Journal of Positive School Psychology http://journalppw.com
2022, Vol. 6, No. 12, 1649-1664

Health Care Expenditure-Gdp Nexus In Sub-Saharan Africa

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Abstract
This study provides a generalized review and survey of the progress and advances in the literature on health spending-Gross Domestic Product (GDP) long-term nexus. Several attempts have been made since Alma-Ata Declaration in 1978 and recently, the Maputo Plan of Action 2016-2030; but in 2022, what is the long-term impact of spending on health on the GDP of sub-Saharan Africa? SSA aggregate data were sourced and extracted from the World Bank Database(World Development Indicators) and ,innovative long-term analysis was applied. The study observed that there is a long-term association between the components of health spending and GDP, implying the confirmation of the long-run role of health spending in stimulating the growth of GDP or GDP facilitating the performance of health spending in SSA. The major conclusion drawn from the review of related studies is that there are conflicting findings/results, and there is neither a consensus nor common stance on the link between health spending and GDP in SSA. The implications of these conclusions and empirical observations are: Authors studying health spending- GDP nexus should apply suitable econometric techniques with special consideration of the peculiar features of the data generated from the economies studied. Furthermore, new variables should be accommodated in the models and modelling process as a deviation from previous econometric traditions to avoid twisted empirical outcomes and conclusions.

Keywords: Alma-Ata Declaration , Health Expenditure**,** Economic Growth**,** sub-Saharan Africa, Cointegration.

1. Introduction

Over the years, different attempts have been made in the health sector of sub-Saharan Africa (SSA) as a follow-up of the Alma-Ata Declaration of September 1978 to enhance, protect, promote and channel the dividends of improved health delivery services to the people especially the vulnerable groups (Ishioro, 2019), and to shore up the spending on health in the region. Among these attempts were conferences on community health financing held in Kinshasa in 1990, and in Brazzaville in 1992 with a desire and drive to promote, develop and sustain community health delivery services in the SSA region. The African Heads of States and government during the Summit on HIV/AIDS, Tuberculosis and Other Infectious Diseases held in Abuja in 2001 pledged to allocate and use a minimum of 15 percent of their national annual budgets as health spending by the year 2015 (Piabuo and Tieguhong, 2017). Furthermore, the Heads of States of the African Union during the health summit on accelerating Child survival implementation in SSA held in Syrte, Libya in July 2004 took a decision to uphold the universally accepted ideals of Child and Maternal health delivery services without

holding back their national resources. Furthermore, other attempts such as the Addis-Ababa Declaration of 2006 on community health in the African Region and the 2008 Ouagadougou Declaration on primary health care and health systems in Africa were other concerted efforts made by stakeholders as a follow-up of the Alma-Ata Declaration of September 1978. Emanating from the Addis Ababa Declaration on Population and Development in Africa Beyond 2014; Our Historic Legacy to Future Generations held in Johannesburg 2015; the Geneva World Health Assembly resolution on the Global Vaccine Action Plan of 2015; and the Maputo Plan of Action 2016–2030 (AU, 2015) are the calls on all SSA countries to ensure and facilitate access to safe abortion to the extent allowed by existing national, human right laws and policies. The denominator factor of these conferences, summits, action plans and declarations is the purposeful commitment to, and improvement of the performance of health spending in SSA. These have re-emphasized the need for unalloyed government commitment to health financing in SSA. Beside these declarations, commitments and summits; the sub-Saharan African region has had a fair share of the outbreak of diseases and epidemics.

A major issue regarding the commitment of governments, agencies and donors, households and the organized private sector to the funding of health in SSA is: despite all these attempts since the Alma-Ata Declaration (Cowan et al., 2001), what is the long-run sustainable relationship between spending on health and GDP at the sub-Saharan African regional level? However, while there are torrent of studies on the empirical nexus between governments and stakeholders commitment, that is, health spending and real GDP per capita in the developed and industrialized countries (especially the OECD countries), such studies for Sub-Saharan Africa are very few; and even fewer are the studies on the aggregate health spending and in SSA; hence our study can be regarded as a justified attempt to fill this age-long- existent gap.

Flowing from the introduction, the other sections of the paper are presented in this order: a highlight of the performance of spending on health in sub-Saharan Africa follows; literature review; model and theoretical framework of the study; materials and methods; findings and discussion of results; and conclusion and recommendations ends the presentation.

2. Performance of health spending in Sub-Saharan Africa

Table 1: Aggregate health spending in Sub-Saharan Africa(1995-2016)

Health Care Expenditure	Y	E	A		R	
	1995	**2000**	**2005**	**2010**	**2014**	**2019**
Health Expenditure Per Capita						
:PPP and	94.217	105.719	155.690	176.751	200.724	189.8
::in US Dollars	40.462	32.538	56.821	88.457	97.633	79.4
Public Health Expenditure						
:As percentage of GDP	2.447	2.269	2.484	2.489	2.314	5.00
: % of Total Health Expenditure	37.483	39.710	41.486	42.963	42.589	NA
: % of Government Expenditure	NA	NA	11.565	11.755	NA	NA
Private Health Expenditure						
: As percentage of GDP	3.693	3.252	3.374	3.309	3.149	NA
Total Health Expenditure						
: As percentage of GDP	6.140	5.521	5.858	5.798	5.463	NA

Source: Author's Compilation from WDI

health spending per capita (measured as PPP constant international) dramatically increased from 94.21 US Dollars in 1995 to 200.724 US Dollars in 2014.Also, health expenditure per capita(expressed in US Dollars) was 40.46 US Dollars in 1995 decreased to $32.54 US Dollars in 2000 but increased rapidly from $56.82 US Dollars in 2005 to $97.63 US Dollars in 2014.

The aggregate performance of public health spending as a percentage of GDP has been predictably poor in sub-Saharan Africa. In 2001,the heads of government in the African Union made a commitment to allocate 15 percent of their national budgets to health delivery services and the health sectors of their countries (Piabuo and Tieguhong, 2017). This commitment has not been realized by the SSA region as less than 3 percent of GDP and less than 12 percent of total government expenditure are committed to health spending. However, the aggregate private health spending as a percentage of GDP in sub-Saharan Africa has been between 3.15 percent to 3.69 percent of GDP from 1995 to 2014.The aggregate total health spending in sub-Saharan Africa ranges from 5.4 percent of GDP to 6.14 percent of GDP from 1995 to 2014.

Table 2: **Compliance of Sub-Saharan African Countries with Abuja / High-Level Task-force on Innovative International Financing for Health Systems**

Health Expenditure	**SSA Countries with more than 15 Percent Health Expenditure**	**SSA Countries with Less than 15 Percent Health Expenditure**
Total health expenditure per capita more than US$ 44	Botswana, Rwanda, Zambia (3 countries)	Algeria, Angola, Cameroon, Cape Verde, Congo, Côte d'Ivoire, Equatorial Guinea, Gabon, Ghana, Guinea-Bissau, Lesotho, Mauritius, Namibia, Nigeria, Sao Tome and Principe, Senegal, Seychelles, South Africa, Swaziland, Uganda (20 countries)
Total health expenditure per capita less than US$ 44	Madagascar, Togo (2 countries)	Benin, Burkina Faso, Burundi, Central African Republic, Chad, Comoros, DRC, Eritrea, Ethiopia, Gambia, Guinea, Kenya, Liberia, Malawi, Mali, Mauritania, Mozambique, Niger, Sierra Leone, Tanzania (20 countries)

Source: Adapted from Piabuo & Tieguhong (2017)

There are many reforms in the health sector of sub-Saharan Africa; these include but not limited to: 2006 Addis-Ababa Declaration on community health in the African and sub-Saharan African region; the 2008 Ouagadougou Declaration on primary health delivery services and health systems management in Africa; the High-Level Taskforce on Innovative International Financing for Health Systems (HLTF) the initiative of the 2009 low income countries designed to allocate at least US$ 44 per capita to enhance, deliver and sustain qualitative health services. However, from table 3 , it can be seen that almost all African countries have not complied with both the target of the Abuja Declaration and the HLTF initiative except countries like Botswana, Rwanda and Zambia. Although, Equatorial Guinea has not been able to meet the target

Abuja Declaration, she has relatively high health spending per capita.

3. Review of Related Literature

A common consensus reached by studies on HCE and GDP for either Africa or sub-Saharan Africa or both is that HCE has been increasingly low in SSA and developing regions globally. These regions depend significantly on donor grants, financial aid and loans for financing HCE in particular and health sector in general (Sulku and Caner, 2009; Novignon, Olakojo and Novignon, 2012; Tirasoglu and Yildirum, 2012; Addo, 2016).

Table 3 : Multi - Country Study For African / Sub-Saharan African Countries

Multi - Country Study For African/Sub-Saharan African Countries				
Study	**Period Covered**	**Countries / Region**	**Estimation Technique Applied**	**Major Results / Conclusion**
Guisan & Exposito (2006)	2000-2005	38 SSA Countries	Exploratory/Analytical Approach	African countries have experienced / exhibited little growth since the 2000s
Andoh et al., (2006)	1990-2000	All African Countries	Multiple Regression Analysis	Positive correlation exists between net national income per capital and health outcome.
Jaunky & Khadaroo (2008)	1991–2000	28 African countries	Panel cointegration analysis	Per capita GDP , Public and private health expenditures are cointegration.
Murthy and Okunade (2009)	2001	83 percent of African Countries	Ordinary Least Squares (OLS)	Real per capita foreign aid has positive effects on per capital health expenditure
Novignon, Olakojo & Nonvignon (2012)	1995-2012	44 SSA Countries	Panel Data: Fixed and Random Effects using Generalized Least Squares (GLS)	Health expenditure positively and significantly influences health status
Eggoh, Houeninvo & Sossou, (2015)	1996–2010	49 African countries	Traditional across-section and dynamic panel techniques	There exists a negative relationship between the growth rate of real GDP per capita and aggregate health expenditure

Source: Author's Compilation

The empirical exploration of the health spending and real GDP per capita nexus was initiated by Kleiman (1974) and Newhouse (1977) who observed that there has been a very strong positive link between health spending and the growth performance of the economy.

Following the empirical outcomes of Kleiman (1974) and Newhouse (1977) ; Hansen and King(1996), Toor and Butt (2005), and Hall and Jones (2007) posit that health spending is a function of real GDP per capita (defined as real GDP per capita).Using empirical support they argued that higher income in the economy means that the proportion of national income devoted to health spending will be more. Hence the changes and fluctuations in the performance of health spending have been adduced to the changes in real GDP per capita

(Huber,1999 ; Imai, Jacobzone, and Lenain, 2000 ; Koen, 2000 ; Matteo, 2000; Heshmati, 2001; Colombo and Hurst, 2002; Cutler, 2002; Imai, 2002; Sahbudak and Sahin , 2015).

Country-Specific Studies on Health Expenditure and GDP for Developing Countries

Table 4 : Country-Specific Studies For Developing Countries

COUNTRY-SPECIFIC STUDIES FOR DEVELOPING COUNTRIES					
	Study	**Period Covered**	**Countries / Regions**	**Estimation Technique**	**Major Results / Conclusion**
1	Taban (2006)	1968-2003	Turkey	Causality Test	There is not any relationship between number of medical institutions and real GDP growth, but bidirectional causality is found between real GDP growth and other health indicators.
2	Tang (2009)	1960-2007	Malaysia	*Cointegration Estimation Technique	There is a positive long-run relationship between Government spending on Health care and Gross Domestic Product (GDP) .
3	Sülkü & Caner (2011)	1984-2006	Turkey	*Cointegration Estimation Technique	There is a long-run relationship between Per capita GDP and health expenditure per capita.
4	Desmond et al. (2012)	970-2009	Nigeria	Regression Analysis	Capital and recurrent expenditure on economic services and insignificant negative effect on economic growth
5	Gong, Li & Wang (2012)	1978–2003	Individual provinces of China	Panel Data estimation Technique using the extended Ramsey model with an Arrow–Romer production function and a Grossman (1972) utility function	Economic growth is related to both the health growth rate and the health level. While growth in health capital always facilitates economic growth, the gross effect of health level on the rate of economic growth depends on how it affects physical capital accumulation.
6	Hassan and Kalim (2012)	1972–2009	Pakistan	ARDL bounds testing approach and Granger Causality test	Per capita GDP, Per capita health expenditures and Per capita education expenditures are cointegrated. There is a bi-directional causality between Per capita GDP and Per capita health expenditures.
7	Tırasoglu & Yıldırım (2012)	2006-2012	Turkey	*Cointegration Estimation Technique	There is a long-run relationship between health expenditure and economic growth in the presence of one structural break.

8	Akintude and Satope (2013)	1977-2010	Nigeria	Vector Error Correction Mechanism (VECM)	There are long-run and positive relationship between health investment and economic growth.
9	Okoro (2013)	1980- 2011.	Nigeria	Granger Causality Test, Johansen Cointegration Test, and Error Correction Mechanism	long run equilibrium relationship exists between government spending and economic growth
10	Babatunde (2014)	1970-2010	Nigeria		Public health expenditure has a vital relationship with growth and development
11	Boussalem, Boussalem & Taiba (2014)	1974-2014	Algeria	Annual data, *Cointegration and Causality in the context of Error Correction Mechanism (ECM).	There exists a long-run, causality running from public spending on health to economic growth while there is no short-run causality from public spending on health to economic growth.
12	Chen, Clarke & Roy (2014)	1978-2006	China	Panel Data estimation Technique	There exists a positive relationship between health expenditure and real GDP
13	Akar (2014)	2004- 2013	Turkey	Long-run and short-run estimation technique	There is a significant relationship between health care expenditures, relative price of central government budget health expenditures, and economic growth in the long-run. But there is no relationship in the short-run.

Source: Author's Compilation

Table 4 presents the review of the GDP- health spending nexus for developing countries and / or country-specific studies. From the review, we established that, the research findings and / or empirical results of these studies according to Tang, Holzel and Posner (2015) are mixed and somewhat different based on each Country's unique characteristics, nature of data used (definition and description including measurement), estimation techniques employed and data span. However, most studies (such as Akar (2014); Tirasoglu and Yildirum (2012); Sulku and Caner (2011) for Turkey; Akintunde and Satope (2013); and Okoro (2013) for Nigeria; Chen, Clarke & Roy (2014) for China; Boussalem, Boussalem and Taiba (2014) for Algeria; Tang (2009) for Malaysia) concluded that there is a long-run inter-connectivity between spending on health (or its proxy) and GDP (or its surrogates). Others include: Coombes (2002); Poullier, Hernandez, Kawabata and Savedoff (2002); Alcalde-Unzu et al.,(2009), and Jakovljevic, et al. (2020).

4.The Model

Chang (2006) in consonance with Fuchs (1996) reaffirmed that health capital is an essential component of human capital stock, which constitutes a major determinant of economic growth (Moise, 2003). The aggregate

production function adopted in this study is specified as:

$$Y_t = F(K_t, H_t, L_t)$$

(1)

Y_t represents economy-wide output(GDP) produced during the current year t;

K_t represents the physical capital accumulated at time t;

H_t represents human capital accumulated at time t while L_t represents labour accumulated at time t. The assumptions of the production function expressed in equation(1) include:

First, economy-wide output (GDP) is homogeneous and divisible, and can be distributed to K_t, to either maintain the degree of previously accumulated capital (denoted as K_t H_t and L_t) or to create more units of health capital

second, the national output (denoted as Y_t) is either consumed, invested or distributed and used to replenish, maintain or generate new K_t and / or H_t.

Hence, $Y_t = C_t + I_t + Mc_t$

(2)

In equation (2), C_t represents the consumption of Y_t;

I_t represents the investment of Y_t in either K_t and / or H_t.;

Mc_t is the part of Y_t deployed to maintain either K_t or H_t, or create new K_t or H_t, or both

However, following the Keynesian short-run equilibrium model, equation (2) can be re-stated as:

$$Y_t = C_t + S_t$$

(3a)

Where S_t represents savings at time t , and other variables are as previously defined.

or

$$Y_t = C_t + I_t$$

(3b)

From equation (3a) and (3b),it can be deduced that:

$$S_t = I_t$$

(4)

Equation (4) implies that at the Keynesian short-run equilibrium, current savings equals current investment. The proportion of savings and investment channeled to either health spending, human capital or capital accumulation can be represented as:

$$S_k = I_k, S_h = I_h, S_e = I_e$$

(5)

In equation (5) S_e, S_k and S_h are the fractions of output saved and distributed to either health spending, human or physical capital accumulation (Ishioro, 2018 , and 2019).

Also, we assume that the capital stocks represented in the production function in equation (1) are subject to depreciation. The associated depreciation rates for both physical and human capital, and health income capital are represented as δ_k and δ_h. Hence, an increase in the stock of both physical and human capitals, and health income capital at a point in time equals gross investment less depreciation.

$$\dot{K}_t = S_k * F(K_t, H_t, E_t) - \delta_k * K_t$$

(6a)

$$\dot{H}_t = S_h * F(K_t, H_t, E_t) - \delta_h * H_t$$

(6b)

$$\dot{E}_t = S_e * F(K_t, H_t, E_t) - \delta_k * E_t$$

(6c)

In equation (6a),(6b) and (6c),the dependent variables are the growth rates of physical capital, human capital and spending on health human capital.

$$\frac{dK}{dt} = S_k \cdot F(K_t, H_t, E_t) - \delta_k . K_t$$

(7a)

$$\frac{dH}{dt} = S_h \cdot F(K_t, H_t, E_t) - \delta_h . H_t$$

(7b)

$$\frac{dE}{dt} = S_e \cdot F(K_t, H_t, E_t) - \delta_e \cdot E_t$$

(7c)

Equation (7a), (7b) and (7c) represent differentiation of equation (6a),(6b) and (6c) with respect to time t. In the equations denoted as (7a), (7b) and (7c), zero less than or equal to S_k, S_h or S_e $(0 \le S_k, 0 \le S_h, 0 \le S_e)$ imply that the per effective unit labor variables are fixed in the steady state. However, the levels of these variables are expected to grow in the steady state at the rate of the population growth (n).

The growth rates of all capital are derived by dividing both sides of their respective equations by the corresponding capital stock – this will generate the effects of capital accumulation overtime. Therefore, we specify the intensive forms of equation (7a), (7b) and (7c) as:

$$\Omega_k = \frac{\dot{k}}{k} = S_k . \frac{f(k,h,e)}{k} - (n + g + \delta_k)$$

(8a)

$$\Omega_h = \frac{\dot{h}}{h} = S_h . \frac{f(k,h,e)}{h} - (n + g + \delta_h)$$

(8b)

$$\Omega_e = \frac{\dot{e}}{e} = S_e . \frac{f(k,h,e)}{e} - (n + g + \delta_e)$$

(8c)

For an economy with surplus capital, the growth rate of the corresponding capital declines and approaches zero in the steady state . Hence,

$$k^* = \frac{s_k . f(k,h,e)}{(n + g + \delta_k)}$$

(9a)

$$h^* = \frac{s_h . f(k,h,e)}{(n + g + \delta_h)}$$

(9b)

$$e^* = \frac{s_e . f(k,h,e)}{(n + g + \delta_e)}$$

(9c)

The per effective unit of output of the economy along the transition, and the growth rate combined with the three variables is given by equation (10) which we adopted as both the framework and pedestal for the specification of our Vector auto regression model:

$$\Omega_y = s_k . f_k(k,h,e) - (n + g + \delta_k) . Sh(k,e) + s_h . f_h(k,h,e) - (n + g + \delta_h)$$

(10)

Materials and Method

5.1 Sources and Description of Data

Annual time series data for this study was sourced for the period 1970 to 2020 from World Development Indicators for sub-Saharan Africa for various years.

5.2 Estimation Technique

This study applied the unit root test, and cointegration test using the modified Pantula Principle in the analysis of our models. These tests and estimation techniques are highlighted below.

Unit Root Tests

Various unit root tests including Dickey and Fuller (1979); Augmented Dickey Fuller (henceforth ADF) álá Dickey and Fuller (1979,1981), Phillips-Perron (henceforth PP) popularized by Phillips and Perron (1988); Maddala and Kim (1999); Ng and Perron (2001); Elliot, Rothenberg and Stock (1996); Kwiatkowski-Phillips-Schmidt-Shin (henceforth KPSS) tests, Kwiatkowski et al.,(1992) have been applied in the literature exploring GDP-Expenditure Nexus. The ADF and PP tests test the null hypothesis of the presence of unit root against the alternative of stationarity (or no unit root). However, the KPSS apply the null hypothesis of stationarity against the alternative of the presence of unit root (Ishioro, 2015a, 2015b, 2017, 2019, 2022a, 2022b).

5.2.1 Long-run Cointegrating Model: Deterministic Components

The principal contribution of our study to the numerous and vast empirical evidences on the GDP-Expenditure Nexus is that, we deviated significantly from most of the previous studies by applying the different models of the Johansen cointegration tests. This long-run component is highlighted below.

Johansen Cointegration Model: Unrestricted Intercepts and Restricted Trends.

Within the framework of the Johansen cointegration test, this model has been described as model four of the test. It is designed to accommodate and account for the constants and deterministic trends components in the cointegrating equations / vectors of the test. This is achieved by including intercepts in both the cointegrating equation (CE) and VAR while only the linear trend is accounted for in the CE. The trend contained in the CE is akin to that of a trend stationary indicator that is meant to allow for exogenous expansion in the selected series. This model can be stated as:

$$\Delta X_t = \sum_{i=1}^{z-1} \varphi_i \Delta X_{t-i} + \alpha[\beta', \beta_1, \beta_0]'[X_{t-1}, t, 1] + \mu_0 + \sigma D_t + e_t \quad (8)$$

Δ represents first difference operator; X_t is a Z x 1 vector of the stochastic series of our model, α and β represent a Z x r matrices characterized by full rank, D_t is the vector of the deterministic series. e_t is the vector of error terms with the usual characteristics of normally, **i**.i.d with zero mean and constant variances.

Results and Discussions

This section presents the results of the optimal lag selection criteria/ model selected for the cointegration tests. The results of the AIC optimal lag selection criteria presented in table 5 provided empirical guidance on the selection of both number of lags and the most suitable variant of the cointegration model.

Table 5 : Results of Akaike Information Criteria

Model	Model 1	Model 2	Model 3	Model 4	Model 5
Data Trend	None	None	Linear	Linear	Quadratic

Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
0	21.038	21.038	20.868	20.868	21.277
1	20.629	20.558	20.357	18.156	18.803
2	21.011	20.265	20.075	18.157	18.376
3	21.702	20.845	20.764	18.124*	18.235
4	22.591	21.648	21.648	18.936	18.935

Source: Author's Computation

NOTE: The rows of the table represent the ranks of the SIC while columns represent Models of the Cointegration test.
The AIC indicated that 18.124 is the lag level that minimized the optimal selection error; as a result it selected three (3) lags as the optimal lag that is suitable for the estimation of the cointegration test for the series during the period under consideration and model four of the Johansen cointegration test was selected as the most appropriate for the estimation of the long-run relation between GDP and expenditure on health series .

Table 6 : Results of Schwartz Information Criteria

	Model 1	Model 2	Model 3	Model 4	Model 5
Data Trend	**None**	**None**	**Linear**	**Linear**	**Quadratic**
Rank or No. of CEs	**No Intercept No Trend**	**Intercept No Trend**	**Intercept No Trend**	**Intercept Trend**	**Intercept Trend**
0	21.038	21.038	20.868	20.868	21.277
1	21.816	21.795	21.742	19.932*	20.386
2	22.594	21.946	21.856	20.036	20.354
3	23.680	22.972	22.941	20.449	20.610
4	24.965	24.221	24.221	21.706	21.706

Source: Author's Computation

NOTE: The rows of the table represent the ranks of the SIC while columns represent Models of the Cointegration Test.
The results of the SIC presented in table 6 include the procedure for optimal lag selection and it provided empirical benchmark for the selection of the most suitable variant of the cointegration model and the attendant number of lags. The SIC indicated that 19.932 is the lag length that minimized the error in the optimal lag selection process; as a result it selected one (1) as the most suitable optimal lag for the estimation of the cointegration test for the series GDP, PhE, PbhE and ThE during the period studied. Model four of the Johansen cointegration test was selected as the most appropriate variant of the Johansen cointegration model for the estimation of the long-run relationship between GDP and $AR^{Pr}HEXP$, $AR^{PUB}HEXP$, and $AR^{TTH}HEXP$.

Results of the Cointegration Tests

Table 7 : Number of Cointegrating Relations by Type of Model

Model Type	Model 1	Model 2	Model 3	Model 4	Model 5
Data Trend	**None**	**None**	**Linear**	**Linear**	**Quadratic**
Test Type	**No Intercept No Trend**	**Intercept No Trend**	**Intercept No Trend**	**Intercept Trend**	**Intercept Trend**
Trace Statistics	0	1	1	2	3
Maximal Eigen	0	0	0	1	1

Source: Author's Computation

The summary of the results of the five models of the Johansen cointegration tests are presented in table 7. For both the Trace and Maximal value statistics; model 1(without intercept and without trend) indicated no cointegrating equation between GDP and the health spending series. This means that using model 1 as the benchmark for the estimation of the long-run relationship among the series would conceal the true nature of the relationship during the period considered in this study. For model 2 (with intercept but without trend), only trace statistic indicated one cointegrating equation while the maximal value statistic indicated no cointegrating equation. Model 3 (with intercept in the CE and VAR but without trends in CE and VAR, indicated only one CE based on trace statistic; while models 4 and 5 indicated one CE each based on maximal value statistic and 2 and 3 CEs based on trace statistics. Therefore, beyond whether or not there is a long-run association between GDP and $AR^{\Pr}HEXP$, $AR^{PUB}HEXP$, and $AR^{TTH}HEXP$, it can be inferred that using the trace statistic without including intercept is likely to produce misleading results while relying on the results of the maximal Eigen value statistic without including trends (linear and quadratic in case of model five) would produce misleading results as well.

Table 8 : Results of Model Four Cointegrating Model.

Cointegration Among GDP, $AR^{\Pr}HEXP$, $AR^{PUB}HEXP$, and $AR^{TTH}HEXP$						
Hypothesized No. of CE(s)	Eigen Value	Trace Statistics	0.05 CV	Maximal Eigen Value	0.05 CV	Decision
None*	0.9656	106.78	63.88	60.68	32.12	Two (2) Cointegrating Equations based on Trace statistics and one (1) based on Maximal Statistic
At Most 1*	0.7383	46.11	42.92	24.13	25.82	
At Most 2	0.6438	21.98	25.87	18.58	19.39	
At Most 3	0.1718	3.3934	12.52	3.3934	12.52	

Source: Author's Computation

The results established two cointegrating equations (using Trace statistic) and one cointegrating equation (based on Maximal Eigen statistic).This empirically suggests that there is a long run co-movement and co-performance of GDP_{AR}, $AR^{\Pr}HEXP$, $AR^{PUB}HEXP$, and $AR^{TTH}HEXP$ in the cointegration equation if model four is adopted as the analytical and estimation technique. Furthermore, our results simply confirm the existence of a long-run equilibrium tendencies among our series (GDP_{AR}, $AR^{\Pr}HEXP$, $AR^{PUB}HEXP$, and $AR^{TTH}HEXP$).It also means that there is at least one-way flow of

causality from one of the variables to the other (in case of a bivariate test or to others in case of multivariate test). Intuitively, it means that in the model, one of the series is a potent determinant of either one or the other variables.

Conclusion and Recommendations

This paper is poised to review attempts and commitments made both globally and regionally (at the SSA) to improve the performance of the spending on health thereby strengthening the relationship between the various gamut of the expenditure and GDP_{AR}.

The study reviewed the different attempts made globally but held within the SSA region such as: Kinshasa, 1990; Brazzaville, 1992; Abuja, 2001; Addis Ababa, 2006; Ouagadougou 2008; Johannesburg 2015, etc. We also adopted a robust theoretical framework to provide a suitable theoretical and empirical foundation for our econometric modelling process. Besides, we attempted a comparative implementation of the 5 strands of the Johansen cointegration tests as applied in Ishioro (2022a, 2022b).

This was complemented with optimal lag and Johansen model selection tests in which optimal lag (2 lags and Johansen model 4 containing linear trend and intercept) were selected based on the SIC while the AIC selected optimal lags 3 and model 4.

Therefore based on model 4 of the Johansen co-integration test, our finding chiefly indicated that there is a long-run co-movement, co-variation and co-performance between GDP_{AR} and spending on health as exemplified by $AR^{\Pr}HEXP$, $AR^{PUB}HEXP$, and $AR^{TTH}HEXP$ at the regional level. We recommend the complementarity of expenditure planning in SSA to boost the performance of spending on health , and the relationship between GDP and spending on health.

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