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Health Expenditure and Economic Growth Nexus: A Generalised Method of Moment Approach for the Case of Selected Africa Countries

Haruna Usman Modibbo[1] & Abubakar Muhammad Saidu[1]

[1]*Department of Economics, Faculty of Arts & Social Sciences, Gombe State University*

Correspondence Email: haroongombe@gmail.com

Abstract
This study empirically examined the impact of health expenditure on economic growth in 45 selected African countries over the period of 2000 to 2017. The study employed panel dynamic Generalised Method of Moment (GMM) techniques and the results of both differenced GMM and system GMM estimates showed that health per capita expenditure has positive and statistically significant impact on economic growth in Africa. Hence, health expenditure and provision of social services by governments at all levels in all countries should not be seen as a cost that need to be curtailed but rather as another means of achieving greater economic growth in the selected African countries. Therefore, the study recommends that governments and health related donor agencies should specifically increase the level their spending on community health and medical services as this may improve the efficiency and effectiveness in relation to prevention, diagnosis and treatment of diseases that hampered human capital development and consequently economic growth in Africa.

Keywords: Health Expenditure, Economic Growth, GMM, Africa.
JEL Classification: H51, O40, C23, O55.

1. Introduction

Development experts have long recognised health as an important factor in the development process of any country. In other words, as a component of human capital, health is essential to a productive society. It is in view of this assertion that the WHO's Commission on Macroeconomics and Health (CMH, 2001) made a powerful case in favour of investment in health as an important driver of economic growth. Generally, investment in health can reduce the burden of preventable and treatable diseases that, on macroeconomic level, can be a drag to national economies and, on microeconomic level, a drain on household and individual incomes.

However, given its huge human resource potentials, no other region of the world has so much chance to benefit from investment in health than African region. As rightly argued by WHO (2017), while good health can drive social and economic growth, ill-health can push people into poverty trap which in turn, hampers development. Therefore, health must constitute a central pillar of any coherent vision of African development, and that investments in health must include those in health-related sectors such as water, sanitation, education and environmental protection.

Unfortunately, a report by World Health Organisation (WHO, 2017), revealed that with over 16% of World' population, Africa bears 25% of the world's disease burden but its share of global health expenditures is less than 1%. Thus, it is obvious that Africa still faces serious challenges in terms of healthcare financing. For example, it was only five Sub-Saharan African (SSA) countries that have struggled to live up to their commitment to allocate as much as 15% of their budgets to the health sector in line with the "Abuja Declaration" target. These are: Rwanda, Botswana, Malawi, Burkina Faso, and Liberia as reported by the United States Agency for International Development (USAID, 2010). Therefore, government interventions in the provision of healthcare across African countries have not been remarkable. Even the little investment in health is affected by leadership and governance challenges as well as rampant corruption in the procurement of medical products and technologies. This has shown the extent to which the role of health is being neglected in many African countries which is equally detrimental to rapid economic growth and development in Africa.

In view of the above, various studies have been conducted to explore the connections between health expenditure and economic growth in Africa. However, while some of these studies were largely on single country and regional basis (e.g. Inuwa & Modibbo, 2012; Mehrara, Fazaeli, Fazaeli, & Fazaeli, 2012; Gisore, Kiprop, Kalio, Ochieng, & Kibet, 2014; Boussalem, Boussalem, & Taiba, 2014, etc), others examined the impact of health expenditure on health outcomes (e.g. Anyanwu & Erhijakpor, 2009; Yaqub, Ojapinwa, & Yussuff, 2012; Odhiambo, 2014). Only few studies examined the cross-country impact of healthcare expenditure on economic growth in Africa (e.g. Tolulope & Taiwo, 2014).

The objective of this study, therefore, is to examine the impact of healthcare expenditure on economic growth in Africa thereby adding on the scanty literatures that studies the whole of Africa. The remaining part of the paper covers the following: section two reviews the literature. While section three discusses the methodology, section four presents and analyses the results. Finally, section five concludes the study with summary of the findings and offers recommendations.

2. Literature Review

The role of health in the development process has been widely acknowledged both on theoretical and empirical basis. For instance, Bloom and Canning and Sevilla (2001; 2004) argued that healthy people are more productive and have higher incentives to save and invest in their abilities. However, the extent to which people are healthy and productive is partly a function of health inputs such as healthcare expenditure and nutritional intake which in turn influences economic growth and development. On cross-country basis, Tatoğlu (2011) examined the relationship between investment in human capital and economic growth in the 20 OECD countries both at group and individual specific level over the period of 1975 to 2005. The findings, however, revealed that increase in health expenditure causes an increase in the economic growth for all the countries both in the short and long runs where a unit increase in health expenditure increases GDP by about 0.33%.

Similarly, Mehrara, Fazaeli, Fazaeli, and Fazaeli (2012) examined the long run relationship between health expenditure and GDP within the framework of Pedroni panel cointegration. A sample of 13 MENA countries was studied using data spanning from 1995 to 2005 and the results revealed the existence of a long-run equilibrium relationship between healthcare expenditure and GDP. Again, Gisore, Kiprop, Kalio, Ochieng, and Kibet, (2014) have empirically investigated how government expenditure contributes to economic growth in East Africa from 1980 to 2010 and their findings based on Fixed Effect model showed that expenditures on health has positive and statistically significant effect on growth. Furthermore, **Cebeci and Ahmet (2016)** investigated the effect of health on economic growth using data of BRICS countries and Turkey for the period of 2000 to 2014. The results of Pedroni panel cointegration test confirmed the existence of long run relationship between health expenditure and economic growth and that the former has significantly positive effect on the later.

Contrary to the above studies, Tolulope and Taiwo (2014) examined the contribution of health inputs and outcomes to growth process in the Sub-Saharan Africa using a panel data of 30 countries spanning from 1995 to 2011. Based on Dynamic Generalised Method of Moment (GMM) modeling framework, the results of the study showed that government expenditure on health has statistically significant negative effects on economic growth. Also, Kulkarni (2016) examined the differences in the healthcare systems of five emerging economies of BRICS using panel data from 1995 to 2010. The results, based on Fixed Effect model, revealed that increase in public health expenditure is not sufficient to achieve the desired improvement in health outcomes and consequently economic growth.

3. Methodology

Sources of Data

The panel data set for this study consists of annual time series spanning from 2000 to 2017 for Forty Five (45) African countries. These data were sourced from the publication of World Development Indicators (WDI, 2017). However, what informed the sample size and the selection of countries was purely the availability of data. The countries comprise: Angola, Cameroon, Central Africa Republic, Chad, Congo, Democratic Republic of Congo, Equatorial Guinea, Gabon, Burundi, Comoros, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Seychelles, Uganda, Zambia, Zimbabwe, Algeria, Egypt, Morocco, Sudan, Tunisia, Botswana, Lesotho, Namibia, South Africa, Swaziland, Benin, Burkina Faso, Ivory Coast, Gambia, Ghana, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo.

Variables Measurement

Within the context of macroeconomic studies, to examine the impact of health expenditure on economic growth, the variables of the study must satisfy two requirements. First, the data must extend into the past to encompass most of the transition in health. Second, the variables must be interpreted as an aggregate or as an average because of the macroeconomic context of the study. Therefore, for the purpose of this study, the variables of interest have made these conditions and they are broadly categorised into two as follows: The dependent variable of this study is economic growth which is measured by Real Gross Domestic Product (RGDP). It is an inflation-adjusted measure that reflects the value of all goods and services produced by an economy in a given year, expressed in base-year prices, and is often referred to as "constant-price," or "inflation-corrected" GDP. This is in line with the work of Gisore, *et al.* (2014). It is measured in US Dollars at constant price taking 2015 as the base year.

The main independent variable of this study is health expenditure, followed by Net Official Development Assistance and Population Growth Rate as control variables. Per Capita Health Expenditure was employed to examine the impact of health expenditure on economic growth in Africa and it is measured in US Dollars at constant price taking 2015 as the base year. This follows the works of Cebeci and Ahmet (2016), and Mehrara *et al*. (2012). Official Development Assistance may be in the form of grants, soft loans, provision of technical assistance received by developing countries from donors and other multilateral development agencies inform of aid. It is measured as a percentage of Gross National Income (GNI) in million USD constant prices, using 2015 as the base year (OECD, 2019). Finally, Population Growth Rate is measured as the exponential rate of growth of midyear population from year t-1 to t, expressed as a percentage. Here, population is based on its de-facto definition, which counts all residents regardless of legal status or citizenship.

Method of Data Analysis

The study employed Generalised Method of Moments (GMM) which is more appropriate in the case of large N and small T. The GMM estimator is a Dynamic Panel Data (DPD) estimation technique in which the lagged dependent variable is considered among the regressors in a panel with large *N* and short time span. It was developed by Arellano and Bond (1991) and later extended by Arellano and Bover (1995) and Blundell and Bond (1998). However, GMM estimator captures only short-run dynamics because it is mostly restricted to short time-series in which the stationarity of the variables is less important (Samargandi, Fidrmuc, & Ghosh, 2014). Therefore, for the purpose of this study, the following GMM model is formulated to examine the dynamic impacts of health expenditure and health indices on economic growth in the selected African countries:

$$LRGDP_{it} = \alpha_i + \beta_1 LRGDP_{it-1} + \beta_2 PCHEX_{it} + Z_{it}\psi + \varepsilon_{it} \quad \ldots\ldots 1$$

Where $LRGDP_{it}$ represents the economic growth of i^{th} country at time *t*; β*'s* are the parameters to be estimated; $LRGDP_{it-1}$ is the lagged of dependent variable, that is, the economic growth of i^{th} country at time *t-1*; α_i is the country-specific effects which is assumed to be independent and constant across the countries; $PCHEX_{it}$ represents per capita health expenditure; $\psi_i Z_{it}$ are the set of control variables; and ε_{it} is the error term which is also assumed to be distributed independently in all periods of the country *i.* However, with lagged dependent variable as a regressor, a correlation is said to exist between it and the error term. In this case, the dynamic nature of the data, which is a fundamental issue in the empirical growth literature, could not be captured by the static panel models such as pooled OLS, fixed effects and random effects models which assumed strict exogeneity among the explanatory variables (Samargandi, Fidrmuc, & Ghosh, 2014).

In view of the limitations of static panel models, therefore, Arellano and Bond (1991) proposed taking the first difference of equation (3.1) in order to eliminate the constants, that is, α_i and ε_{it}, so that in later periods, there should be additional lagged values of the instruments that are available. However, a potential weakness in the Arellano-Bond GMM estimator was identified in the later work of Arellano and Bover (1995) and Blundell and Bond (1998). According to them, the lagged level variables are often poor instruments for the first differenced variables, particularly in situations whereby the variables are close to a random walk. Consequently, they modify and expanded the original Arellano-Bond GMM estimator by including both lagged levels and lagged differences. Hence, the original Arellano-Bond GMM estimator is called Difference-GMM estimator while the extended version of it commonly termed as a System-GMM estimator (Baum, 2014).

Diagnostic Checks

Generally, GMM estimator strongly depends on the validity of the instruments for it to be consistent. To ensure this consistency, Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998) suggested the following specification tests:

Test of Over-identifying Restrictions

This is known as Sargan test of over-identifying restrictions. It tests the overall validity of the instruments by analysing the sample moment conditions used in the estimation process. By following the work of Inuwa (2017), the test statistics for the GMM estimator in the first-differenced model can be estimated as follows:

$$S = \hat{v}' Z \left(\sum_{i=1}^{N} Z_i' \hat{v}_i \hat{v}_i' Z_i \right)^{-1} Z' \hat{v} \tilde{a} \chi^2_{p-k} \quad \ldots\ldots 2$$

Where $\nu = y - X\delta$, and δ is a two-step estimator of δ for a given Z. it should be noted that Z is not necessarily a set of optimal instruments; p stands for number of columns in Z provided $p > k$. According to Inuwa (2017), a version of serial correlation test can be obtained based on a one-step estimator of δ which may be asymptotically normal under the general distributional assumptions, but a robust chi-square Sargan test based on one-step estimates may not be available. The null hypothesis of Sargan test statistics is given as follows:

$$S_1 = \frac{1}{\hat{\sigma}^2} \tilde{v}' Z \left(\sum_{i=1}^{N} Z_i' H_i Z_i \right)^{-1} Z' \tilde{v} \quad \ldots\ldots 3$$

Where $\tilde{V}$ stands for one-step residuals which has a limiting chi-square distribution only if the errors are *iid* over time and across individual units. However, under the null hypothesis that the moment conditions are valid, S_1 is asymptotically chi-squared distributed with m_d-k degrees of freedom, where m_d represents the number of moment conditions and k the number of estimated parameters (Blundell, Bond, and Windmeijer, 2000 in Inuwa, 2017).

Arrelano-Bond Test for Autocorrelation

This test examines the hypothesis that the first differenced error term (ε_{it}) is not serially correlated at second difference. The expectation is that the differenced error term may exhibit a first-order serial correlation even if the original error term is not (Eggoh, Houeninvo, & Sossou, 2015). This is because Δv_{it} is mathematically related to Δv_{it-1} via the shared v_{it-1} term. Therefore, given a system difference-level regression, in addition to testing for first-order serial correlation in levels, there is a need to also check whether the differenced error term is second-order serially correlated. This, according to Roodman (2009), will detect the existence (or otherwise) of correlation between the v_{it-1} in Δv_{it} and the v_{it-2} in Δv_{it-2}.

Also, following the work of Inuwa (2017), the test statistics for second-order serial correlation based on residuals from the first-difference equation takes the form:

$$AR(2) = \frac{\hat{v}_{-2}'\hat{v}_*}{\hat{v}^{1/2}} \overset{a}{\sim} N(0,1) \quad \ldots\ldots 4$$

Under the assumption that $E(v_{it} v_{i(t-2)}) = 0$, and $\hat{v}$ is given by:

$$\hat{v} = \sum_{i=1}^{N} v_{i(-2)}' - 2\hat{v}_{-2}' X_* \left(X' Z A_N Z' X\right)^{-1} X' Z A_N \left(\sum_{i=1}^{N} Z_i' \hat{v}_i \hat{v}_{i*}' \hat{v}_{i(-2)}\right) + \hat{v}_{-2}' X_*' \hat{v}_{-2} \quad \ldots\ldots 5$$

It should be noted that the test for AR(2) is only applied if $T_i \geq 5$, and the asymptotic power of the test strongly depends on the efficiency of the estimators used. The AR(2) statistics tests for lack of second-order serial correlation in the first-difference residuals. However, this will only be the case if the errors in levels are not serially correlated, or they follow a random-walk process. In any case, Arrelano and Bond (1991) argued that the two situations can be separated by computing an AR(l) statistic, in a similar way as AR(2), to test for lack of first-order serial correlation in the differenced residuals.

4. Results

This section presents, interprets and analyses the results of the study. It also discusses the major findings with particular reference to the results of previous studies.

Descriptive Statistics of the Data

Table 1: Descriptive Analysis of Variables for All Countries (Combined Panel)

		Time Period: 2000 – 2017 (45 Countries)			
PCHEXP	810	47.6897	81.7421	0.2366	496.2134
LNODA	810	19.7112	1.3725	12.2061	23.1508
POPGR	810	2.4604	0.9039	-2.6287	5.5391
		Countries with Minimum/Maximum Values			
Variables		Minimum		Maximum	
PCHEXP		Democratic Republic of Congo		Seychelles	
LNODA		Equatorial Guinea		Nigeria	
POPGR		Seychelles		Rwanda	

Source: World Development Indicators (World Bank, 2017)

Author's computation using STATA version 14, extracted from appendix I, (2019)

Table 1 above presents the descriptive statistics of variables over the period of 2000 to 2017 which covers 45 African countries. The results revealed that the average value log of per capita health expenditure over the study period was about US$47.69 with a large standard deviation of about US$81.74. The country with the highest per capita health expenditure was Seychelles in 2017 with a value of about US$496.21 followed by South Africa in 2011 with about US$325.18 value of per capita health expenditure. On the other hand, Democratic Republic of Congo was the country with minimum per capita health expenditure of about US$0.24 only recorded in the year 2000. This has justified the large value of standard deviation obtained in the result which indicates that in most of the selected countries, their respective per capita health expenditure is below the mean value over the period of the study.

In the case of log of net overseas development assistance, the average value received by the selected countries over the study period was about US$19.71 with a standard deviation of about US$1.37. On individual basis, countries that received the lowest and highest values of development assistance were Equatorial Guinea (US$12.21) and Nigeria (US$23.15) in the year 2014 and 2006, respectively. Finally, with respect to population growth rates, the average was about 2.46 in the studied countries with a standard deviation of about 0.90. Seychelles recorded the minimum population growth rate of -2.63 in 2011, while the highest growth of about 5.54 was reported in Rwanda in the year 2000, followed by Liberia in the same year 2000 and Sierra Leone in 2003 with a population growth rate of 5.34 and 4.77 respectively.

Estimations of Panel Generalised Method of Moments

Table 2: Results of Two-Step Panel Generalised Method of Moments

Dependent Variable: Log of Real Gross Domestic Product (RGDP)		
Independent Variables	Difference GMM	System GMM
$RGDP_{t-1}$	0.858942***	0.921156***
	(0.0165)	(0.0017)
LPCHEXP	0.061830***	0.021184***
	(0.0062)	(0.0005)
LNODA	0.017392***	0.013278***
	(0.0021)	(0.0003)
POPGR	0.021850***	0.020281***
	(0.0026)	(0.0005)
Diagnostics Tests		
Number of Observation	720	720
Number of Countries	45	45
Sargan Test	39.83751 [0.5222]	40.07080 [0.5559]
Arrelano-Bond AR(2) Test	-1.284977 [0.1988]	0.035131 [0.3467]

Source: Author's computation using Eviews version 9, extracted from appendix IV, (2019).
*Note: Figures in () and [] are standard errors and probability values respectively. ***, ** and * indicate significance at the 1%, 5% and 10% levels respectively.*

From the results presented in table 4.2 above, the diagnostic tests used are the Arellano-Bond Autocorrelation test and Sargan test for over-identification. Under the results of Difference GMM, the p-value for the second-order Arellano-Bond (AR2) test (0.1988) is greater than 0.05 indicating that the null hypothesis of no serial correlation in the first difference errors cannot be rejected. Also, Sargan test for over-identification restriction validity shows that the null hypothesis cannot be rejected with a p-value of. Thus the GMM model employed is said to be specified correctly and that the instruments used in the model are equally valid.

In relation to the estimated coefficients, the coefficient of one period lagged dependent variable is statistically significant at 1% level indicating that this year's growth performance is, among other factors, determined by the previous year's economic performance which confirms the assumption of dynamic nature of economic growth in across the studied countries. Similarly, the results show that per capita health expenditure has positive and statistically significant effect on economic growth in Africa at 1% level which is in line with the a priori expectation. Specifically, an increase in per capita health expenditure by 1% would increase economic growth by about 0.06%. The magnitude of this result is, however, very small which explains the degree of effectiveness with which the money allocated to health sector is being utilized. Furthermore, the coefficients of the control variables, that is, net overseas development assistance and population growth rate have exhibited positive and statistically significant signs at 1% level showing that a 1% increase in each, will increase economic growth in Africa by about 0.02% respectively.

In a similar way, the results of System GMM confirm that of Difference GMM. The Sargan test is performed to test the validity of the instruments and based on the results; the instruments of the model are valid. Similarly, the results have no serial correlation based on Arrelano-Bond serial correlation test. Still the coefficient of per capita health expenditure has positive and statistically significant effect on African economic growth where a 1% increase in per capita health expenditure increases economic growth by about 0.02%. Also, net overseas development assistance and population growth rate maintained their positive and statistically significant signs indicating that a 1% increase in each increases economic growth in Africa by about 0.01% and 0.02% respectively.

Discussion of Finding

Although the long-run relationship between health expenditure and economic growth is well established in the works of Tatoğlu (2011) for OECD countries, Mehrara *et al*. (2012) for 13 MENA countries, Cebeci and Ahmet (2016) for BRICS countries and Turkey, this could not be confirmed in African countries due to insufficient data on health expenditure. As a result, this study employed linear dynamic panel GMM model to examine the impact of health expenditure on economic growth in Africa. Based on the results of differenced GMM and system GMM estimations, as presented in table 4.2, it was revealed that health expenditure has positive and statistically significant impact on economic growth in Africa. This has buttressed the findings of Tatoğlu (2011) for 20 OECD countries, Mehrara, Fazaeli, Fazaeli, and Fazaeli (2012) for 13 MENA countries, Cebeci and Ahmet (2016) for BRICS countries and Turkey as well as Gisore, Kiprop, Kalio, Ochieng, and Kibet (2014) for Eastern Africa. However, the findings of this study contradicted the works of Tolulope and Taiwo (2014) who found health expenditure to impact negatively on the economic growth of Sub-Saharan Africa and Kulkarni (2016) who reported that increase in health expenditure is not sufficient to improve health outcomes and consequently economic growth.

5. Conclusion and Recommendation

Based on the findings obtained, this study concluded that health expenditure is among the factors influencing economic growth in Africa. This suggests that ensuring quality of life of the population in terms of health is one of the preconditions for increasing productivity and economic growth. Hence, the policy implication is that, health expenditure and provision of social services by governments at all levels in all countries should not be seen as a cost that needs to be curtailed but rather as another means of achieving greater economic growth in the selected African countries. Therefore, the study recommends that governments and health related donor agencies should specifically increase the level their spending on community health and medical services as this may improve the efficiency and effectiveness in relation to prevention, diagnosis and treatment of diseases that bedeviled some of the studied countries like Sierra Leon, Nigeria, and Niger which hampered human capital development.

This study has empirically examined the impact of health expenditure on economic growth in Africa. However, the study has not been exhaustive as many issues still deserve further attention in future research. For instance, the long-run relationship between health expenditure and economic growth in Africa could not be established due to insufficient data on the later variable. This can be examined by future studies when sufficient data is available. Also, differences in the impact of health expenditure on economic growth across African countries have not been examined. Therefore, future studies can examine the country-specific impact of health expenditure on economic growth in Africa by using techniques such as Seemingly Unrelated Regressions Equations (SURE) model.

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