A contribution to the health-growth empirics on Africa

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2018

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Abstract

Africa faces significant health-related challenges due to the high level of morbidity in the continent. These challenges ruin productivity and hinder economic growth. This paper investigates the effect of health on economic growth using two health variables: life expectancy and infant mortality. The study covers the period 1975 to 2015 and uses both cross-sectional and panel regressions in econometric estimation. Under both methods of estimation, the study establishes a conditional convergence for African economies. The health variables have statistically significant effects on economic growth under both static and dynamic panel regressions, though we emphasise the results obtained under the dynamic panel method. The results indicate raising life expectancy can significantly spur growth, while infant mortality can slow down economic growth. Our results suggest that countries in the North-African subregion do not enjoy higher growth on account of health. On the policy side, this study suggests that governments in Africa should invest more in health to improve economic growth.

Keywords: Life expectancy, Infant mortality, Economic growth, Panel data, Africa

JEL classification: I15, C21, C23

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1. Introduction

The wellbeing of a nation's population is crucial to her economic outcomes because healthier people are more productive, have a greater incentive to invest in human capital and learn more; and they tend to live longer, as we have seen in many developed countries lately. On the other hand, income at the national and individual levels has an impact on health (Deaton, 2003). Weil (2014) argues that the effect of income on health is more profound at the lower end of the income distribution. Higher income can improve health through better nutrition, technology and improved medical services, and contributions from investment in public health infrastructures, including sanitation and water provisions.

Since the emergence of the endogenous growth model, various studies have been conducted to test the impact of health on economic growth. However, the impact of health on economic growth is not clear from the empirical studies conducted so far. While some scholars have established that there is a positive and significant effect of health on economic growth (Mayer, 2001; Gallup & Sachs, 2001; Bhargava *et al.*, 2001; Bloom, Canning, & Sevilla, 2004; Swift, 2011; Barrow, 2013; Piabuo & Tieguhong, 2017), others have argued that no such thing exists, especially for developing countries (Acemoglu & Johnson, 2007; Cooray, 2013; Frimpong & Adu, 2014). There is also the methodological issue in this debate. There is a problem of endogeneity because the causality of the health-income relationship runs in both directions. Besides, Caselli, Esquivel, and Lefort (1996) observe that the significance of health variables on economic growth vanishes under the difference Generalised Method of Moments (FDGMM) estimator.

This study looks at the impact of health on economic growth in Africa, taking into consideration the issues that health-growth empirics have generated. Sachs (2001) argues the level of morbidity in tropical countries would make it difficult to have healthy populations assuming they were rich. By implications, the health-improving effect of income may be challenging to realise in tropical countries; further, the impact of improved health on productivity may elude these countries. This fact makes the investigation of the impact of health on economic growth for African countries, coupled with the conflicting results of health-growth empirics in developing countries, a relevant task. Additionally, this panel study has more clusters (over 42 clusters) than existing studies on the health-growth empirics on Africa, thereby avoiding the bias inherent in studies with fewer clusters.

The study establishes a conditional convergence for African economies under cross-sectional and panel regressions using life expectancy and infant mortality rate as health variables. Life expectancy at birth measures the number of years a man is expected to live based on some prevailing demographic factors. In contrast, the infant mortality rate measures the number of infants dying before age one per 1,000 live births in a given year. Health is a multidimensional concept that can be measured in many ways. Still, life expectancy and infant mortality rate are two health indicators available for periods covered in this study for most African economies. According to Weil (2014), there is a strong relationship between these health variables and income. The health variables are statistically significant under the panel models, including the FDGMM. The statistical significance of the health variables remains against the observation of Caselli *et al.* (1996). But only infant mortality as a health variable is statistically significant under the cross-sectional regression.

The conclusion from this study relies on the results from the system Generalised Method of Moments (SysGMM). The specification tests confirm the validity of the model. Thus, this study contributes to the literature that health does matter for economic growth in Africa. Raising life expectancy can significantly improve productivity, while a surge in infant mortality can reduce economic growth in Africa. African leaders must do more by investing in health to boost productivity and enhance development. They will do well by implementing various declarations on health policy in Africa, such as the 2001 Abuja Declaration where they agreed to devote 15% of the government budget to health-related expenditures in their countries, the 2006 Addis-Ababa Declaration on community health in the African region, and the 2008 Ouagadougou Declaration on primary health care and health systems in Africa. The economic costs of various health challenges facing the continent, such as Ebola (World Bank, 2014) and malaria (Sachs, 2001; Gallup & Sachs, 2001), are significant. African governments must genuinely and urgently pursue investment in health to improve peoples' health and reduce morbidity to raise productivity in Africa.

The rest of this study is organised as follows: section two deals with the literature review. Issues of model, methodology and data are addressed in section three. Section four focuses on empirical analysis, while the study is concluded in section five.

2. Literature review

The Solow-Swan (1956) economic growth model sparks a major debate on the convergence to steady-state economic growth. In their studies and subsequent studies that follow the neoclassical tradition, technological changes predict convergence to a steady state under constant labour supply with per capita output growing at the same rate as technological progress (Thompson, 2008). This is hinged on the fundamental assumption of diminishing returns to capital. The model assumes technology is exogenous. However, the unsatisfactory performance of the neoclassical growth model in explaining the vast difference in economic performance across countries of the world led to new thinking about the determinants of economic growth. Indeed, per capita growth can persist over a long term without the tendency to decline as against the neoclassical prediction (Barro & Sala-i-Martin, 2004).

The shortcomings of the neoclassical growth model led to the development of the endogenous growth model pioneered by Romer (1986). Under this model, technology is explained by economic factors such as physical capital and labour in the form of human capital. The adequacy of these factors in the right quantity and quality, when combined with capital, explains the reasons for economic growth and sustenance of high economic growth in countries of the world. This model does not assume diminishing returns to capital. The model has lent itself to the econometric test of determinants of economic growth.

One of the factors to be tested in explaining growth under this model is human capita (Lucas, 1988). However, it is recognised that building of human capital rest on the health of the people. Without health, it would be hard for people to acquire the needed skills to perform simple tasks to aid economic growth. Weil (2014) posits that increasing life expectancy reduces the depreciation rate of human capital, thereby making the investment in education very attractive. Health is not just beneficial to investment in education; it increases productivity. Healthier people are more productive. This view links health to long-run economic growth.

Health proxied by male and female life expectancy causes economic growth in a study conducted on Latin American countries by Mayer (2001). This result reinforces the view that a healthy workforce can be more productive. Again, it is believed that a higher life expectancy means that the productive workforce will be economically active for a longer time. The intergenerational impact of this could be better imagined when we consider the role of grandparents in raising their grandchildren. This will be very true when females have a higher life expectancy than men. Onarheim, Iversen, and Bloom (2016) submit that giving priority to women's health facilitates their economic participation. This tends to improve the productivity of economies, and the effect can be substantial, especially in low-income economies.

Bhargava *et al.* (2001) conclude in their study that adult survival rates (ASR) have a positive effect on the growth of gross domestic products (GDP) in developing countries. Dube and Phiri (2014) posit that the effect of nutrition on economic growth is positive; and there exists bi-directional causality between nutrition and economic growth with a strong causality effect running from nutrition to economic growth in a study on South Africa. Good health is difficult to attain without proper nutritional intake; thus, it is just right that there exists a positive relationship between nutrition and economic growth. People's appropriate nutritional intakes are proportional to their level of wellbeing, which determines to a large extent their level of productivity.

According to Swift (2011), “better health can lead to economic growth not only through an increase in total GDP as population increases, but also more importantly, through long-term gains in human and physical capital that raise productivity and per capita GDP.” He finds long-run co-integrating relationships between life expectancy and total gross domestic product (GDP) and GDP per capita for 13 Organisation for Economic Cooperation and Development (OECD) economies. Barro (2013) explains that health does have a positive impact on economic growth. Gallup and Sachs’ (2001) influential study suggests that eliminating malaria would raise growth by 1.3% per year in endemic regions. This conclusion underscores the importance of health in the productivity of any nation. Further, Bloom, Canning, and Sevilla (2004) conclude that raising life expectancy by one year is capable of increasing output per capita by 4%.

However, in a study on a selected 30 African countries, Frimpong and Adu (2014) find that population health does not drive economic growth in the countries studied. Still, they find that economic growth increases life expectancy using a panel co-integration method. Cooray (2013) reports mixed results. In the entire sample of the study, health capital does not affect economic growth. In a sub-sample of high and upper middle-income economies, she finds a significant and positive relationship between health capital and economic growth. For low- and middle-income economies, health capital only positively influences economic growth through its interaction with education and health expenditure. Besides, different dimensions of health may produce different effects of health on productivity (Bloom & Canning, 2008; Bloom, Kuhn, & Prettner, 2018).

3. Model, methodology, and data

3.1 Model

The framework for analysing growth follows the neoclassical specification of the Cobb-Douglass production function. In this study, the production function, with its arguments: capital and a composite labour input, *à la* Lucas (1988), is specified as follows:

$$Y_i = A_i K_i^{\alpha} \langle L_i^{e} \rangle^{1-\alpha} \tag{1}$$

where Y_i is the output of the equation (1), K_i is the physical capital component of the total capital, while A_i is regarded as the country-specific productivity term. The composite labour component of the capital stock, otherwise known as the effective labour, is defined below.

$$L_i^e = h_i v_i L_i \quad (2)$$

where h_i is the per-worker human capital in the form of education, v_i is the per-worker human capital in the form of health needed to aid the worker to be in his highest level of productivity at work, while L_i is the number of workers. The equation (1) thus becomes

$$Y_i = A_i K_i^{\alpha} \langle h_i v_i L_i \rangle^{1-\alpha} \quad (3)$$

The form of equation (3) allows for the addition of other relevant variables in explaining cross-country variation in output when transformed for the estimation of economic growth regression. Such transformation for the estimation of a cross-country economic growth regression, according to Caselli *et al.* (1996), takes the following general specification.

$$ln\langle Y_{i,t} \rangle - ln\langle Y_{i,t-\tau} \rangle = \beta ln\langle Y_{i,t-\tau} \rangle + W_{i,t-\tau}\delta + \eta_i + \xi_t + \epsilon_{i,t} \quad (4)$$

where $Y_{i,t}$ is the per capita GDP in country i in period t, $W_{i,t}$ is a row vector of determinants of economic growth, η_i is a country-specific effect, ξ_t is a period-specific constant while $\epsilon_{i,t}$ is an error term.

In interpreting equation (4), we use the coefficient of the lagged dependent variable of GDP per capita. A negative and significant coefficient is consistent with the prediction of the neoclassical growth model. This implies that countries close to their steady-state level of output will experience a slowdown in growth, otherwise termed conditional convergence. In this case, according to Caselli *et al.* (1996), the variables in $W_{i,t-\tau}$ and the individual effect η_i are proxies for the long-run level the country is converging to. In essence, when $\beta = 0$ there is no convergence effect, and the other right-hand side variables measure differences in steady-state growth rates. However, our interest in this study is to achieve a result where $\beta < 0$.

3.2 Methodology and data

Most cross-country studies on the determinants of economic growth before Knight, Loayza and Villaneuva (1993), Loayza (1994) and Islam (1995) adopted cross-sectional regression in growth estimation through Ordinary Least Square (OLS) regression. OLS is consistent and unbiased as it exploits both within and between variations of the data. However, this method is inconsistent for growth estimation on the grounds of correlated individual effects and endogeneity. The standard error for a cross-sectional regression estimate is only consistent if the individual effect is uncorrelated with the other right-hand variables. The fixed effects (FE) estimator offers some improvement over the OLS. It controls for both the observed and unobservable factors. Even so, the exogeneity condition for unbiased estimates under the static panel data is hardly met. In other words, the condition of no covariance is violated under the framework of dynamic growth regression because the lagged variable and the individual-specific effects are correlated under both OLS and FE. It creates a problem of biasedness in the estimate of the convergence coefficient. With concerns over heteroskedasticity and autocorrelation, the standard errors of FE and OLS are clustered at the country level to obtain robust standard errors.

Besides, some of the variables on the right-hand side of the regression equation may be endogenous to the growth rate. This necessitates the use of dynamic panel regression in this study. Though, the FE model may approximate the dynamic panel model where t is large. The dynamic panel model helps to correct the shortcomings of the static panel models and cross-sectional regression using OLS. One of the ways through which the shortcomings of the OLS for cross-sectional regression is corrected under the panel data analysis is the use of differencing approach or by using the Generalised Method of Moments (GMM), which uses instruments to generate consistent estimator. Indeed, the validity of the GMM approach is hinged on the assumption that the explanatory variables can be used as valid instruments in the growth regression. The development of the dynamic panel model started with the work of Arellano and Bond (1991). The method was subsequently extended in the works of Arellano and Bover (1995) and Blundell and Bond (1998). The validity of these models rests on the absence of autocorrelation of order 2 (AR2). This study implements Windmeijer's (1995) two-step estimation of the SysGMM for finite-sample correction of standard errors. For dynamic models, too many instruments can pose a problem to the validity of the models. This paper follows Roadman (2009a, 2009b) in implementing the models. The order of the autocorrelation and the number of instruments are reported under the appropriate models.

The data for this study is collected from the World Bank World Development Indicators (WDI), KOF globalization index of the Swiss Economic Institute, and Polity IV project for data on political regimes. The data spans the year 1975 to the year 2015. The variables of interest in this study are GDP per capita, investment proxied by gross fixed capital formation as a percentage of real GDP per capita, government size proxied by general government final consumption expenditure as a percentage of GDP, economic globalization is the KOF de jure economic globalization index, education is proxied by secondary education general pupils, population growth rate, the political regime is Polity2 data from Polity IV project, life expectancy, infant mortality, and a dummy variable representing the North-African subregion. It is expected that life expectancy will relate positively to growth, while infant mortality will drag down economic growth. The dependent variable, GDP per capita growth rate, was generated from the GDP per capita after logging it. For cross-sectional regression, the resulting data from using *collapse* function in STATA 15 over the period covered in this study was divided by the number of years; while for the panel regression, the data had to be collapsed into nine periods of five years per period. Apart from the GDP per capita, education and infant mortality variables are also in log. The summary statistics of the variables for the year 1975 to the year 2015 is in Table 1 below.

Table 1: Summary statistics

Variable	Mean	St. Dev.	Min	Max
GDP per capita growth rate	0.01	0.03	-0.10	0.24
Log GDP per capita	7.06	0.96	5.36	9.71
Investment	21.68	9.29	3.18	71.29
Government size	15.17	5.83	1.53	53.17
Economic globalisation	36.06	10.81	9.55	78.81
Education	12.44	1.53	8.57	16.21
Population growth	2.56	0.95	-4.44	6.14
Political regime	-1.21	5.88	-10	10
North Africa	0.14		0	1
Life expectancy (LE)	55.40	8.13	28.18	75.65
Infant mortality (IM)	4.22	0.51	2.55	5.13

Notes: The data is sourced from World Bank Development Indicators (WDI), KOF globalization index of the Swiss Economic Institute (Gygli, Haelg, Potrafke, & Sturm, 2019), and Polity IV project. The dummy for North Africa was generated based on the regional grouping of African countries by the African Development Bank (AfDB). Source: Author's computation.

4. Empirical analysis

The results of the econometric estimation of the model specified in equation (4) are presented in this section. The cross-sectional regression is estimated using the OLS. Notwithstanding the theoretical challenges of the cross-sectional regression for a dynamic model, the results are presented in Table 2 below. The result of the test of absolute convergence appears in column 1 of Table 2. The result indicates that there is absolute convergence for African economies. The result in column 2 indicates conditional convergence controlling for investment, government size, economic globalisation, education, population growth, and political regime. Besides the dummy for the North-African economies, all other variables included in column 2 are retained in column 3. In column 4, one of the health variables, life expectancy, is introduced into the model. Also, in column 4 is the interaction of life expectancy with the dummy for North Africa. In column 5, another health variable, infant mortality and the interaction between infant mortality and the dummy for North Africa are presented. The two health variables are jointly introduced in column 6.

Table 2: Results of cross-sectional regressions for life expectancy and infant mortality

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Log GDP per capita	-0.0031**	-0.0039***	-0.0039***	-0.0052***	-0.0056***	-0.0055***
	(0.0013)	(0.0008)	(0.0008)	(0.0013)	(0.0011)	(0.0010)
Investment		0.0000	0.0000	0.0002	0.0002	0.0001
		(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0001)
Government size		0.0004**	0.0004**	0.0003	0.0002	0.0001
		(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Econ. globalisation		0.0003***	0.0004***	0.0003**	0.0003**	0.0003**
		(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Education		0.0008	0.0009	0.0002	0.0001	0.0001
		(0.0005)	(0.0006)	(0.0005)	(0.0005)	(0.0005)
Population growth		-0.0047**	-0.0048**	-0.0044**	-0.0037**	-0.0039**
		(0.0017)	(0.0017)	(0.0016)	(0.0016)	(0.0015)
Political regime		-0.0007***	-0.0008**	-0.0007*	-0.0007*	-0.0006*
		(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
North Africa			-0.0011	-0.0108**	-0.0082**	
			(0.0033)	(0.0048)	(0.0038)	
Life expectancy (LE)				0.0004		-0.0002
				(0.0003)		(0.0004)
North Africa x LE				0.0001		
				(0.0001)		
Infant Mortality (IM)					-0.0090**	-0.0116
					(0.0035)	(0.0084)
North Africa x IM					0.0017	
					(0.0012)	
R^2	0.33	0.65	0.65	0.71	0.72	0.70
Regional dummy	Yes	No	No	No	No	No

Notes: Significance levels: *: 10%, **: 5%, ***: 1%. Robust standard errors are in parentheses. The dependent variable is the GDP per capita growth rate. The main independent variable, Log GDP per capita is lagged by one period. Econ. globalisation refers to economic globalisation. All models are estimated using OLS. The regional dummies are redundant where "No" is reported for regional dummies using *Testparm* in *STATA* 15; in other words, the regional dummies are excluded from the estimation. Source: Author's computation.

Table 2 shows that we establish both absolute and conditional convergence with varying rates of convergence as the regressors change for the cross-sectional regressions, from column 1 to column 6. The log GDP per capita in column 1 has a statistically significant coefficient of -0.0031 with the appropriate negative sign for the absolute convergence. The coefficient implies an absolute convergence rate of 0.31% per year. The rate of conditional convergence is 0.39% per year from column 2. This rate of convergence for African economies is very low. It implies that it would take these economies several years to get halfway towards the steady-state output level. Though the coefficients in columns 4–6 are larger, this would not make a significant difference in the trajectory of the economies.

Economic globalisation appears to have favoured the African economies. In Table 2, the coefficient of the variable is consistently significant in all the cross-sectional regression models. This suggests that if the economies continue to participate in global trade by offering more than primary products, the economy will likely expand faster. The population growth rate of the African economies is a curse to their drive towards development. They need to control their population growth rate in tandem with their economic activities. A huge population is not necessarily good, nor a magic wand needed for economic transformation. It depends on the resource available per capita and level of productivity, which may determine the level of the internal market that could aid economic growth. Also, institutional factors, as indicated by the coefficient of political regime, suggest that African economies need to work on their institutions to support their drive for economic growth. The coefficient consistently indicates the poor institutional quality in these economies. Corruption is endemic in Africa because of the abundance of natural resources. This has perennially generated instability that hampers economic growth.

Under the cross-sectional regressions, the health variables, life expectancy in column 4 and infant mortality in column 5, are not statistically significant. The North African countries appear to be better organised in structures and institutionally. These economies enjoy proximity to the European economies and the Middle East countries. The connections with these economies impact the way things are done in North Africa. However, the interaction terms generated by multiplying health variables with the dummy for North Africa are not statistically significant. Though data shows that these economies have better health statistics than countries in the sub-Saharan subregion, this does not produce a higher growth rate for North African economies.

The results from the panel regressions are in Table 3. The models in columns 1 and 6 do not include any health variable. These models are estimated to show that the conditional convergence reported is not driven by the inclusion of health variables. The results from panel regressions controlling for the impact of health proxied by life expectancy on economic growth, using pooled OLS, FE, FDGMM, and SysGMM, indicate a conditional convergence with 0.75%, 5.19%, 8.41%, and 2.01% convergence rate per year in columns 2-5, respectively. The results in columns 7-10 show the impact of health proxied by infant mortality on economic growth with a conditional convergence rate of 0.88%, 5.59%, 11.43%, and 4.51% per year, respectively. The SysGMM results in columns 5 and 10 indicate that it would take African economies over 34 and 15 years, respectively, to reach halfway towards the steady-state output level.

Apart from establishing a conditional convergence, health variables are statistically significant in line with *a priori* expectations. In columns 2-5, the health variable, life expectancy, is positive and statistically significant as expected under all the estimation methods. It indicates that raising life expectancy will enhance economic growth in Africa. On the other hand, infant mortality is negative and statistically significant in models in columns 7-10. This consistently shows that the current situation of infant mortality will slow down the rate of economic growth. Due to the constraints of the other estimation methods as argued under the methodology, the analysis in this study will follow the results from the SysGMM estimation, which passes its evaluation criteria. Based on the SysGMM results, raising life expectancy by one year will increase economic growth by 0.83%. While, for every 1% increase in infant mortality, economic growth will decline by 0.12%.

The significance of the health variables does not vanish under the FDGMM; the models meet the appropriate evaluation criteria in columns 4 and 9, contrary to the report of Caselli *et al*. (1996). Neither OLS nor FDGMM is suitable for the estimation of the model. We cannot rely on the FE estimator either. While both FE and FDGMM automatically drop the dummy variable for North Africa, the OLS has a fundamental challenge in estimating a dynamic model. Besides, the results of the FDGMM model are larger than results from other estimators, which make them suspect. Under the models in columns 5 and 10, it is evident that the North African countries are not significantly different from the rest of Africa as they do not enjoy higher growth on account of health.

Table 3: Results of panel regressions for life expectancy and infant mortality

	Life expectancy					Infant mortality				
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log GDP per capita	-0.0067**	-0.0075**	-0.0519***	-0.0841***	-0.0201*	-0.0082**	-0.0088**	-0.0559***	-0.1143***	-0.0451***
	(0.0030)	(0.0030)	(0.0064)	(0.0131)	(0.0120)	(0.0033)	(0.0033)	(0.0156)	(0.0194)	(0.0151)
Investment	0.0007	0.0009*	0.0007***	0.0014**	0.0036***	0.0008*	0.0010**	0.0007	0.0013**	0.0017
	(0.0005)	(0.0005)	(0.0002)	(0.0006)	(0.0009)	(0.0005)	(0.0004)	(0.0005)	(0.0006)	(0.0012)
Government size	-0.0002	-0.0000	-0.0001	-0.0007	-0.0005	-0.0003	-0.0001	-0.0001	-0.0005	-0.0028*
	(0.0005)	(0.0005)	(0.0003)	(0.0006)	(0.0015)	(0.0005)	(0.0005)	(0.0004)	(0.0006)	(0.0016)
Econ. globalisation	0.0006***	0.0006***	0.0003	-0.0029**	0.0007	0.0006***	0.0005***	0.0003	-0.0023	-0.0008
	(0.0002)	(0.0002)	(0.0003)	(0.0013)	(0.0012)	(0.0002)	(0.0002)	(0.0003)	(0.0014)	(0.0006)
Education	-0.0030	-0.0037	-0.0040	-0.0235**	-0.0009	-0.0026	-0.0044*	-0.0040	-0.0282***	-0.0255*
	(0.0022)	(0.0024)	(0.0040)	(0.0106)	(0.0160)	(0.0021)	(0.0024)	(0.0059)	(0.0102)	(0.0131)
Population growth	0.0005	0.0008	-0.0013	-0.0003	0.0013	0.0020	0.0025	0.0004	0.0031	0.0022
	(0.0021)	(0.0023)	(0.0020)	(0.0034)	(0.0045)	(0.0022)	(0.0021)	(0.0020)	(0.0028)	(0.0046)
Political regime	0.0001	-0.0000	-0.0001	-0.0057***	-0.0014	-0.0001	-0.0001	-0.0001	-0.0056***	0.0007
	(0.0005)	(0.0005)	(0.0005)	(0.0018)	(0.0022)	(0.0005)	(0.0004)	(0.0005)	(0.0017)	(0.0014)
North Africa	0.0008***	-0.0312***			-0.1592*	-0.0168**	-0.0342***			-0.2598
	(0.0003)	(0.0088)			(0.0918)	(0.0063)	(0.0075)			(0.2030)
Life expectancy (LE)		0.0008**	0.0008**	0.0032***	0.0083***					
		(0.0003)	(0.0004)	(0.0012)	(0.0026)					
North Africa x LE		0.0005***			0.0006					
		(0.0002)			(0.0020)					
Infant mortality (IM)							-0.0163**	-0.0176*	-0.1092**	-0.1235**
							(0.0061)	(0.0102)	(0.0450)	(0.0493)
North Africa x IM							0.0117***			0.0858
							(0.0026)			(0.0594)
R^2	0.26	0.28	0.39			0.26	0.30	0.39		
Sargan p-value				0.31					0.12	
Hansen p-value					0.43					0.42
AR2 p-value				0.36	0.78				0.54	0.35
No of Instruments				27	36				27	36
Observations	288	288	288	230	288	287	287	287	229	287
Method	OLS	OLS	FE	FDGMM	SysGMM	OLS	OLS	FE	FDGMM	SysGMM

Notes: Significance levels: *: 10%, **: 5%, ***: 1%. Clustered robust standard errors are in parentheses. The dependent variable is the GDP per capital growth rate. The main independent variable, Log GDP per capita is lagged by one period. Econ. globalisation refers to economic globalisation. The FDGMM has 44 clusters, while other methods have 47. All models have time dummies except the result in column 10. This exclusion of the time dummies from the model in column 10 results from the redundancy test performed using *Testparm* in *STATA* 15. Source: Author's computation.

5. Conclusion

This study tests the impact of health on economic growth using two measures of health: infant mortality and life expectancy. These variables are chosen because of their pervasive effects on any economy. Besides, these variables are available for many African countries for periods covered in this study. The choice of infant mortality is based on the assumption that it is a good indicator of human capital development, adequacy of capital goods in the health sector, and the sector efficiency in service delivery apart from the overall wellbeing of the people. Life expectancy is another good indicator of how well people live and a potent indicator of productivity. Healthy people live longer, and they are more productive. How long people live also has some intertemporal benefits for the economy. It facilitates investment in human capital and helps learning. The benefits can be huge, especially where women's health is given appropriate attention (Onarheim, Iversen, & Bloom, 2016). A considerable intertemporal gain comes from the role of grandparents in raising their grandchildren.

Sachs (2001) shows some concerns about the implications of tropical countries' health challenges. Sachs (2001, p. 1) argues:

> Improving the health and longevity of the poor is an end in itself, a fundamental goal of economic development. But it is also a *means* to achieving the other development goals relating to poverty reduction. The linkages of health to poverty reduction and to long-term economic growth are powerful, much stronger than is generally understood. The burden of disease in some low-income regions, especially sub-Saharan Africa, stands as a stark barrier to economic growth and therefore must be addressed frontally and centrally in any comprehensive development strategy.

The conclusion from this study indicates that health does matter for economic growth in Africa. Both life expectancy and infant mortality are statistically significant in our panel models. These two measures of health are found to influence African economies' growth. Raising life expectancy and reducing infant mortality can boost economic productivity in Africa. However, improved health services in the North African subregion does not translate to higher growth for the North African countries. Nevertheless, our finding supports Sachs (2001).

African leaders must do more by investing in health in order to continue to improve productivity and attain the desired level of development. They must embrace and own various declarations they have signed to reduce morbidity and improve health in the continent. Despite various declarations, such as the 2001 Abuja Declaration, the 2006 Addis-Ababa Declaration, and the 2008 Ouagadougou Declaration that African countries have signed to improve health on the continent, only five African countries have met the agreed percentage in the Abuja declaration as of 2016. Many African countries continue to rely on the donors' funds for health financing. This situation makes it challenging to realise various accords signed by the African countries on health improvement. African governments must move fast to improve revenue sources and revenues. This will help them to invest in health and health infrastructures to improve productivity and raise growth. Reliance on the donors' funds for health financing is not good for Africa as this is highly susceptible to the business cycle in the donors' countries.

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