informality in a country as argued by Tonuchi et al (2020). Therefore, this study concludes that investment in human capital should be a deliberate decision like the investment in physical capital if the nation intends to grow. And that investment in human capital will not yield the required result if a sound legal, economic, and political institution is not deliberately built.

Therefore, the study recommends strong institutional building by investing in the rule of law and liberty of the citizens and investing in the infrastructural building to ensure a friendly business environment. It is important to note that infrastructural building improves the institutional factors thereby improving the relationship between human capital and economic growth. Building an institution that guarantees everyone's rights and equitable distribution of income should be the priority of developing countries' leaders. This can be achieved first

through a strong check and balances in the three alms of government and easing regulations that hinder business success in the region.

### **Competing Interest**

Authors declare no competing interests.

### **Disclaimer**

The opinion shared are that of the author and not any institution.

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