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HEALTH EXPENDITURE AND ECONOMIC GROWTH IN SUB-SAHARAN AFRICA: AN EMPIRICAL INVESTIGATION[1]

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Abstract

In this study, the causal relationship between health expenditure and economic growth is examined using panel data from sub-Saharan African countries for the period 2008-2017. The study decomposes health expenditure into two components: public health expenditure and private health expenditure. In order to establish whether the causal relationship between health expenditure and economic growth depends on a country's level of income, the study divides the studied countries into two groups: low-income countries and middle-income countries. In order to address the omission-of-variable bias, which is associated with some of the previous studies, the study incorporates life expectancy as an intermittent variable between health expenditure and economic growth – thereby creating a system of multivariate equations. Using a panel ECM-based Granger-causality model, the study found that when public expenditure is used as a proxy, a distinct unidirectional causality from health expenditure to economic growth is found to prevail in low-income countries, but no causality is found to exist in middle-income countries. However, when private health expenditure is used, a short-run causality from economic growth to health expenditure is found to prevail in middle-income countries, but no causality is found to exist in low-income countries. Policy implications are discussed.

Keywords: Health Expenditure; Economic Growth; Sub-Saharan Africa; Panel Granger Causality

1. Introduction

The relationship between health expenditure and economic growth has attracted a great deal of literature in recent years. Studies such as Newhouse (1977), Leu (1986), Parkin et al. (1987), Posnett and Hitiris (1992), Hansen and King (1996), and Barros (1998) have argued that income can have a significant effect on health spending. On the contrary, studies such as those by Barro (1991), Barro and Sala-i-Martin (1992), and Knowles and Owen (1995; 1997), have found a positive and significant impact of health spending on economic development. The latter strand has been further supported by Grossman (1972). According to Grossman (1972), health

expenditure is expected to cause economic growth in the medium to long term because expenditure on health is generally regarded as an investment in human capital. The endogenous growth theories, such as those of Romer (1986), Lucas (1988) and Rebelo (1991), have also incorporated human capital in aggregate production function, which relies on good health status and one of its determinants, since better health status has an impact on the working conditions of workers (see also Halıcı-Tülüce el al., 2016). According to World Bank (1993), improved health spurs economic growth in a number of ways[2]. It reduces production losses which could have been caused by workers' illness. It also enables a country to transfer resources which would have been spent on treating illness to other alternative uses. Previous studies have also found that it is possible to explain the health-growth relationship with total factor productivity (Halıcı-Tülüce et al., 2016). According to this mechanism, health affects growth through total factor productivity (TFP), and poor health has the propensity to reduce aggregate productivity (Cole and Neumayer, 2006). Barro and Sala-i-Martin (1995), for example, while examining the determinants of growth, found that life expectancy is an important factor for growth.

Although a number of studies have been conducted on the relationship between health expenditure and economic growth in various countries, very few studies have explored this topic in African countries. Even where such studies have been conducted, the findings are inconclusive. In addition, some of the previous studies suffer from methodological weaknesses. For example, a number of previous studies have over-relied on a bivariate causality model to examine the causal relationship between health expenditure and economic growth; yet, a bivariate causality model has been found to suffer from the omission-of-variable bias. In other words, the introduction of one or more additional variables in the bivariate model between health expenditure and economic growth may not only change the magnitude of the results, but

[2?] See also Rivera and Currais (1999).

may even change the direction of causality between these two variables. In order to address these weaknesses, the current study aims to examine the causal relationship between health expenditure and economic growth – using panel data from African countries. In addition, the study decomposes health expenditure into public and private health expenditure. In order to examine whether the relationship between health expenditure and economic growth depends on the level of income, the countries used in this study are divided into two categories, i.e. low-income countries and middle-income countries. In order to address the omission-of-variable bias, which is associated with some of the previous studies, the current study uses life expectancy as an intermittent variable between health expenditure and economic growth – thereby creating a multivariate causality framework. The motivation for including infant mortality as an intermittent variable is supported by the relationship between life expectancy and health expenditure on the one hand and the impact of life expectancy on economic growth on the other. In particular, the relationship between health expenditure and life expectancy has been hotly contested in recent years. While some previous studies have argued that medical care has contributed significantly to the observed mortality decrease through effective combating of infectious diseases, others have argued that more medical care does not unambiguously lead to an increase in life expectancy. Likewise, the relationship between life expectancy and economic growth has attracted intense debate in recent years. While some studies argue that economic growth Granger-causes life expectancy at birth, other studies argue that it is life expectancy that Granger-causes economic growth.

The rest of the paper is organised as follows: section 2 provides an overview of the literature review, while section 3 presents the methodology, empirical analysis and the discussion of the results. Section 4 concludes the study.

2. Literature Review

Very few studies have been conducted to examine the relationship between health expenditure and economic growth; and where such studies have been conducted, the empirical findings have been either conflicting or inconclusive at best. While some of the studies have found a positive relationship between health expenditure and economic growth, others have found either negative or inconclusive results. Studies that have found a positive relationship between health expenditure and economic growth include studies, such as Rivera and Currais (1999), Hartwig and Sturm (2014), Blázquez-Fernández et al. (2015), Halıcı-Tülüce et al. (2016), Piabuo and Tieguhong (2017), Behera and Dash (2018), and De Mendonça and Baca (2018), amongst others. Rivera and Currais (1999), for example, while examining the relationship between health status and productivity using data from OECD countries during the period 1960–1990, found that health has a positive effect on economic growth. Hartwig and Sturm (2014), while examining the determinants of health care expenditure using data from 33 OECD countries during the period 1970–2010, found GDP growth to be one of the determinants of health care expenditure growth. Blázquez-Fernández et al. (2015), while examining the relationship between early-life health and economic growth in Spain during the period 1980–2007, found that higher infant mortality has a direct negative impact on per capita income growth. The authors argue that a greater risk of early-life death is associated with losses on accumulation of both physical and human capital, and fertility gains, which in turn reduces growth. Halıcı-Tülüce et al. (2016), while examining the relationship between health expenditure and economic growth in 25 high-income and 19 low-income economies for the periods of 1995–2012 and 1997–2009, respectively, found that there is a positive relationship between public health expenditure and economic growth. Piabuo and Tieguhong (2017), while comparing the impact of health expenditure on economic growth between CEMAC countries and five other African countries that achieved the Abuja Declaration, found that health expenditure has a positive and significant effect on economic growth in both samples. In

addition, the long-run relationship between health expenditure and economic growth was also found to exist in both groups of countries. Behera and Dash (2018), while examining the impact of macroeconomic policies on the growth of public health expenditure in Indian states during the period 1990–2014, found that economic growth and fiscal balance lead to a favourable impact on public health expenditure in the long run. De Mendonça and Baca (2018), while examining the relevance of corruption on the effect of public health expenditure and taxation on economic growth in a sample of 75 developing countries during the period 1995–2014, found that an increase in public health expenditure leads to an increase in economic growth. Wang (2015), while estimating the optimal health care expenditure in a growing economy using data from the Organization for Economic Co-Operation and Development (OECD) over the period 1990 –2009, found that when the ratio of health spending to gross domestic product (GDP) is less than the optimal level of 7.55%, increases in health spending effectively lead to better economic performance. However, above 7.55%, more spending does not equate to better care.

Apart from the above-mentioned studies, there are studies that have found negative, inconclusive or no relationship between health expenditure and economic growth. Eggoh et al. (2015), while examining relationship between human capital (measured by education and health-related variables) and economic growth for a large sample of 49 African countries during the period 1996-2010, found that public expenditures on education and health have a negative impact on economic growth. Frimpong and Adu (2014), for example, while investigating the extent to which the health of the population affects economic performance using panel data for 30 Sub-Saharan African countries during the period 1970–2010, found that the health status of the population has not significantly driven economic performance. Afonso and Sarabanda (2016), while examining the impact of health sector on R&D, economic growth

and wages in 21 OECD countries during the period between 1991 and 2008, found that an increase in health-labour share in skilled population has no effect on growth. Yazdi Analizadeh (2017), in estimating the impacts of economic growth and environmental quality on heath expenditure in the Middle East and North Africa region (MENA) countries during the period 1995–2014, found that while there is a cointegration relationship between health expenditure, income, CO_2 and PM10 emissions, health expenditure is not more sensitive to income and the adjustment to changes in income in MENA countries.

In addition to the above-mentioned studies, there are a few studies that have attempted to examine the causality between health and economic growth, which is the centrepiece of the current study. These studies can be broadly divided into three groups. The first group argues that there is a unidirectional causal flow from health to economic growth, since a healthy work force increases economic growth. The second theory, however, maintains that the causality runs from economic growth to health – because higher economic growth leads to a greater investment in the health sector. The third view, which is the middle-ground view, argues that both economic growth and health Granger-cause each other. Studies whose findings are consistent with the first view include studies like Erdila and Yetkinerb (2009) for the case of high-income countries, Gurgul et al. (2012), Ghorashi and Rad (2017), Ye and Zhang (2018) for the case of Belgium, Norway, Mexico, the US, China, and Japan, and Zaidi and Saidi (2018), amongst others. Erdila and Yetkinerb (2009) investigated the causal relationship between real per capita GDP and real per capita health care expenditure using a large macro panel data set with a VAR representation. The study found that although there is a dominant bidirectional causality between economic growth and health care expenditure in the studied countries, a one-way causality running from health expenditure to economic growth was found to predominate in high-income countries. Ghorashi and Rad (2017), while examining the causal

relationship between CO_2 emissions, health expenditures, and economic growth in Iran during the period 1972–2012, found that there is unidirectional causal flow from health expenditures to economic growth in Iran. Ye and Zhang (2018) examined the relationship between health care expenditure and economic growth among 15 Organisation for Economic Co-operation and Development (OECD) and five major developing countries. Their findings show that: i) there is a unidirectional linear causality running from health care expenditure to economic growth for Belgium, Norway, and Mexico; and ii) there is a unidirectional non-linear causality from health spending to economic growth for the US, China, and Japan. Zaidi and saidi (2018), for example, while examining the relationship between environmental pollution, health expenditure and economic growth in the Sub-Saharan African countries, found that there a one-way relationship going from the health expenditure to GDP per capita in sub-Saharan African countries.

Unlike the above-mentioned studies whose findings support a causality from health to economic growth, there are a number of studies whose findings overwhelmingly support the opposite, i.e. a causality from economic growth to health. These include studies such as Erdila and Yetkinerb (2009) for the case of low- and middle-income countries, Halıcı-Tülüce (2016), Katrakilidis et al. (2016), Khan et al. (2016), Mohapatra (2017), and Ye and Zhang (2018) for the case of Ireland, Korea, Portugal, and India, amongst others. Erdila and Yetkinerb (2009) while investigating the causal relationship between real per capita GDP and real per capita health care expenditure using a large macro panel data, also found a one-way causality from income to health to predominate in low- and middle-income countries. Halıcı-Tülüce (2016) examines the relationship between health expenditure and economic growth using panel data consisting of twenty-five high-income and nineteen low-income economies during the periods of 1995–2012 and 1997–2009, respectively. The study found one-way causality from economic

growth to public health expenditure in the long-run. Katrakilidis et al. (2016), while examining the dynamic linkages between economic growth, environmental quality and health in Greece during the period 1960–2012 using index of infant mortality as a proxy for health quality, found that there is a strong causal effect running from income towards infant mortality. Khan et al. (2016), while investigating the relationship between health care expenditure (HCE) and economic growth in the selected South Asian Association for Regional Cooperation (SAARC) countries during the period 1995–2012, found that there is a unidirectional causality running from per capita GDP to health care expenditure in the South Asian countries in the short run. Mohapatra (2017), while examining the relationship between economic growth, public expenditure on health and infant mortality rate in India, found that GDP Granger-causes public health expenditure in the short run and in the long run. Ye and Zhang (2018), while examining the relationship between health care expenditure and economic growth among 15 Organisation for Economic Co-operation and Development (OECD) and five major developing countries, found that there is a unidirectional linear or non-linear causality running from economic growth to health care expenditure for Ireland, Korea, Portugal, and India.

Apart from the above-mentioned studies, there are a number of studies which posit that both health and economic growth Granger-cause each other. In other words, these studies argue that there is a bidirectional relationship between health and economic growth. Studies whose findings are consistent with this view include Devlin and Hansen (2001), Amiri and Ventelou (2012), Kumar (2013), Chaabouni et al. (2016), Halıcı-Tülüce (2016), Mohapatra (2017), and Ye and Zhang (2018) for the case of Canada, Finland, Iceland, New Zealand, Spain, Brazil, and South Africa, amongst others. Devlin and Hansen (2001), for example, while examining the relationship between health care spending and economic output using data from 20 OECD countries, found that there is a bi-directional causal relationship between health spending to

economic growth in two out of 20 countries, namely Denmark and Iceland. Amiri and Ventelou (2012), while assessing the relationship between total expenditure on health and GDP in OECD countries, also found that there is a predominant bidirectional Granger causality between total expenditure on health and GDP in the studied countries. Kumar (2013) investigated the relationship between health care spending and gross domestic product (GDP) for the organisation for economic co-operation and development countries over the period 1960–2000. The author found that a bi-directional causality exists between health spending and GDP in the studied countries. Chaabouni et al. (2016), while examining the causal relationship between CO_2 emissions, health expenditures and economic growth using a global panel of 51 countries over the period 1995–2013, found that there is bi-directional causality between health expenditures and economic growth for the global panel. Halıcı-Tülüce (2016), while examining the relationship between health expenditure and economic growth using panel data consisting of 25 high-income and 19 low-income economies, also found a reciprocal relationship between health expenditure and economic growth in the short run. Similar findings were found by Ye and Zhang (2018) for the case of Canada, Finland, Iceland, New Zealand, Spain, Brazil, and South Africa while examining the casual relationship between health care expenditure and economic growth among 15 OECD and five major developing countries.

3. Empirical Analysis

3.1 Model Specification – A Trivariate Granger-Causality Model

To address the shortfalls of bivariate Granger-causality, this study utilises a multivariate Granger-causality model within a panel data framework. The Granger causality model adopted in this study for both public expenditure model and private expenditure model can be expressed as follows (see Odhiambo, 2017):

Model 1: Public Health Expenditure, Life Expectance and Economic Growth

$$\Delta \mathrm{y/N_{it}} = \alpha_{1j} + \sum_{k=1}^{p} \varphi_{11ik} \Delta \mathrm{y/N_{it-k}} + \sum_{k=1}^{p} \varphi_{12ik} \Delta PubHeath_{\mathrm{it-k}} + \sum_{k=1}^{p} \varphi_{13ik} \Delta LifeExp_{\mathrm{it-k}} + \xi_{1i} ECT_{it-1} + \varepsilon_{1it} \ldots \ldots (1)$$

$$\Delta\, PubHeath_{\mathrm{it}} = \alpha_{2j} + \sum_{k=1}^{p} \varphi_{21ik} \Delta \mathrm{y/N_{it-k}} + \sum_{k=1}^{p} \varphi_{22ik} \Delta PubHeath_{\mathrm{it-k}} + \sum_{k=1}^{p} \varphi_{23ik} \Delta LifeExp_{\mathrm{it-k}} + \xi_{2i} ECT_{it-1} + \varepsilon_{2it} \ldots \ldots (2)$$

$$\Delta LifeExp_{\mathrm{it}} = \alpha_{3j} + \sum_{K=1}^{p} \varphi_{31ik} \Delta \mathrm{y/N_{it-k}} + \sum_{k=1}^{p} \varphi_{32ik} \Delta PubHeath_{\mathrm{it-k}} + \sum_{k=1}^{p} \varphi_{33ik} \Delta LifeExp_{\mathrm{it-k}} + \xi_{3i} ECT_{it-1} + \varepsilon_{3it} \ldots \ldots (3)$$

Model 2: Private Health Expenditure, Life Expectance and Economic Growth

$$\Delta \mathrm{y/N_{it}} = \theta_{1j} + \sum_{k=1}^{p} \pi_{11ik} \Delta \mathrm{y/N_{it-k}} + \sum_{k=1}^{p} \pi_{12ik} \Delta PriveHealth_{\mathrm{it-k}} + \sum_{k=1}^{p} \pi_{13ik} \Delta LifeExp_{\mathrm{it-k}} + \xi_{1i} ECT_{it-1} + u_{1it} \ldots \ldots (4)$$

$$\Delta\, PriveHealth_{\mathrm{it}} = \theta_{2j} + \sum_{k=1}^{p} \pi_{21ik} \Delta \mathrm{y/N_{it-k}} + \sum_{k=1}^{p} \pi_{22ik} \Delta PriveHealth_{\mathrm{\,it-k}} + \sum_{k=1}^{p} \pi_{23ik} \Delta LifeExp_{\mathrm{it-k}} + \xi_{2i} ECT_{it-1} + u_{2it} \ldots \ldots (5)$$

$$\Delta LifeExp_{\mathrm{it}} = \theta_{3\mathrm{j}} + \sum_{k=1}^{p} \pi_{31ik} \Delta \mathrm{y/N}_{\mathrm{it-k}} + \sum_{k=1}^{p} \pi_{32ik} \Delta PriveHealth_{\mathrm{it-k}} + \sum_{k=1}^{p} \pi_{33ik} \Delta LifeExp_{\mathrm{it-k}} + \xi_{3i} ECT_{it-1} + u_{3it} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

where:

y/N	Real GDP per capita
PubHealth	Public health expenditure
PrivHealth	Private health expenditure
LifeExp	Life expectancy
Δ	First difference operator
ECT	Error-correction term
ε and u	White noise error terms
i	Individual country
t	Time period
p	Lag length

The data used in this study cover the period 2008 to 2017. The data were obtained from the World Bank's Databank. In addition, individual countries' national data sources were used to supplement the World Bank's data.

3.2 Empirical Analysis

3.2.1 Panel Unit Root Test

In order to identify the order of integration of the variables used in the study, three panel unit root tests are employed. These include: i) Levin-Lin-Chu (LLC) (2002); ii) Im, Pasaran and Shin (IPS) (2003); and iii) ADF Fischer tests. The results are reported in Table 1 for both low-income and middle-income countries.

Table 1: The results of panel unit root tests

	PP – Fisher-Chi Square		**IPS *W*-Statistics**		***ADF - Fisher Chi-square***	
	Level	**First Difference**	**Level**	**First Difference**	**Level**	**First Difference**
Low-income SSA Countries						
y/N	58.1071	109.790***	4.10250	-3.47970***	44.1690	92.0789***
PubHealth	44.5181	277.717***	0.53056	-3.70936***	-0.84460	98.0311***
PrivHealth	64.7706	131.034***	1.26942	-3.70936***	44.0849	102.482***
LifeExp	0.00263	230.909***	-8.24210***	-	13.4434	176.420***
Middle-income SSA Countries						
y/N	29.6367	86.9039***	0.89745	-3.04730***	16.4000	64.3190***
PubHealth	28.5239	171.085***	-0.47490	-3.98651***	48.2386	89.4492***
PrivHealth	44.4804	86.9890***	-0.38600	-3.40912***	48.9658	82.5215***
LifeExp	0.01003	172.831***	-1.46146	-5.84309***	19.1970	79.7347***

*Note: *** indicates rejection of the respective null hypothesis at the 1% level of significance.*

The results of panel unit root tests reported in Table 1 show that on the whole the data is stationary in first difference. This implies that we can now proceed to examine the cointegration among the variables included in this study.

3.2.2. Panel Cointegration Test

In order to examine whether cointegration exists among the variable used in this study, two panel cointegration tests are employed in order to ascertain the veracity of the findings. These include: (i) the Pedroni (2004) residual cointegration test; and (ii) the Kao (1999) residual cointegration test. The cointegration results are reported in Table 2.

Table 2: Panel cointegration results

Pane A: Public Health Expenditure, Life Expectancy and Economic Growth				
	Panel A1: Low-income countries		**Panel A2: Middle-income countries**	
Pedroni Residual Cointegration Test				
Pedroni panel cointegration test – within-dimension				
	t-Statistic	**Probability**	**t-Statistic**	**Probability**
Panel v-Statistic	3.483484***	0.0002	-0.564717	0.7139
Panel rho-Statistic	2.017901	0.9782	3.253789	0.9994
Panel PP-Statistic	-5.286024***	0.0000	-5.670770***	0.0000
Panel ADF-Statistic	-5.286024***	0.0000	-4.289016***	0.0000
Pedroni panel cointegration test – between-dimension				
Group rho-Statistic	4.150426	1.0000	4.628521	1.0000
Group PP-Statistic	-6.545456***	0.0000	-13.75099***	0.0000
Group ADF-statistic	-6.545456***	0.0000	-7.629399***	0.0000
PANEL 2: Kao Residual Cointegration Test				
	t-Statistic	**Probability**	**t-Statistic**	**Probability**
ADF	-1.587667*	0.0562	- 2.715764***	0.0033
Panel B: Private Health Expenditure, Life Expectancy and Economic Growth				
Pedroni Residual Cointegration Test				
Pedroni panel cointegration test – within-dimension				
	Panel A1: Low-income countries		**Panel A2: Middle-income countries**	
	t-Statistic	**Probability**	**t-Statistic**	**Probability**
Panel v-Statistic	3.004595***	0.0013	2.869923***	0.0021
Panel rho-Statistic	0.624265	0.7338	1.779551	0.9624
Panel PP-Statistic	-3.459324***	0.0003	-5.537260***	0.0000
Panel ADF-Statistic	-3.516095***	0.0002	-4.181747***	0.0000
Pedroni panel cointegration test – between-dimension				
Group rho-Statistic	2.678377	0.9963	4.259162	1.0000
Group PP-Statistic	-6.214016***	0.0000	-13.73603***	0.0000
Group ADF-statistic	-4.917564***	0.0000	-2.931011***	0.0017
PANEL 2: Kao Residual Cointegration Test				
	t-Statistic	**Probability**	**t-Statistic**	**Probability**
ADF	-1.467936*	0.0711	-1.924080**	0.0272

*, ** and *** denote significance at 10%, 5% and 1% levels, respectively.

Overall, the results of the two panel cointegration tests reported in Table 2 show that the variables in all the two models (Models 1 and 2) are cointegrated. The cointegration has been confirmed by the most reliable tests among the seven Pedroni tests, namely Panel PP-Statistic,

Panel ADF-Statistic, Group PP-Statistic, Group ADF-statistic, amongst others (see also Asongu et al., 2016).

3.2.3 Panel Granger-Causality Results

The Granger-causality test in this study is performed to examine the causal relationships among public health expenditure, life expectancy and economic growth in Model 1, and private public health expenditure and economic growth in Model 2. While the short-run causality is determined by the corresponding F-statistic in each equation, the long-run causality is based on the coefficient of the error-correction term (ECM) in each equation (see also, Odhiambo, 2014). As a general rule, the coefficient of the lagged ECM is expected to be negative and statistically significant (see also Asongu 2013; Odhiambo, 2013).

Table 3 presents the Granger-causality results for both low-income and middle-income countries.

Table 3: Granger-causality results for both models

Panel A: Pane A: Public Health Expenditure, Life Expectancy and Economic Growth								
Dependent Variable	**Low-Income Countries**				**Middle-Income Countries**			
	Δ y/N	**Δ LifeExp**	**Δ PubHealth**	**ECT**	**Δ y/N**	**Δ LifeExp**	**Δ PubHealth**	**ECT**
ΔLy/N	-	0.458602 [0.7659]	3.053512** [0.0317]	-0.00497*** (-3.174039)	—	11.29040*** [0.0011]	0.649795 [0.4218]	-0.011332*** [-4.235421]
Δ LifeExp	3.145625** [0.0293]	-	1.712662 [0.1706]	-0.000816 [-1.602717]	0.764611 [0.4684]		0.526475 [0.5924]	-0.001256 [-1.256749]
ΔPubHealth	0.258667 [0.6117]	8.022441*** [0.005]		-0.018804 (-0.588524)	0.414129 [0.5212]	7.078283*** [0.0089]		-0.040669*** [-2.916741]
Panel B: Private Health Expenditure, Life Expectancy and Economic Growth								
Dependent Variable	**Low-Income Countries**				**Middle-Income Countries**			
	Δy/N	**ΔLifeExp**	**Δ PrivHealth**	**ECT**	**Δy/N**	**ΔLifeExp**	**ΔPrivHealth**	**ECT**
Δy/N	–	12.85472 (0.000) ***	0.353896 [0.5529]	-0.001269** [-2.223471]	-	7.366823** [0.0077]	0.130265 [0.7188]	-0.017099*** [-4.406536]
ΔLifeExp	0.102592 [0.9026]	-	0.162032 [0.8715]	-0.004533 [-0.434670]	0.430420 [0.7862]	-	3.123650** [0.0205]	-0.004585*** [-5.188442]
ΔPrivHealth	0.462091 [0.4975]	11.34384*** [0.000]	-	-0.002319 [-0.201042]	2.338194* [0.0689]	1.818079 [0.1411]	-	0.190111 (1.698743)

Note: *; **; *** denote significance at 10%, 5%, and 1%, respectively.

The results reported in Table 3 show that when public expenditure is used as proxy for health expenditure, a unidirectional causal flow from health expenditure to economic growth is found to prevail both in the short run and in the long run in the case of the low-income countries. The short-run causal flow is confirmed by the corresponding F-statistic in the economic growth equation, which is found to be statistically significant. Likewise, the long-run causal flow is confirmed by the coefficient of the ECM term in the economic growth equation, which has been found to have the correct negative sign and is statistically significant. However, in the case middle-income countries, the study failed to find any causal relationship between health expenditure and economic growth in either direction. The results apply irrespective of whether the casualty is estimated in the short run or in the long run. Other results show that in the case of low-income countries, a unidirectional causal flow from economic growth to life expectancy and from life expectancy to health expenditure tends to dominate in the short run. These findings have been confirmed by the corresponding F-statistics in the life expectancy and public health equations, which have been found to be statistically significant. In the case of middle-income countries, the results show that a unidirectional causal flow from life expectancy to economic growth and health expenditure tends to prevail both in the short run and in the long. The short-run causality has been confirmed by the corresponding F-statistics in the economic growth and public health expenditure equations, which have been found to be statistically significant. Likewise, the long-run causality has been confirmed by the coefficients of the corresponding ECM terms in the economic growth and public health equations, which have been found to be both negative and statistically significant.

When private health expenditure is used as a proxy for health expenditure, the results show that no causality between health expenditure and economic growth exists in low-income countries, but in the middle-income countries a unidirectional causal flow from economic growth to

health expenditure is found to prevail in the short run. The neutral causality between health expenditure and economic growth in low-income countries has been confirmed by the corresponding F-statistics and ECM coefficients in both economic growth and private health expenditure equations, which have been found to be all statistically insignificant. The short-run causality from economic growth to health expenditure in the case of middle-income countries, on the other hand, has been confirmed by the corresponding F-statistics in the private health expenditure equation, which has been found to be statistically significant. Other results show that for low-income countries, there is: i) a short-run and long-run unidirectional causality from life expectancy to economic growth; and ii) a short-run unidirectional causality from life expectancy to health expenditure. For middle-income countries, there is: i) a short-run and long-run unidirectional causality from life expectancy to economic growth; and ii) a short-run and long-run unidirectional causality from health expenditure to life expectancy.

4. Conclusion

This study examines the causal relationship between health expenditure and economic growth in sub-Saharan African countries using panel data from 2008 to 2017. The study used two proxies of health expenditure – public and private health expenditure – to examine this linkage. To assess whether the level of income has a bearing on the causal relationship between health expenditure and economic growth, the study clustered the countries studied into two groups: low-income and middle-income countries. To avoid the omission-of-variable bias, which has been found in some previous studies, the study used infant mortality as an intermittent variable between health expenditure and economic growth – thereby leading to a system of multivariate equations. Using panel cointegration and a panel ECM-based Granger-causality model, the study found that the causal relationship between health expenditure and economic growth in sub-Saharan African countries depends on the specific country's income level, as well as the proxy used to measure health expenditure. In addition, the results tend to change over time.

When public expenditure is used as a proxy, a distinct unidirectional causality from health expenditure to economic growth is found to prevail in low-income countries in both the short and the long run, but no causality is found to exist in middle-income countries. However, when private health expenditure is used, a short-run causality from economic growth to health expenditure is found to prevail in middle-income countries, but no causality is found to exist in low-income countries. These findings have important policy implications. This finding of a unidirectional causality from public health expenditure to economic growth in low-income countries, although contrary to some previous studies, is not surprising given that in many low-income sub-Saharan African countries, most health services are provided by state health facilities because the private health sector has not fully developed. Secondly, the short-run causality from economic growth to private health expenditure shows that although there are a number of private health facilities in middle-income countries, these facilities have no bearing on economic growth as they are largely driven by income growth. This study, therefore, recommends that for low-income countries, investment in public healthcare should be intensified and effectively enhanced, as it is likely to lead to greater economic improvement. However, for middle-income countries the study recommends that growth-oriented policies be intensified so as to further stimulate private investment in the health sector.

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