Innovations

Fertility Issues, labour productivity and economic performance in Sub–Saharan Africa: An application of dynamic panel data models

Kitessa Delessa Terefe[1] ; Mekonnen Bersisa Gadisa (PhD)[2]

1 Department of Economics, School of Business and Economics, Ambo University Woliso Campus, Woliso, Ethiopia.
Email: kitebuze@gmail.com

2 Department of Economics, School of Business and Economics, Ambo University Woliso Campus, Woliso, Ethiopia.
Email: mbersisa@gmail.com

Corresponding Author: **Mekonnen Bersisa** (PhD)

Abstract

Issue: Human capital development has gotten a lot of attention in recent years because it has important national and international implications for countries in Sub-Saharan Africa (SSA). Many variables are at work in most SSA nations, causing the core components of human capital, Fertility, health and education, to fall short of expectations. As fertility, health capital and labor productivity are important for economic development, the study used a dynamic panel data technique to empirically evaluate the primary determinants of GDPPC for SSA nations utilizing current year data ranging from 2000 to 2018.**Methods:** The FGLS and the dynamic panel data GMM model were used to estimate the model. **Finding:** The estimated equation based on the FGLS result shows that labor productivity and health capital have a positive impact to SSA nations' per capita GDP across the study period while fertility rate has negative impact. FDI, educational attainment and terms of trade, on the other hand, have a negative impact on the region's GDPPC. The GMM estimation result reveals that lagged GDPPC, labor productivity, FDI, and Terms of Trade all seem to have a positive and significant impact on per capita GDP. In another sense, the fertility rate has a negative impact. **Conclusion:** As a result, the study's findings suggest that advances in human capital, particularly health capital and labor productivity, boost per capita GDP. As a result, SSA countries should focus more on measures that improve human capital while also promoting economic development. Furthermore, countries must build a cautious policy climate that promotes economic integration across sectors, mobilizes domestic resources, and improves health and labor skills in order to achieve long-term growth based on human capital gains.

Keywords: 1. Health Capital, 2.Fertility, 3.FGLS, 4.GMM

1. Introduction

Human capital accumulation appears to play a vital role in promoting economic development, according to studies on economic growth and development (Christopher & Kumar, 2020). Human capital is defined as an intangible resource required to increase labor productivity (Goldin, 2016), and it is closely linked to education, experiences, and health care. This shows that human capital is a wide concept that encompasses a person's knowledge and talents acquired through education, training, new learning, health care, and level of experience (Benos & Zotou, 2014). Though it is difficult to quantify new learning and training, health and education are the most often utilized human capital indicators (Ogundari & Awokuse, 2018). Both, health and education, are pillars in the economic development process (Todaro & Smith, 2005).

Human capital investment, through its impact on productivity, is a powerful engine of economic growth (ADB, 2020). Progress theories have underlined the importance of human capital development and its role in promoting economic growth (Lucas & Robert, 1998). In this regard, research has frequently focused on various forms of capital where worker productivity is critical (Siepel & Cowling, 2017). Differences in productivity can be attributed to a variety of abilities derived from previous experiences (Arcidiacono, Kinsler, & Price, 2017).

Good health is an important element of human capital, and it is a predictor of good economic performance in a variety of ways. For example, when people are healthy, they have more capacity and productivity at work since there are fewer days lost due to illness, but poor health lowers the availability of workers for work. As a result, improved health (both physically and mentally active individuals) leads to increased output, allowing goods and services to be produced at their best. Furthermore, the health professional can save time that can be put to better use by engaging in other productive tasks (Alok, 2012). As a result, part of economic progress is health capital. In the struggle against poverty and backwardness, good health and a productive workforce are critical (Ephraim, 2014).

Human capital development has been, and continues to be, a major source of concern for SSA's economy. Over the years, health-care spending in poor countries has been low (Jacob, Solomon, & Justice, 2012). The majority of countries in these regions, particularly those in Sub-Saharan Africa, rely on foreign grants and loans to fund their health care. Such expenditures are not only unsustainable, but also insufficient in light of the region's massive health-care burden (Jacob, Solomon, & Justice, 2012).

Various studies (though few) have been conducted to investigate the relationship between health spending and health outcomes, but the results have been equivocal (Anyanwu & Erhijakpor, 2007). Other variables such as change in technology, income, education, and cultural variations, according to some experts, are more important than health spending and have been identified as dominant derivers of health outcomes. Furthermore, for the economies of less developed nations, the association between health spending and health outcomes remains small (Novignon, Mussa, & Chawaula, 2012); (Lieras-Muney & Sherry, 2008); (Burniside & Dollar, 1998). Because the extent to which public spending effects health outcomes is dependent on the efficiency of policies and institutions, the link was inconsequential (Burniside & Dollar, 1998). Furthermore, the labor force is a critical factor in determining a country's ability to produce production that leads to growth. Labor productivity is important, yet it is low and inadequate in Africa. Amongst others, low income, lack of adequate training and low infrastructure are responsible factors for low productivity of labor force in SSA (David & Jameelah, 2013); (Mordi & Mmieh, 2008).

The current study is motivated by the inconclusive debate between health spending and health outcomes in one way, and the plausible pathway through which health improvements (health capital) influence the economic performance of the region is missing, which this study fills by considering the influence of health improvement on economic growth through labor productivity, and examining how health capital influences labor productivity and economic growth in SSA.

This research looks at health capital and labor productivity, as well as other macroeconomic variables, to see if there's a link between them. Previous research that focused on country-specific cross-sectional and time-series studies failed to find a link between the three essential variables. This study, on the other hand, uses advanced panel data methodologies to show the empirical relationship between health capital, labor productivity, and economic performance in SSA.

2. Objectives of the study

The main objective of the research is examining interconnections between fertility, labor productivity, and economic performance in SSA.

3. Methodology and Analysis

To explore the impacts of health capital and labour productivity on economic performances, the panel data model based on the growth accounting framework is:

$$(GDP\_PC)_{\mathrm{it}} = A_{it}{PL_{it}}^{\beta_1}{K_{it}}^{\beta_2}{HC_{it}}^{\beta_3}, e^{\varepsilon_{\mathrm{it}}} --------(1)$$

Where $\boldsymbol{GDP\_PC}$ is measure of per capita GDP, **PL** is measure of labour productivity, K is measure of physical capital via foreign direct investment (**FDI**) for this study, and **HC** is measure of health capital respectively. Further, **A** measures total factor productivity (TFP). The parameters,$\boldsymbol{\beta_1}$,$\boldsymbol{\beta_2}$and $\boldsymbol{\beta_3}$, are measuring elasticity output and the subscripts ***i*** and ***t*** denotes country and time respectively.

The Cobb-Douglas production function has a number of convenient properties. The parameters of explanatory variables measures elasticity.

$$A_{it=}f(EA_{it}, FR_{it}, ToT_{it}) --------(2)$$

Where; EA measures educational attainment, FR measures fertility rates, TOT measures fertility rates.

By substituting (2) into (1), we obtain:

$$(GDP\_PC)_{\mathrm{it}} = {PL_{it}}^{\beta_1}{FDI_{it}}^{\beta_2}{HC_{it}}^{\beta_3}{EA_{it}}^{\beta_4}{FR_{it}}^{\beta_5}{ToT_{it}}^{\beta_6}e^{\varepsilon_{\mathrm{it}}} ----(3)$$

The study uses the following equation after equation (3) is linearized by applying the natural logarithm to both sides to determine the dynamic relationship between economic performance and its determinants, notably, health capital and labour productivity.

Taking into account all potential variables in line with the study at hand, the specific outfitted and estimable econometric model is set as:

$$\ln(GDP\_PC)_{\mathrm{it}} = \beta_0 + \beta_1 \ln PL_{it} + \beta_2 lnFDI_{it} + \beta_3 lnHC_{it} + \beta_4 \ln EA_{it} + \beta_5 \ln FR_{it} + \beta_6\, lnToT_{it} + \varepsilon_{it} ----------(4)$$

Given the potential of lagged per capita GDP to influence the current GDP and in order not to lose the dynamic information, the autoregressive one (AR (1)) is incorporated. Thus, the dynamic model based on the previously specified model is set as follows:

$$\ln(GDP\_PC)_{\mathrm{it}} = \beta_0 + (1+\gamma)\ln(GDP_{PC})_{\mathrm{it-1}} + \beta_1 \ln PL_{it} + \beta_2 lnFDI_{it} + \beta_3 lnHC_{it} + \beta_4 \ln EA_{it} + \beta_5 FR_{it} + \beta_6\, lnToT_{it} + \varepsilon_{it} ----------(5)$$

Where GDP_PC, PL, FDI, HC, EA, FR, and TOT are per capita GDP, Labour productivity, Foreign direct investment, Health capital, educational attainment, Fertility rate and terms of trade respectively and ε_t is the white noise error term.

The dynamic formulation of the model is Equation (5). With the inclusion of lagged GDP per capita, the problem of endogeneity develops, and so static models such as Ordinary Least Square (OLS), Fixed Effects (FE), Random Effects (RE), and Feasible Generalized Least Squares (FGLS) are not employed, or if used, are more likely to yield incorrect results.

As a result, we use the dynamic panel data approach of the System Generalized methods of moments (GMM) with robust standard errors to overcome the model estimation limitation raised above (Nnyanzi & Kilimani, 2018);(Anderson & Hsiao, 1981);(Arellano & Bond, 1991);(Anderson & Hsiao, 1981);(Anderson & Hsiao, 1981);(Anderson & Hsiao (Samini & Salarzadeh, 2014). Furthermore, the GMM avoids spurious regression by solving the problem of temporal autocorrelation of residuals (Bokana & Akinola, 2017).

Table 1: Summary of Variables, Description and Data Sources

Variable	Definition	Source	Hypothesized Sign
Per Capita GDP	A ratio of GDP to population in constant US $	WB, WDI	Dependent Variable
Labor Productivity	Ratio of GDP to employment level	WB, WDI	?
Foreign Direct Investment	Foreign Direct investment (% of GDP)	WB, WDI	+
Health Capital	The life expectancy at birth	WB, WDI	?
Educational Attainment	Average years of schooling	WB, WDI	+
Fertility Rate	Number of children per family	WB, WDI	-
Terms of Trade	A ratio of exports to imports	WB, WDI	+

Source: **WB-WDI (2020)**

4. Data Used

The study is empirical in nature, with the goal of establishing a relationship between the economic performance as measured by per capita GDP and its determinants in SSA economies. This research aims to prove the importance of human capital and labor productivity in the region's economic development and welfare. The data to be analyzed is annual panel data spanning the years 2000 to 2018, with GDP per capita (as an endogenous variable) and various exogenous variables. The data for this study will come from the World Bank's World Development Indicator (WDI).

5. Method of Data Analysis

The World Bank's World Development Indicator (WB-WDI) was used to collect the above-mentioned potential variables of interest, and the study took into account the data's nature. Dynamic panel data econometric analysis will be employed to address the research objectives provided by the System GMM.

6. Estimation and discussion of results

The empirical study of the proposed model utilizing descriptive statistical analysis and econometric-based regression results is the focus of this section. Fixed Effect (FE), Random Effect (RE), Feasible Generalized Least Squares (FGLS), and System Generalized Methods of Moments are all used in the regression estimation (GMM).

6.1 **Descriptive Statistics**

The descriptive statistics of the variables utilized in the study to assess the link between health capital, labor productivity, and economic performance in SSA for the countries included in the sample are summarized in Table 3.1. For the period 2000-2018 (T=19years), summary data were compiled for 30 SSA nations (n=30) with 570 observations (N=n*T=30*19=570).

As can be seen in the table below, GDPPC has an overall average annual growth rate of roughly 23.22 percent, with a lowest annual growth rate of 20.31 percent and a highest annual growth rate of 26.87 percent. The difference in GDPPC growth within SSA countries differs by roughly 1.43 percent from the overall average rate.

When compared to the other variables considered as potential predictors of SSA's economic performance, the average proportion of FDI contributes the most. FDI accounted for 4.57 percent of total investment, with the biggest overall share of 103.30 percent and the smallest overall share of -6.37 percent. The overall contribution of this sector differs by around 8.90 percent from the overall average contribution. Similarly, the average contribution of terms of trade as a percent of GDP is 4.11 percent, with a maximum of 5.74 percent and a minimum of 2.78 percent Furthermore, the entire average share of health capital is expected to be 4.04 percent, with a maximum contribution of around 4.31 percent and a minimum contribution of approximately 3.68 percent.

The average overall contribution of productivity of labour was about 2.68 % with maximum overall contribution of 6.43% and minimum overall contribution of -1.70%. On average the overall growth rate of Fertility rate was about 1.58% for SSA countries with maximum overall growth of 2.04% and minimum overall growth of 0.28. On the other hand, the average overall contribution of education attainment was about 1.81% with maximum value of 1.95% and minimum value of 1.61%.

Table 1: Summary of descriptive statistics

Variable		Mean	Std.Dev.	Min	Max	Observations
lnGDPPC	overall	23.22	1.43	20.31	26.87	N=570
	between		1.43	20.54	26.60	n =30
	within		0.28	22.53	23.85	T=19
lnPL	overall	2.64	1.52	-1.70	6.43	N=570
	between		1.45	0.00	5.93	n =30
	within		0.52	0.94	3.83	T=19
FDI	overall	4.57	8.90	-6.37	103.30	N=570
	between		5.15	0.60	26.21	n =30
	within		7.31	-21.34	81.70	T=19
lnHC	overall	4.04	0.11	3.68	4.31	N=570
	between		0.08	3.86	4.29	n =30
	within		0.07	3.83	4.25	T=19
lnEA	overall	1.81	0.13	1.61	1.95	N=570
	between		0.13	1.61	1.95	n =30
	within		0.03	1.67	1.91	T=19
lnFR	overall	1.58	0.28	0.68	2.04	N=570
	between		0.27	0.80	2.01	n =30
	within		0.07	1.35	1.76	T=19
lnToT	overall	4.11	0.48	2.78	5.74	N=570
	between		0.43	3.38	5.22	n =30
	within		0.22	3.27	4.97	T=19

Source: Own calculation, 2021

6.2 Pair wise Correlation Analysis

Table 2[1]below presents the correlation matrix between the GDPPC and its determinants for SSA over the period of 2000-2018. Correlation between GDPPC and productive labour is equal to 0.1889 and statistically significant with Pvalue=0.000). This shows that there is significant relationship between the GDPPC and labour productivity. The correlation between GDP per capita FDI is negative and the correlation coefficient is equal to -0.1793. As this value is less than 0.5 and statistically significant ($p\_value = 0.000$) is less than 1%), there is weak and significant negative relationship between

[1]Description of the correlation matrix is for first column only as the interest is on assessing the impacts of variables on tax revenue.

GDP per capita and FDI. On the contrary, the there is a positive association between the health capital and GDPPC measuring economic performance with the correlation coefficient of 0.0479 yet insignificant.

Furthermore, educational attainment, fertility rate and terms of trade as a percentage of GDP has negative correlation with GDPPC with correlation coefficient of -0.2197,-0.0173 and -0.2674 respectively with significant impact as shown with p-values for educational attainment and terms of trade and insignificant impact for fertility rate.

Table 2: Pair wise Correlation

	lnGDPPC	lnPL	FDI	lnHC	lnEA	lnFR	lnToT
lnGDPPC	1.0000						
lnPL	0.1889*** (0.0000)	1.0000					
FDI	-0.1793*** (0.0000)	0.0007 0.9875	1.0000				
lnHC	0.0479 (0.2534)	0.3588*** (0.0000)	0.1154*** (0.0058)	1.0000			
lnEA	-0.2197*** (0.0000)	-.3425*** (0.0000)	-0.0362 0.3882	0.2339*** (0.0000)	1.0000		
lnFR	-0.0173 (0.679)	-0.8099*** (0.0000)	-0.0854* 0.0415	-0.4575* (0.0000)	0.2734*** (0.0000)	1.0000	
lnToT	-0.2674*** (0.0000)	0.4473*** (0.0000)	0.3463*** (0.0000)	0.1902*** (0.0000)	-0.0397 (0.3438)	-0.5092*** (0.0000)	1.0000

Notes: ** indicates the statistical significance at 5 %($**$ p < 0.05) and values in parenthesis shows p-values.
Source: Own calculation, 2021

6.3 The Estimation Results of the Regression Model

This section presents the results of panel regression estimation using GDPPC as dependent variable and the set of potentials as explanatory variables. The model is estimated using four distinct estimation strategies, as shown in the empirical result in the table below. The fixed effect regression model, the random effect regression model, the Feasible generalized least square model, and the dynamic panel data generalized methods of moments. This allows examining and contrasting various estimating strategies as well as the results' robustness.

Table: The panel regression Estimation results: Dependent Variable: lnGDPPC

Variable	Fixed	Random	FGLS	GMM
lnPL	0.10285697***	0.10293199***	0.10293199***	0.03401682***
FDI	0.000742	0.000739	0.000739	0.00060596*
lnHC	2.2156346***	2.2331769***	2.2331769***	0.0447
lnEA	-0.33409946*	-0.33760908*	-0.33760908*	-0.0550
lnFR	-0.83986404***	-0.81752863***	-.81752863***	-0.52046028***
lnToT	-0.00653	-0.00857	-0.00857	.06307699***
lnGDPPC L1.				0.80313593***
cons	15.954797***	15.863265***	15.863265***	4.9961345***
N **r2** **r2 a** **rmse**	570 0.854 0.844 0.109	570 0.109	570	540
F Prob>F	2605.37 0.00000***			
Wald Chi2 Prob>chi2		3078.39 0.0000***	1727.06 0.0000***	32873.83 0.0000***

Notes: legend: *p<0.05; **p<0.01; ***p<0.001. Where FE= Fixed Effects, RE= Random Effects, FGLS= Feasible Generalized Square and GMM = Generalized Methods of Moments
Source: Own Calculation, 2021

The long run model estimation utilizing the Fixed Effect (FE) and Random Effect (RE) techniques is shown in the first and second columns. The FE model is based on the crucial assumption that unobserved cross-country heterogeneity is associated with the regressors included in the models, whereas the RE estimation is based on the relaxed assumption that unobserved heterogeneity is correlated with the regressors included in the models.

Accordingly, the F statistic value (2605.37) for model 1 (Fixed Effect Model) is high and significant (P value =0.0000***), indicating that the overall model is acceptable. According to the regression results, the coefficient of determination (R^2) of 85.4 percent indicates that its determinants account for 85.4 percent of variations in per capita GDP, with the regressors accounting for greater variance in the dependent variable. In the Fixed Effect model, our variables of interest, labor productivity and health capital, have a considerable positive impact on SSA nations' per capita GDP. They're all statistically significant at 1%. Educational achievement, on the other hand, has a negative and considerable impact on fertility rates. It is significant at 5 percent. Furthermore, FDI and terms of trade have had no effect on GDPPC during the study period.

The Wald Chi2 (3078.39) for model 2 is equally high and statistically significant (Pvalue =0.0000***). (Random Effect model). As a result, the overall model is satisfactory. Labor productivity and health capital have a good and considerable impact on SSA countries' economic performance. At 1%, they are statistically significant. On the other hand, educational attainment and fertility have a detrimental impact on the region's economic performance. FDI and trade growth are both considerable over the research period, yet they have no econometric impact on the region's economic success.

One of the advantages of using the RE model over the FE model is that it allows for the addition of time-invariant factors that may be useful in explaining the key determinants of SSA nations' economic success. The FE model, on the other hand, gives consistent and efficient estimates when the unobserved heterogeneity is associated with the model's regressors, whereas the RE model does not. The RE model, on the other hand, yields estimates that are both consistent and efficient if the null hypothesis of no association between unobserved heterogeneity and regressors is accepted. The FE model estimates are consistent but inefficient in this case. Here Hausman test is used to differentiate between the two approaches (i.e FE or RE model in panel data) produces efficient and consistent estimates.

As a result, the null hypothesis of no correlation is rejected in favor of fixed effect models using the Hausman test. The results of the diagnosis tests from the FE regression model demonstrate that the model has an autocorrelation problem ($Cov(U_i, Xb) = -0.2615 \neq 0$) .The assumption of no correlation between the vector of explanatory variables and the error term (($Cov(X_{it}, \varepsilon_{it}) = 0$) in the Classical Linear Regression Model (CLRM) is violated.

As a result, even though the Hausman test prefers the fixed effects model to the random effect model because of the autocorrelation problem, inefficient estimates may arise. The Feasible Generalized Least Square (FGLS) estimation technique is ideal to come up with efficient estimates when there is an autocorrelation and heterocedasticity concern. As can be seen from the FGLS regression findings, it accounts for both autocorrelation and heterocedasticity issues and operates under the premise of no autocorrelation and homoscedasticity . Instead of accounting for serial correlation in the error term, the econometric model specification could potentially reflect economic performance by including the lagged value of the dependent variable, which is problematic. The generalized method of moments, a dynamic panel data model, is used to solve the problem of serial correlation (GMM). As a result, FGLS and GMM approaches are used to estimate and analyze the model.

The Wald Chi2 (32873.83) with (P value = 0.0000***) is also high and statistically significant for model 4 according to the results of the dynamic panel methods (the GMM model). As a result, the overall model is satisfactory. Labor productivity, foreign direct investment, terms of trade, and lagged GDP per capita all have a positive and considerable impact on SSA countries' economic success. At 1%, labor productivity, terms of trade, and lagged GDP per capita are statistically significant, whereas foreign direct investment is statistically significant at 5%. The fertility rate, on the other hand, has a negative substantial impact during the period, and it is significant at 1%.

Labor productivity (PL) has a considerable and favorable impact on SSA's economic success. The variable is significant at 1%, according to the FGLS and GMM regression results. According to the FGLS, a 1% increase in PL translates to a 0.127 percent increase in the region's GDP per capita. An increase in PL over time leads to an increase in GDP per capita, which is used to compare economic performance. (Campell, 2009); (Kazuya, 2009); (Campell, 2009); (Campell, 2009); (Campell, 2009); (Campell (Wu, 2013).

At 1%, foreign direct investment (FDI) has a negative and substantial influence on the FGLS model, whereas it has a positive and significant impact on the GMM model. This negative impact supports the thesis that less developed countries' economies have inadequate incentives to attract FDI and have poor investment climates. However, if properly managed and implemented, FDI has the potential to break the vicious cycle of poverty in the region by contributing to the region's economic performance and job creation, so increasing the society's welfare. As seen in the GMM regression result, a positive and significant result is expected (Nguyen, Ngoc, & Duc, 2019).

Health capital (HC), a key component of human capital that measures life expectancy at birth, is a sign of increased energy, productivity, working and saving, and so improves the demographic transition to the growth and development process. According to the FGLS estimation result in the table above, a 1% increase in HC corresponds to a 1.45% increase in per capita GDP, demonstrating that improvements in health capita have a positive and considerable impact on the region's economic performance over the period under discussion. The findings are in line with those of (Bloom & Fink, 2013); (Addison,Pikkaraine & Risto Ronko, 2017).

According to the FGLS regression result, Educational Attainment (EA) has a negative and significant impact on the region's economic performance. Higher education, as measured by years of schooling, contributes to dynamic efficiency improvements through innovation and adoption of a wide range of technologies, which have a tremendous impact on the region's economic growth. In developing nations, such as SSA, educational attainment is lower, but there has been a considerable growth of schools and enrollment rations, at least in terms of quantity. However, knowledge and the ability to invent and innovate are not as promising in terms of contributing to economic performance.

As a result, the EA return is negative, indicating that it is more dependent on institutional features, where there are no parallel and spontaneous changes due to weak academic institutions (particularly the education policy, which requires attention) and inefficiency. As a result, a significant positive effect of human capital as measured by the enrolment ratio can only be achieved if the economy has reached a certain degree of development. The changing age structure of a population is also important, since it leads to a decrease in the ratio of workers to dependents, resulting in an increase in the age dependency ratio.

According to the FGLS model, a 1% increase in educational attainment results in a 1.59 percent decline in regional economic performance, while all other variables stay constant. Despite the oddity of the conclusion, it is consistent with Humna and Emranul (2017); Pitchette (2001); Kitessa (2018).

At the 1% level of significance, Fertility Rate (FR) is negative and significant for both FGLS and GMM models. Holding all other variables equal, a 1% increase in fertility rate causes a 0.66 percent loss in per capita income growth in the FGLS model, but a 1% increase in fertility rate causes a 0.52 percent decrease in per capita income growth in the GMM model. This implies that having more children per family leads to increased dependency and population (a percentage of which contributes nothing to the economy) and, as a result, poorer per capita income. Thus, high fertility, i.e., rapid population growth, explains why rapid population expansion has a negative and deteriorating influence on economic performance in general and puts pressure on social service supply in particular (health, education and other social services) (Kitessa,2018) (Li, 2016); (Weil, 2013).

When all other factors are held constant, terms of trade (ToT) has a negative and considerable influence on the per capita output of SSA's economy. Both the FGLS and GMM models have a ToT of 1%, which is statistically significant. Holding all other variables equal, a 1% increase in ToT causes a 0.136 percent loss in per capita output growth in the FGLS model, but a 1% increase in ToT causes a 0.063 percent decrease in per capita GDP growth in the GMM model. Nurkse (1952) ; Myrdal (1985) ; (Prebisch, 1950).

The GMM finding demonstrates that lagged per capita GDP is a robust and substantial predictor of current economic performance, demonstrating that higher per capita income in one era leads to higher per capita income in the next. This demonstrates the model's superiority in accounting for the lag of the dependent variable as an explanatory variable. If other conditions stay constant, a 1% increase in lagged per capita GDP corresponds to a 0.803 percent increase in per capita GDP. The finding is agrees with (Nnyanzi, Babyenda, & Bbale, 2016).

7. Conclusion

Capital accumulation, especially human capital, a key development aspect for the economy of SSA. But, the peculiar characteristics identifying the economies of SSA is low human capital development explained through low education, low productivity and less access to health services. The appealing fact is that development aspirations we have cannot be realized if this challenges do not get a momentum solutions.

To handle the issue, the study used data from the World Development Indicators (WDI) from 2000 to 2018 to examine links among health capital, labour productivity and economic performances for 30 SSA countries. In doing so, the empirical analysis was done using sophisticated econometric approaches. These are fixed effects; Random Effects, FGLS and Dynamic GMM models.

The key outcome of the analysis is that both life expectancy and labour productivity are the key variables in determining the economic performances of Sub-Saharan Africa as per the objective of the study. The findings suggest that there could be strongly works on these two potential variables to attain sustained economic developments in the region.

References

1. *Acemoglu, D., & Johnson, S. (2006). Disease and development: The effect of life expectancy on economic growth. NBER Working Paper Series, No. 12269.*
2. *Addison, T., Pikkaraine, V., & Risto Ronkko, F. T. (2017). Development and poverty in sub-Saharan Africa. Helsinki: United Nations Uiversity - World Institute for Development Economics Research.*
3. *Alok, K. a. (2012). Urbanization, human capital and cross- country productivity differences. Economic Letters , 14-17.*
4. *Anderson, T., & Hsiao, C. (1981). Estimation of dyanmeic models with error components. Journal of the American Statistical Society , 76, 598-606.*
5. *Anyanwu, C., & Erhijakpor, E. (2007). Health expenditure and health outcomes in Africa. African Development Bank Economic research paper .*
6. *Arcidiacono, P., Kinsler, J., & Price, J. (2017). Productivity spillovers in team production: evidence from professional basketball. Journal of Law Economics .*
7. *Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo Evidence and an application to employment equations. Review of Economic Studies , 58, 277-297.*
8. *Barro, R. (1991). Economic growth in a Cross Section of Countries. Quartely Juurnal of Economics , 407-443.*
9. *Barro, R., & Sala-i-Marthin, X. (1997). Technological diffusion,convergence, and growth. Journal of Economic Growth , 1-26.*
10. *Benos, N., & Zotou, S. (2014). Education and econoic growth: A meta regression analysis. World Development Review , 64, 669-689.*
11. *Berta R., a. L. (2004). Public Health Capital and Productivity in the Spanish REgion: A dynamic panel data model. World Development , 32 (5), 871-885.*
12. *Bloom, D., & Fink, D. (2013). The economic cause for devoting public resources to health. Institute for the study of Labor (IZA). Bonn.*
13. *Bokana, G., & Akinola, W. (2017). Productivity effects of higher education human. Productivity effects of higher education , 35, 173-198.*
14. *Campell, H. (2009). Measuring the Contributions of Education to Labour Productivity in a Developing Economy. International Journal of Education Economics and Development , 156-165.*
15. *Christopher, P., & Kumar, U. (2020). Government expenditure on human capital and growth in Namibia. A time series analysis. Journal of Economic Structures .*
16. *David, U., & Jameelah, O. (2013). Labour productivity and health capital in Nigeria: The empirical evidence. International Journal of Humanities and Social Science .*
17. *Dormont, B., Oliveira, M., Pelgrin, F., & Suhrcke, M. (2008). Health expenditure, longetivity and growth.*

18. *Ephraim, I. (2014). The effect of health capital on labour producvitiy in Nijeria from 1970 to 2013.*
19. *Goldin, C. (2016). Human Capital in Diebolt C,Haupert M (eds) handbook of Cliometrics. Berlin: Heldberg,Windoek.*
20. *Jacob, N., Solomon, A., & Justice, N. (2012). The effects of public and private health care expenditure on health status in sub-Saharan Africa: new evidence from panel data analysis. Health Economics , 2-22.*
21. *Jacob, N., Solomon, A., & Justice, N. (2012). The effects of public and private health care expenditure on health status in sub-Saharan Africa: new evidence from panel data analysis. Health Economics REview , 2-22.*
22. *Kazuya, O. (2009). Long Working Hours in Japan: An International Comparison and Research Topics. Japanese Economy , 23-45.*
23. *Kitessa D. (2018): Drivers of economic growth in Ethiopia: Does foreign aid and policy complementarity matter? Journal of Economics and International Finance , Vol. 10(8), pp. 95-110.*
24. *Knowles, S. a. (1997). Education and Health in effective labour empirical growth model. The Economic Record , 73, 314-328.*
25. *Li, Y. (2016). The relationship between fertility rate and economic growth in Developing countries. Lund University: School of Economics and Management.*
26. *Lieras-Muney, & Sherry, G. (2008). Health inequality, education and medical innovation. Demography , 741-761.*
27. *Lucas, & Robert. (1998). On mechanism of economic development. Journal of monetary economics , 3-42.*
28. *Mankiw, N. (1992). A Contribution to the Empirics of Economic Growth. Quarterly Journal of Economics , 407-437.*
29. *Mankiw, N., Romer, D., & Weil, D. (1992). A contribution to the empirics of economic growth. Quartely journal of Economics , 107, 407-437.*
30. *McDonald, S., & Roberts, J. (2002). Growth and multiple forms of human capital in an augmented Solow model: A panel data investigation. Economics Letters, 74, 271–276.*
31. *Myrdal, G. (1971). Economic Theory of Underdeveloped Regions. Harper and Row.*
32. *Mordi, C., & Mmieh, F. (2008). Divided labour and divided in farm markets in Nigerian Petroleum sector. Brunel University.*
33. *Moura, R., & Forte, R. (2010). The effects of foreign direct investment on host country economic grwoth-Theory and empirical evidence. Faculdade de Economia do Porto.*
34. *Mushkin, S. (1962). Health as investment. Journal of Political economy , 70, 129-157.*
35. *Nguyen, H., Ngoc, H., & Duc, H. (2019). The nexus between economic integration and growth: application to Vietnam. Annals of Financial Economics .*
36. *Nnyanzi, B., Babyenda, P., & Bbale, M. (2016). Regional Economic Integration and Tax Revenue: East African Community. Journal of Economic Integration.*

37. *Nnyanzi, J., & Kilimani, N. (2018). Estimation of disaggregated impactss of education expansion on economic growth in SSA. Modern Economy , 2119-2149.*
38. *Novignon, J., Mussa, R., & Chawaula, L. (2012). Health and vulnerability to poverty in Ghana: Evidence from the Ghana living standards survey Rounds 5. Health Economic Review .*
39. *Nurkse, R. (1971). The theory of Development and The Idea of Balanced Growth. London: Palgrave Macmillan.*
40. *Ogundari, K., & Awokuse, T. (2018). Human capital contribution to economic growth in Sub-Saharan Africa: does health status matter more than education? Economic Analayis Pol. , 131-140.*
41. *Plaxedes, G., & Seetanah, B. (2020). The effect of mining foreign direct investment inflow on economic growth of Zimbabwe. Journal of Economic Structure .*
42. *Prebisch, R (1950). The Economic Development of Latin America and its Principal Problems', UN ECLA; also published in Economic Bulletin for Latin America, Vol. 7, (1962) pp.1-22.*
43. *Saif, H. ,. (2019). Impact of Health on Labour producivity: Empirical evidence in Pakistan. Journal of Natural and Social Sciences , 139-147.*
44. *Samini, P., & Salarzadeh, H. (2014). Globalization and economic growth: Empirical evidence on the role of complementarities. Plos One .*
45. *Seetanah, B., & Teeroovengadum, V. (2019). The economic importance of education: evidence from Africa using dynamic panel data analysis. Journal of Applied Economics , 125-143.*
46. *Siepel, J., & Cowling, M. (2017). Non-founder human capital and the long run growth and survival of high-tech ventures. Technovation , 34-43.*
47. *Were, M. (2015). Differential effects of trade on economic growth and investment: A cross-country empirical investigation. Journal of African Trade , 71-85.*
48. *Wu, H. (2013). Measuring Industry Level Employment, Output and Labour Productivity in the Chinese Economy. Economic Review , 42-61.*