Health Outcomes and Economic Growth in Sub-Saharan Africa

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Abstract

Background: Significant efforts have been made in improving economic growth rates in sub-Saharan Africa. Economic growth, however, seems to be behind the desired rates, and also not inclusive. It is important to recognize the importance of health capital in achieving and sustaining the desired rates of growth in the region. This paper examines the relationship between health outcomes and economic growth in sub-Saharan Africa.

Methods: The paper employs the panel data technique in achieving the objectives. Panel data technique was used because this study is a cross-country examination of the effects of health outcomes on economic growth over time. In this approach, we use the Generalized Method of Moments estimation technique. Data for the study were sourced from the 2019 World Bank's World Development Indicators for a sample of 39 countries in sub-Saharan Africa.

Findings: The findings confirm the significant contribution of health outcomes to economic growth in SSA. An improvement in life expectancy at birth, and the reduction in the rates of infant and under-five mortalities, lead to an increase in the growth rate of per capita gross domestic product. Besides, capital formation, education, and trade openness contribute positively to economic growth, whereas the population growth rate negatively affects the growth rate of per capita gross domestic product.

Conclusion: Given the significant effect of health outcomes on economic growth, sub-Sahara African countries will benefit from actively investing in the health sector to increase life expectancy and reduce mortality rates. This perhaps can be achieved through effective education of the populace in keeping healthy life practices and deliberate investments in the health sector by governments to improve the efficiency of the sector and to make appropriate health care available and accessible. This will contribute to the achievement of sustained economic growth rates in the region.

Keywords: Economic growth, Health outcomes, Life Expectancy, Mortality, Sub-Saharan Africa

Introduction

Health status is an important component of human capital and has significant implications for the development of both the individual and the economy. Poor health affects the individual's ability to develop his/her potentials and therefore hinders effective participation in both the social and economic aspects of the society. For instance, poor health may undermine educational attainment since good health determines one's ability to withstand the pressure that comes along with climbing the educational ladder. This affects the human capital development of the person and therefore his/her ability to work and earn income. Also, poor health may prevent the person from working in a demanding work environment, with implications for the accumulation of wealth and ability to obtain the necessities of life. These affect the person's quality of life and wellbeing and may influence the likelihood of falling into the poverty bracket. Thus, in the pursuit of economic goals, improving the health status/outcomes of the individual is important for proper wellbeing of the citizens and an important factor in the fight against poverty. Thus, as countries implement policies to eradicate poverty and improve livelihood, efforts should be made to improve health outcomes to enhance the attainment of these goals.

Poor health also has economic implications for the nation. As has been argued in the literature, health, being a component of human capital [1, 2, 3], can improve/hinder the economic growth rate. Poor health affects the development and sustainability of the human capital base of the economy, which affects productivity and hence hinders economic growth. This is because poor health, aside from affecting the educational attainment of the individual also affects the person's effective participation in the labour market and his/her productivity. Besides, poor health can affect savings, which in turn can affect physical capital accumulation [3, 4, 5]. It is argued that with poor health, people may spend a lot of their earnings on sustaining or improving their health and this may affect their ability to save, which affects savings and investment in the economy, thus affecting economic growth. Indeed, poor health may be one of the reasons for underdevelopment in many regions of the world, including Sub-Saharan Africa as has been argued in the literature [6, 7].

The importance of health featured prominently in the Millennium Development Goals (MDG), which had three out of the eight goals dealing with health-related issues. These goals focused on reducing child mortality, improving maternal health and combatting HIV/AIDS, malaria, and other diseases. These were believed to be necessary to enhance the growth and development of nations. The Sustainable Development Goals also has goal three focusing on achieving good health and wellbeing by 2030, while providing financial protection. The targets of this goal, among others, include reducing mortality from maternal, neonatal and child deaths and non-communicable diseases[1]. These suggest that for the sustainable development of both the individual and the economy, it is important to improve health outcomes. Health outcomes, can be measured using mortality, which is a statement about the number of deaths per population in a given

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[1] https://www.un.org/development/desa/disabilities/envision2030-goal3.html accessed 9th April 2020.

period, or life expectancy, which is the number of years a new-born is expected to live, given mortality patterns at the time of the birth of the person. Given the importance of health, it is necessary to understand how mortality reductions and improvement in life expectancy affects economic growth in SSA.

Poor health is argued to be contributing to the slow rate of the growth of per capita Gross Domestic Product (GDP) in SSA. The region is known to record high rates of communicable diseases and child mortality, compared to other regions in the world [8]. Besides, Life expectancy in SSA is low at 61 years compared to a reported global average of 72.38 years [9]. Mortality on the other hand is high with average infant and under-five mortality in SSA reported to be 54.1 and 78 per 1000 live births, respectively [9]. These mortality values are high compared to the world average of 29 and 39.8 per 1000 live births for infant and under-five mortality, respectively as reported by the World Bank [9]. This may be part of the factors contributing to the poor growth performance in the SSA region [7]. Economic growth in SSA has been unstable for most countries, despite the positive growth rates recorded from the year 2000. On the average, the growth rate of GDP per capita in SSA is estimated to have bounced back to 2.4 percent in 2017, after slowing to 1.3 percent in 2016 [9]. The fluctuation in growth rates may partly be due to the high mortality rates coupled with the high fertility rates in the region [10]. The high mortality rate with the high fertility rate leads to a high dependency ratio, which can drag the growth rate of GDP per capita [11]. These suggests that while focusing on the factors that promote

economic growth, efforts should be made to improve health outcomes, and reduce population growth rates in SSA.

Empirical studies have produced differing conclusions on the effect of health outcomes on economic growth. Some studies have suggested that reductions in mortality and improvement in life expectancy contribute positively and significantly to economic growth [12, 13, 14, 15, 16, 17, 18, 19, 20, 21]. Others suggest no significant effect of health outcomes on Economic growth [22, 23]. These have led to different policy conclusions from the authors. For instance, studies that find a significant effect of health outcomes on economic growth have suggested that governments should implement policies and programmes in addition to increasing health expenditure to improve health outcomes and to achieve the desired growth rates. On the contrary, Acemoglu and Johnson, who found a positive effect of health outcomes on economic growth in their study, reported that though improvement in life expectancy leads an increase in GDP, it also increases the population growth rates, with the latter being higher than the former [24]. Hence, the net effect is a fall in GDP per capita, contradicting previous evidence of the effect of life expectancy on economic growth. He and Li also report that the effect of health outcomes on economic growth is only observed above a certain threshold implying non-linear effects [25]. Similarly, Aghion, Howitt and Murtin reported that the significant contribution of health outcomes to economic growth in OECD[2] countries is due to the reduction in the mortality rate of adults below 40 years [17]. Gyimah-Brempong and Wilson report that even though health capital

contributes to economic growth, the effect declines with higher accumulation of health capital [12].

Given the importance of health status/outcomes to both the individual and the economy, it is necessary to understand the contribution of health outcomes to economic growth to inform policy. It is also necessary to take into account all relevant factors such as the population growth rate, physical capital formation and trade openness, as these can also affect economic growth. This study is, therefore, a contribution to the literature on the effects of health outcomes, measured as mortality and life expectancy, on economic growth in SSA, and to provide some insights to inform policies that aim to enhance economic growth in SSA.

Methods
The econometric estimation of the effect of health outcomes on economic growth is based on Barro's theoretical framework [2], which is an extension of the neoclassical growth model to incorporate health capital as a component of the production process. According to the model, output (Y) in an economy depends on physical capital (K), labour hours (L) and human capital. Human capital in the model consists of two factors, education (S) and health capital (H). Imposing the Cobb-Douglas form for simplicity and ease of estimation, the model is formulated as equation (1).

$$Y = A \cdot K^{\delta} S^{\lambda} H^{\gamma} (Le^{xt})^{1-\delta-\lambda-\gamma} \quad \ldots\ldots\ldots\ldots (1)$$

In equation (1), A is the level of technology considered exogenous and xt is labour-augmenting technological progress, which is also considered exogenous. The following restrictions are further imposed on equation (1); $\delta > 0$, $\lambda > 0$, $\gamma > 0$, and $0 < \delta + \lambda + \gamma < 1$. Equation (1) is converted into per capita terms by dividing through by Le^{xt}, the labour and labour augmenting technological progress, resulting in equation (2). In equation (2), the variables y, k, s and h are quantities of output, capital, education and health capital per unit of effective labour in the economy. We proceed by taking logs of equation (2), resulting in equation (3).

$$y = A \cdot k^{\delta} s^{\lambda} h^{\gamma} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

$$\ln y_{it} = \beta_0 + \delta \ln k_{it} + \lambda \ln s_{it} + \gamma \ln h_{it} + \varepsilon_{it}$$
$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

$$\Delta y_{it} = \beta_0 + \beta_1 \Delta y_{it-i} + \delta \ln k_{it} + \lambda \ln s_{it} +$$
$$\gamma \ln h_{it} + \alpha \ln popg_{it} + \beta \ln open_{it} + \varepsilon_{it} \ldots\ldots(4)$$

In equation (3), h_{it} represents health capital, which we proxy with life expectancy at birth, and infant and under-five mortality rates. ε_{it} is a random error term assumed to be normally distributed and β_o is the constant term. For estimation, equation (4) is specified as a follow up to equation (3).

In equation (4) Δy_{it} is the growth rate of per capita GDP. Further, we include the population growth rate ($popg_{it}$) and trade openness ($open_{it}$) as control variables that may influence our outcome variable in equation (4). The introduction of the population growth rate is because as health improves, particularly, as mortality is reduced and life expectancy is increased, there is the likelihood that it will lead to an increase in population growth rate, which can also affect the growth of per capita GDP. We also include trade openness to measure the extent to which countries' trade with the outside world influence the economic growth rates.

We use the Arellano and Bond estimators [26] in the estimation of equation (4). The Arellano and Bond estimators are used because of the possibility of reverse causality from improved health outcomes to economic growth, which can cause endogeneity in the model. While we postulate in this study that health outcomes can improve economic growth, it has been suggested in the health literature that growth increases income and hence improves the standard of living and therefore health outcomes of the population [27, 28, 29]. The use of the Arellano and Bond estimator helps solve this as the system uses the lags of the variables as instruments in the estimation process. This procedure also deals with the heterogeneity that is inherent in panel data as it uses the first difference forms of the variables in the estimation, ensuring that time-invariant factors that are unobserved are removed. The study further carried out a test of instrument validity using the Hansen test [30]. Also, due to the use of the lags, dynamic panel data models are likely to suffer from autocorrelation [31]. Thus, we test for both first and second order autocorrelation in our estimations.

The study used data from the World Banks' World Development Indicators for 2019 [9]. In all, a total of 39 SSA countries[3] were used, for the period 1995 to 2019. Some of the countries in SSA had incomplete data at the time of this study and hence were dropped from the study. Life expectancy was measured in years while mortality was measured as the number of infant and under-five deaths per 1000 live births, respectively. These are exactly the same definitions used in the World Development Indicators where we pick our data from. Economic growth was measured as the growth in Gross Domestic Product per capita. The other control variables used in the study are the gross fixed capital formation as a percentage of GDP, school enrolment rate, the population growth rate and trade openness. Trade openness was measured as the ratio of the sum of exports and imports to gross domestic product (GDP).

Results
Descriptive statistics
The descriptive statistics of the variables, presented in Table 1, shows that the mean per capita GDP growth in SSA was 2.23 percent, with a standard deviation of 6.22 percent. The rate of population growth on average was 2.64 percent with a maximum of 10.26 percent. Gross Fixed Capital Formation has an average of 21.40 percent of GDP. The average life expectancy at birth in SSA is 53.54 years, with infant and under five mortality rates of 74.86 and 119.88 per 1000 live births, respectively. The pattern for these health outcomes are shown in Figures 1 and 2. The average school enrolment rate (gross) is 97.76 percent.

[3] *Angola, Benin, Botswana, Burkina Faso, Burundi, Central Africa Republic, Cameroon, Cape Verde, Chad, Comoros, Congo Rep., Cote d'Ivoire, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia The, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Madagascar, Malawi, Mali,* *Mozambique, Namibia, Niger, Rwanda, Senegal, Sierra Leone, South Africa, Sudan, Eswatini, Tanzania, Togo, Uganda, Zambia.*

Table 1: Descriptive Statistics

Variables	Mean	Standard deviation	Minimum	Maximum
Per capita GDP growth rate	2.23	6.22	-33.98	91.67
Life Expectancy at Birth (LEB)	53.54	6.21	30.47	73.92
Mortality Rate (Infant)	74.86	25.57	18.20	155.70
Mortality Rate (Under-five)	119.88	47.03	21.30	275.10
Population growth rate	2.64	0.89	-1.13	10.26
School Enrolment rate	97.76	26.54	28.80	181.70
Fixed capital formation (Gross)	21.40	10.28	-2.42	113.58

Source: Computed from the World Bank's World Development Indicators (WB, 2019)

Figures 1 and 2 present the pattern of mortality and life expectancy in SSA over the study period. It can be observed in Figures 1 and 2 that there have been significant reductions in infant and under-five mortality rates over the period. The reduction in infant mortality is, however, higher than that of under-five morality as indicated in Figure 1. Indeed, the reduction in mortality rates might be due to the numerous policy initiatives and efforts to improve child health in the region, including the integrated management of childhood illnesses, the safe motherhood program, Primary Heath care programs, various immunisation programs and the Millennium Development goal, among others. These might explain the reduction in mortality rates over time and the improvement in life expectancy at birth. Figure 2 suggests the continual improvement in life expectancy at birth over the study period in the SSA region, even though life expectancy is relatively lower in some countries in the region.

Empirical Findings
The study investigated the effect of health outcomes on Economic Growth in SSA. The results, presented in Table 2 suggest that an improvement in Life expectancy at birth leads to an increase in the economic growth rate, while a fall in the rates of infant and under-five mortalities lead to an increase in the economic growth rate. These are significant at the 5 per cent level of significance. These estimates confirm the importance of health outcomes to the economic growth process in SSA. Furthermore, trade openness, education and gross fixed capital formation have positive effects on economic growth, while the population growth rate has a negative effect on economic growth. The Hansen test of over-identifying restrictions does not reject the null of instrument validity. This suggests that the instruments used in the estimations are valid. Furthermore, the test for second-order serial correlation confirmed that the models do not suffer from second-order autocorrelation. In Table 2, all the variables are logged, except the growth rate of GDP per capita.

The positive effect of life expectancy on economic growth indicates the importance of improving life expectancy in the region. While the average life expectancy in the region is low, efforts at improving this will

yield positive results for growth and development in the region. Besides, efforts in reducing mortality rates in the region is also an important channel to improve the growth rates in SSA. Given the negative effects of mortality rates on economic growth, reducing mortality rates is an important policy objective. Indeed, several efforts are already in place to reduce the high child mortality rate in the region. This is therefore a call to strengthen such efforts to achieve the desired results with its attendant implications for economic growth and development in the region.

Discussion

In this study, as presented in table 2, the effect of health outcomes on economic growth shows that improvement in life expectancy at birth leads to an increase in the economic growth rate, while a fall in the rates of infant and under-five mortalities lead to an increase in the economic growth rate.

Specifically, the results indicate that an increase in life expectancy by 1 per cent results in an increase in the economic growth rate by 0.158 per cent. The coefficient of life expectancy is significant at 5 per cent. Besides, the negative coefficients of infant and under-five mortality rates suggest that a significant reduction in the rates of infant and under-five mortalities lead to an improvement in economic growth rates. Specifically, a 1 per cent fall in infant and under-five mortality rates lead to a 0.161 and 0.117 per cent increase in the economic growth rate, respectively. Our findings, however, indicate that the contribution of health outcomes to economic growth was significantly driven by reductions in mortality rates than by the improvement in life expectancy over the study period.

Figure 1: Infant and Under-Five Mortality rates per 1000 live births

Figure 2: Life Expectancy at Birth in Years
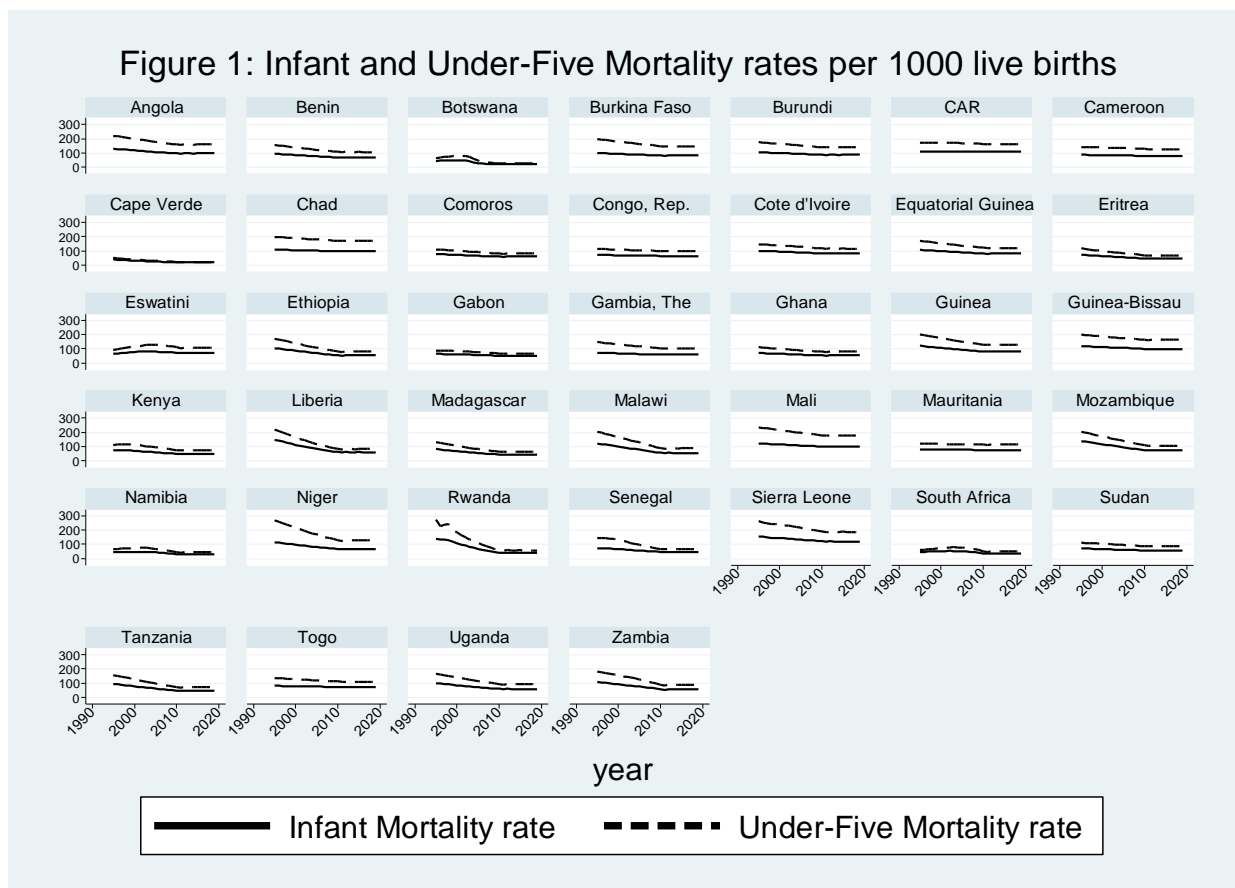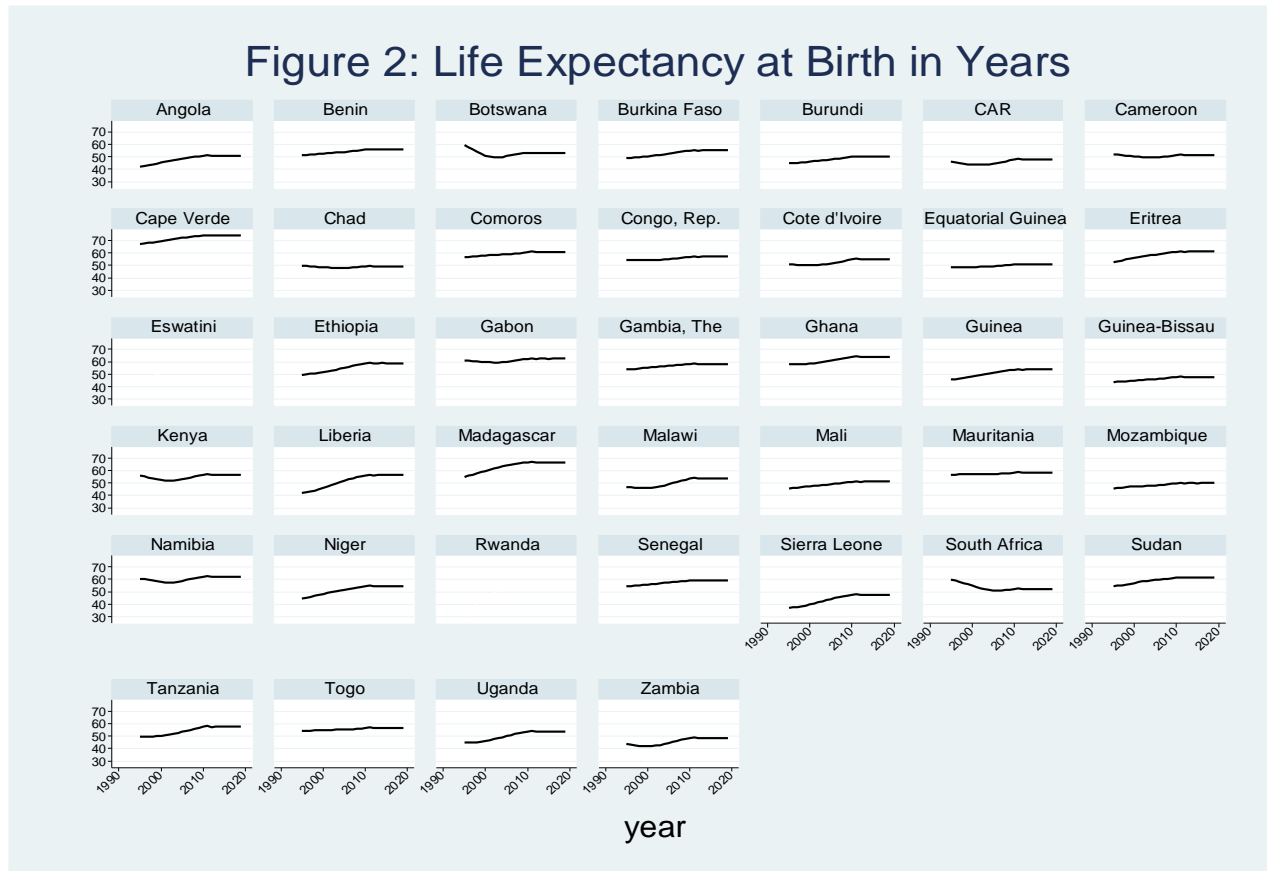
The results confirm the findings of studies that report a positive contribution of health outcomes to economic growth [12, 18, 20, 2, 21, 17, 13, 14, 19] and have therefore recommended investment in the health sector to improve health outcomes. The findings from this study provide evidence of the significant effect of health outcomes on economic growth and thus concludes that as the nations within SSA strive to improve the economic growth rates, efforts should be made to improve health outcomes in the region as this promises significant economic returns. This can be done by investing in the health sector, through appropriate interventions to reduce the rate of disease prevalence, reduce the financial burden to encourage appropriate health care use and improve health systems to provide efficient health care services. These have been documented in the literature as effective channels to improve health outcomes. These should be accompanied with appropriate health education to enhance proper health care practices that will ensure that the returns to investing in the health sector yields the required benefits. Our findings that contributions to economic growth are driven more by mortality reductions than improvement in life expectancy might also be because investments in the health sector in the past have mostly focused on reducing deaths than improving conditions of living. Indeed, improvement in life expectancy at birth also depends on improving other factors that are relevant to improving conditions of living. Thus, there is the need to also invest in other sectors that enhance health outcomes like sanitation, education, clean

Table 2: Health Outcomes and Economic Growth in SSA

VARIABLES	Model LEB	Model IMR	Model UMR
GDP per capita growth (lag 1)	-0.0748***	-0.148***	-0.172***
	(0.0165)	(0.0255)	(0.0394)
GDP per capita growth (lag 1)	-0.126***	-0.159***	-0.185***
	(0.0313)	(0.0415)	(0.0488)
Gross Capital formation	3.965***	4.215***	4.807***
	(0.0483)	(0.734)	(0.930)
Trade Openness	5.912***	14.21***	14.34***
	(1.318)	(1.426)	(1.179)
School enrollment rate	2.244*	0.389	1.700
	(1.276)	(0.861)	(1.596)
Population growth	-2.949***	-0.450	-1.136**
	(0.988)	(0.692)	(0.517)
Life expectancy	15.80**		
	(7.663)		
Infant Mortality		-16.14***	
		(2.464)	
Under-five mortality			-11.70***
			(2.593)
$F_{(7, 39)}$	32.26***	49.70***	68.29***
First order autocorrelation	-2.62**	-2.51**	-2.50**
Second order autocorrelation	-0.67	-0.93	-0.80
Hansen test of over identifying restrictions	34.82	33.79	33.53
Observations (Countries)	853 (39)	853 (39)	853 (39)

t statistics in parentheses   *** $p<0.01$, ** $p<0.05$, * $p<0.1$

All variables, except GDP per capita growth and population growth are in natural logs

water and others to enhance the attainment of improved health outcomes.

The results also confirm the importance of education in the economic growth process. Education is positive and weakly significant in the model for life expectancy (model LEB). The coefficients of education are positive in the models for infant and under-five mortality, but not significant. The positive and significant coefficient implies a positive effect of education on economic growth. Specifically, a 1 per cent increase in the school enrolment rate leads to an increase in the economic growth rate by 0.022 per cent in SSA. This result is consistent with the findings of studies that have reported a positive effect of education on economic growth [2, 13, 32, 33, 34, 35, 36]. Education enhances the productivity of the human capital of every nation and improves efficiency, and this has significant implications on economic growth rates. Thus, the importance of education cannot be understated in the economic growth process. Given the results from this study, efforts should be made in improving not only enrolment at all levels of education but also the school completion rates and the quality of education. These will greatly improve the human capital base in the region and therefore enhance their productive capabilities, which will in turn improve output in the region. Governments should therefore invest in the educational sector from the

provision of appropriate infrastructure to enhancing the quality of the labour force within the sector to achieve such results.

Also, the importance of capital formation in the economic growth process cannot be ignored in the region. The study confirms the positive effect of capital formation on economic growth in SSA. Specifically, a 1 per cent rise in the capital formation increases the growth rate of GDP per capita by about 0.040 to 0.048 per cent across the three models estimated. These coefficients are highly significant at the 1 per cent level of significance in all the three models. The positive and significant coefficients of capital formation confirm the conclusions reached by earlier studies [2, 12, 32, 37, 38, 39] that recommended that efforts are made to improve capital formation in SSA. There is the need to invest in capital, and possibly also attract investment into the region to supplement what is already in existence. This result is not surprising as it has been the basic prediction of the neoclassical model of growth that economic growth is driven by growth in capital. It is important to encourage both savings and investments to improve capital formation in the region. Savings particularly becomes important to enhance domestic investments while complementing this with foreign investments in the region.

Furthermore, the results confirm the importance of trade openness in the economic growth process. Specifically, the coefficients of trade openness in the three models are positive and significant. Indeed, trade facilitates the diffusion of technology and hence improves productivity and efficiency of production among trading partners. This, therefore, improves the economic growth process among these countries given the ability to attract the new technologies to enhance production

activities. Specifically, a 1 per cent rise in trade openness leads to between 0.059 to 0.143 per cent rise in the growth rate of GDP per capita in the three models, and are all significant at the 1 per cent level of significance as reported in Table 2. Our results confirm the hypothesis that countries that trade with the outside world tend to grow faster than those that do not. These results confirm the findings of previous studies on the effect of trade openness on economic growth [20, 38, 39, 40, 41]. These results imply that it will be an advantage for countries to have an open trading environment, while they develop their markets and industries to take advantage of the trading benefit thereof from an open trading environment.

Our results also indicate the deleterious effect of the population growth rates on economic growth in the region. The results from Table 2 indicate that the population growth rate hinders the growth rate of per capita GDP. The coefficients are all negative and significant in the three models estimated. The negative coefficients of population growth rate may suggest that the high rate of population growth in the region may be dragging the rate of growth of per capita GDP. This finding lends support to the empirical literature on the effect of population growth on economic growth [24, 42]. Acemoglu and Johnson, for instance, suggested that while improvement in life expectancy may lead to an increase in GDP, it also increases the population growth rates, with the latter being higher than the former, and therefore hinders the growth rate of per capita GDP [24]. One possible explanation is that a significant reduction in the mortality rate, with a high fertility rate as observed in SSA, implies an increase in the population growth rate. This increases the dependency

ratio as the non-working population relative to the working population increases, and therefore affects the rate of saving, investment and therefore the growth rate of per capita GDP. This can be addressed using appropriate fertility interventions, which will help in reducing the fertility rate and hence having the growth rate of the population in check to support the growth of per capita GDP. Indeed, high population growth means the need for more resources to provide the needs of the increasing population and this may be a strain on the limited resources of the nation, and therefore growth prospects of the economy. Thus, efforts to improve the growth rate of per capita GDP should also focus on addressing the high population growth rate in the region.

Conclusion

The study examined the effect of health outcomes on economic growth in SSA using panel data of 39 SSA countries for the years 1995 to 2019. The study used data for countries with availability of a complete set of data for the study. The effect of health outcomes on economic growth was investigated drawing insights from the augmented Solow growth model and was estimated using the Generalised Method of Moments estimator. The findings suggest a significant effect of health outcomes on economic growth. A reduction in the rates of infant and under-five mortality and an increase in life expectancy at birth lead to an increase in the growth rate of per capita GDP in SSA. The results imply that as comortality rates and improving life expectancy at birth. This could be achieved by appropriate investments in health outcomes as suggested by the empirical literature [27, 28, 29]. Government investment in the health sector is important as it helps in the provision

of infrastructure, improved technology, human capital and other necessities needed to make the health system function better. Besides, educating the public on safety and important health practices can also help in improving health outcomes in the quest to achieve sustained growth in per capita GDP.

We also find that important variables of trade openness, population growth rate, gross fixed capital formation and school enrolment rate have important effects on the growth rate of per capita GDP. Specifically, we find that while trade openness, school enrolment rate and capital formation lead to an improvement in the growth rate of per capita GDP, the population growth rate has negative effects on the growth of per capita GDP. It is, therefore, important that while efforts are made to improve the growth rate of per capita GDP in SSA, these are also addressed to help in achieving the desired results. Further studies may also be needed, which incorporates foreign direct investment and measures of democracy to account for their effects on the growth rate of per capita GDP in the presence of the health human capital in the model. These are relevant issues that can potentially improve the policy environment and help in achieving sustained growth rate in the SSA region.

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