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The Effects of Total Health Expenditure on Economic Growth in Central and Eastern Sub-Sahara African Regions

Faith Yusufu[1], Olanike Bosede Awoyemi[2], Kehinde John Komolafe[3]

Abstract :

This study looked at the link connecting the growth of the economy and health spending in Central and Eastern Sub-Saharan Africa. To assess the short and long-term effects of total per capita health expenditure on the growth of the economy across Sub-Saharan African areas (East Africa and Central Africa), the panel data analysis was employed. In the short-term, total per-capita health expenditure (THE_PC) in Central Africa has an upbeat outcome on economic growth (LGDP_PC) at all levels of significance. In the long-term, current health per-capital expenditure (CHE_PC) has an upbeat outcome on the growth of the economy (LGDP_PC) at 5% and 10% significance levels, whereas life expectancy at birth (LEB) has a downbeat outcome on the growth of the economy. In East Africa THE_PC in the short and long-run has a favorable effect on the growth of the economy (LGDP_PC) at 5 and 10% significant levels, whereas CHE_GDP has a downbeat outcome on the growth of the economy (LGDP_PC) at all levels in the long-run. The findings imply that increasing per-capita health spending will boost the growth of economy in the short-term, while increasing CHE_PC and LEB will boost economic-growth in the long-run. More investment on health services is recommended.

Keywords: *Public Spending, Economic Growth, GDP Per-Capita, Long Run, Mean Group, Dynamic Fixed Effect, Pooled Mean Group/ARDL (Autoregressive Distributed Lags), Short Run*

1. Introduction

Numerous variables are leading to the rise in healthcare spending in all industrialized countries. The indiscriminate alcohol intake, rise in GDP, medical improvement, technological advancement, life expectancy, death of an infant, etc. are all factors of health operating cost (Phi, 2017). Income (per capita GDP) has been highlighted as a critical factor in explaining disparities in the increase of overall healthcare expenditures between countries. Concerning health expenditure regressions, the age structure of a population

[1]*Department of Economics, University of Jos, Plateau State, Nigeria, faithyusufu54@gmail.com*
[2]*Department of Economics, Afe-Babalola University Ado-Ekiti, Ekiti State, Nigeria, nikeawoyemi@abuad.edu.ng*
[3]*Department of Economics, Afe-Babalola University Ado-Ekiti, Ekiti State, Nigeria, akjohn2@yahoo.com*

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is frequently incorporated as a covariate. Often used pointers include persons under 15 years and over 65 years proportion to the active or total population. When these variables are built-in in regression-models that explain per capita health spending, they are often inconsequential. Technological advancement has long been viewed as the most important driver of health care expenditure. Depending on the sort of model under consideration, a variety of proxies for advances in medical care technology were used. Surgical operations and the amount of specialized medical equipment are two examples of proxies used in cross-section investigations (World Health Organization, 2011). Medical commodities consumed in outpatient settings are the other major area of health spending. Different distribution methods, the availability of generic pharmaceuticals, and comparing prices in different countries are all factors that can influence spending. Slovak republic, central European countries, as well as Sothern European countries and Bulgaria republic channel a large proportion of the total health expenditure to the acquisition of medical equipment while United Kingdom, Netherland and Denmark channel were less than 15 % of entire health expenditure to the acquisition of medical equipment (European Union, 2018). Due to low budget allocation to the healthcare sector, a decline in GDP, and a pitfall in tax collection, per capita on health in Africa countries ranged from $8-129 compared to $4000 per capita on health in high-income countries (United Nations, 2020). According to Piabuo and Tieguhong (2017), the significance of health as the main component of individual and national growth is attracting increasing recognition around the globe. This is seen in an array of changes undertaken by countries in Africa to raise health investment to reach the Millennium Development Goals in this region. Increasing health expenditure budget allocation is supported firstly by Africa region community health declaration by Addis Ababa in 2006; secondly by primary health care declaration by Ouagadougou 2008 and finally by the health expenditure allocation of 15% as declared in Abuja 200l. In 2009, to provide an essential package of health, Low-income countries were admonished by HLTF (High-level Taskforce on Innovative international financing for Health System) to allocate as slow as $44 per capita. Both Abuja target and the HLTF proposal have not only been neglected in African countries but greatly not considered except for Botswana, Rwanda, and Zambia (WHO, 2014).

Research on the link between money spending and healthcare spending has long been carried out and established by many writers in different nations, however, few have been done on Africa as a whole. Out-of-pocket spending continues to be the largest component of health spending in Sub-Saharan

Africa's countries, which are primarily classified as poor or middle income. External help to lower-middle-income nations has also increased, reaching a peak in 2014. The average health spending per person in low-income countries was $41, whereas it was as high as $2,937 per person in high-income countries (WHO, 2020). In recent years, governments' interests in health spending as a priority in African countries have waned, resulting in the harsh blow to many African economies when the covid-19 pandemic struck. Better health has been identified as a key component in boosting economic growth and productivity, necessitating extra attention to the economy's health sector (Khan, Razali & Shafie 2016). Enhanced health advances the growth of the economy in many aspects, including reducing productivity losses originating from workers' ill health. It also allows a government to redirect wealth to more productive activities that would benefit the economy (Odhiambo 2021; Atilgan et al., 2017). This has created hurdles to some types of health treatment, preventing those who cannot afford it from receiving it. In most African countries, only the middle and upper classes can afford some healthcare services. This has resulted in innumerable fatalities and impoverishments to the point that human capital has been destroyed and Africa's life-expectancy has been steadily declining. Some earlier researches have claimed that medical care has played a key role in reducing mortality by effectively combating contagious ailments (Odhiambo 2021).

2. Theoretical Background

Overall, it should be emphasized that, while both Keynes and Wagner's Laws describe the long-run association between government spending and growth of the economy, Keynes classified public spending as an external component that results in the growth of the economy rather than an internal phenomenon (Lingxiao, Peculea, and Xu, 2016). Devarajan, Swaroop, and Zou (2006), as well as Easterly and Rebelo (2006), have utilized this idea and conducted a systematic assessment of the link between the mix of public expenditures and economic development (1993). This study, which is based on this theory, specifies the link between the variables of interest in the following sub-section.

Effects of total health expenditure and per capita health expenditure on economic growth

To investigate the impact of public spending on economic spending on the growth of Nigeria's economy, Akpokerere and Ighoroje(2013)

employed OLS(ordinary least squares) multiple regression techniques. They reported that elevating public spending on TRACO (transportation and communication) and HEA (health) has a positive effect on the growth of the economy whereas rising public spending on EDU (education) and POW (power) hurts the growth of the economy. Juma, Ouyang, and Cai (2018) used the VECM approach to empirically examine the influence of government spending on economic growth in Tanzania from 1990 to 2015. All variables showed long-run cointegration, according to the results. Furthermore, the findings revealed that government spending, gross-capital formation, foreign direct investment inflows, and price increases have upbeat and notable relationships with the growth of the Tanzanian economy in the long run and short-run

Frimpong and Adu (2014) used panel data from 30 Sub-Saharan African nations from 1970 to 2010 to assess the extent to which population health affects economic performance. The authors evaluate the link between the health per capita of population and the growth of the economy in Sub-Saharan Africa using a theoretical model based on an upgraded Solow growth model and a panel cointegration econometric technique. They discover that the population's health has had no impact on the growth of economy. HIV/AIDS, on the other hand, resulted in a significant negative impact of population health on the growth of economy. Furthermore, the inverse appears to be the case, since economic expansion boosts life expectancy in the region greatly. Zaidi and Saidi (2018), worked with annual data from 1990 to 2015 to estimate the association between the growth of the economy, environmental pollution, and health expenditure (HE) in Sub-Saharan African nations. The ARDL estimation method was used to model the long run as well as the short run, as the VECM-Granger causality-test was used to check the trend of causality (Wang 2011). The VECM Granger causality results revealed the presence of an association between GDP per capita and HE (Health expenditure) in a single direction. On the contrary, a double directions causation association was seen between GDP per capita and Carbon dioxide (CO2) production, as well as between health expenditure and CO2 production. Barros (1998) explored the factors that influence the increase of cumulative health spending. The study was unique as it examined disparities in growth (rather than levels) of health-care spending across countries. Estimates are provided for 24 nations (OECD countries). Factors that were previously thought to influence health expenditure growth, such as population aging, as well as the presence of gate-keepers, were shown to be insignificant.

3. Methodology

The panel data analysis using the mean group, dynamic fixed effect and pooled mean group/ARDL (Autoregressive Distributed Lags) was used and the data covered the period 2000-2019 with data derived from the ministry of health and World Bank Database.

4. Empirical Findings/Results

Model Specification

Examine the effects of total health expenditure and per capital health expenditure on economic growth Central and Eastern Africa regions

GDP_PC = f(THE, CAH, CHE, PHE, PRHE, GE, LEB,PGR, LF)

However, models are specified in empirical forms as;

$$\text{n}GDP_{it} = \delta_0 + \delta_1 \ln THE_{it} + \delta_2 \ln CHE_{it} + \delta_3 \ln GE_{it} + \delta_4 \ln PGR_{it} + \delta_5 \ln LEB_{it} + \delta_6 \ln CAH_{it} + \delta_7 \ln PRHE_{it} + \delta_8 \ln PUHE_{it} + \delta_9 \ln LF_{it} + \varepsilon_{1it}\text{“}\delta_s\text{”}$$

represent the coefficients of the regression equation, “δ_0”are constants and**“**ε_{1it} **”** are the error term where; The variables under consideration are Gross Domestic Product per capita (GDP_PC), capital health expenditure as percentage of GDP (CAH_GDP), current health expenditure as a percentage (%) of GDP (CHE_GDP), total health expenditure as percentage (%) of GDP (THE_GDP), total health expenditure per capita (THE_PC), private health expenditure as percentage of GDP (PRHE_GDP), Public health expenditure per capita (PUHE_PC), public health expenditure as percentage of GDP (PUHE_GDP), population growth rate (PGR), life expectancy at birth (LEB) and labor force (LF).

Summary Statistics for Southern and Western Africa

The basic statistical summary of the series under consideration for Central and Eastern Africa includes the observation, mean, minimum, maximum, standard deviation, and observations as in *table 1*. From t*able 1*, it is shown that the mean GDP_PC for Central Africa is 3112.89 and the standard deviation is less than the mean with a value of 4885.75 this indicates that the value is close to the mean. The minimum value for GDP_PC is 194.873 which is the smallest value in the series and the maximum value of GDP_PC is 20532.98 which is the highest value in the series. The mean value of CAH_GDP is 0.333196 and the standard deviation (SD) is 0.50850 which indicates that the value shows evidence of variability. The minimum value for CAH_GDP is 0.005856 and is the smallest value in the series and the

maximum value of CAH_GDP is 3.506457 which is the highest value in the series. The mean value of CHE_GDP is 3.873493 and the SD is 1.89099 which indicates that the value does show evidence of wide variability. The minimum value for CHE_GDP is 1.263574 and is the smallest value in the series and the maximum value of CHE_GDP is 10.99253 which is the highest value in the series. Also, the mean value (MV) of THE_GDP is 3.68119 and the SD is less than the mean with a value of 2.027318 this indicates that the standard deviation is less than the mean. The minimum value for THE_GDP is 0 which is the smallest value in the series and the maximum value of THE_GDP is 10.99253 which is the highest value in the series. The mean value of THE_PC is 78.0559 and the standard deviation is greater than the mean with a value of 103.2268 this indicates that the value shows evidence of wide variability from the mean value. The minimum value for THE_PC is 0 which is the smallest value in the series and the maximum value of THE_PC is 423.143 which is the highest value in the series.

The mean value of PRHE_GDP is 2.786741 and the standard deviation is less than the mean with a value of 1.693 this indicates that the value is close to the mean. The minimum value for PRHE_GDP is 0 which is the smallest value in the series and the maximum value of PRHE_GDP is 10.30414 which is the highest value in the series. The MV of PUHE_GDP is 0.941176 and the SD is less than the mean with a value of 0.63377, this indicates that the value is close to the mean. The minimum value for PUHE_GDP is 0.061829 which is the smallest value in the series and the maximum value of PUHE_GDP is 2.668057 which is the highest value in the series. Also, the mean value of PRHE_PC is 53.29285 and the standard deviation is greater than the mean with a value of 72.43.88 this indicates that there is wide variability of the mean. The minimum value for PRHE_PC is 2.961304 which is the smallest value in the series and the maximum value of PRHE_PC is 340.7427 which is the highest value in the series. Furthermore, the mean value of PGR is 2.826059 and the SD is 0.92375 which specifies that the value seems to show no evidence of wide variability as the standard deviation is less than the mean. The minimum value for PGR is 0.25949 is the smallest value in the series and the maximum value of PGR is 4.654911 which is the highest value in the series. Also, the MV of LEB is 56.53823 and the SD is 5.79706 indicate the value is close to the mean. The minimum value for LEB is 44.061 is the smallest value in the series and the maximum value of LEB is 69.024 which is the highest value in the series. Lastly, the MV of LF is 41.59879 and the SD is 13.6573 indicate the value is close to the mean. The

minimum value for LF is 18.24 is the smallest value in the series and the maximum value of LF is 73.96 which is the highest value in the series.

The mean GDP_PC for East Africa is 2906.073 and a standard deviation greater than the mean with a value of 4576.157 this indicates wide variability. The minimum value for GDP_PC is 208.075 which is the smallest value in the series and the maximum value of GDP_PC is 20532.95 which is the highest value in the series. The MV of CAH_GDP is 0.323108 and the SD is 0.42896 indicates the value shows slight evidence of variability. The minimum value for CAH_GDP is 0.001199 and is the smallest value in the series and the maximum value of CAH_GDP is 3.340199 which is the highest value in the series. The mean value of CHE_GDP is 6.199292 and the SD is 2.77912 which specifies that the value does not show evidence of variability. The minimum value for CHE_GDP is 2.49064 and is the smallest value in the series and the maximum value of CHE_GDP is 20.41341 which is the highest value in the series. Also, the mean value of THE_GDP is 5.888131 and the standard deviation is less than the mean with a value of 3.02879 which indicates that the value is close to the mean. The minimum value for THE_GDP is 0 which is the smallest value in the series and the maximum value of THE_GDP is 20.41341 which is the highest value in the series. The mean value of THE_PC is 68.23239 and the standard deviation is greater than the mean with a value of 101.258 this indicates that the value shows evidence of wide variability from the mean. The minimum value for THE_PC is 0 which is the smallest value in the series and the maximum value of THE_PC is 650.0706 which is the highest value in the series.

The mean value of PRHE_GDP is 4.338321 and the standard deviation is less than the mean with a value of 2.73926 this indicates that the value is close to the mean. The minimum value for PRHE_GDP is 0 which is the smallest value in the series and the maximum value of PRHE_GDP is 18.77272 which is the highest value in the series. The MV of PUHE_GDP is 1.63171 and the SD is less than the mean with a value of 0.782868, this shows that the value is close to the mean. The minimum value for PUHE_GDP is 0.424952 which is the smallest value in the series and the maximum value of PUHE_GDP is 4.461491 which is the highest value in the series. Also, the mean value of PRHE_PC is 42.8837 and the standard deviation is less than the mean with a value of 56.19234 this indicates that there is wide variability of the mean. The minimum value for PRHE_PC is 4.342175 which is the smallest value in the series and the maximum value of PRHE_PC is 368.1695 which is the

highest value in the series. Furthermore, the mean value of PGR is 2.256873 and the SD is 0.99805 which specifies the value is close to the mean value. The minimum value for PGR is 0.37033 is the smallest value in the series and the maximum value of PGR is 4.720052 which is the highest value in the series. Also, the MV of LEB is 58.67675 and the SD is 7.70149 indicate the value is close to the mean as the mean is larger than the value of the standard deviation. The minimum value for LEB is 39.441 is the smallest value in the series and the maximum value of LEB is 74.51463 which is the highest value in the series. Lastly, the MV of LF is 53.68469 and the SD is 19.5655 indicate the value is close to the mean. The minimum value for LF is 15.14 is the smallest value in the series and the maximum value of LF is 79.95 which is the highest value in the series.

Table 1 Summary Statistics for Central Africa and East Africa

Variable	Mean	Min	Max	Observations
		CENTRAL AFRICA		
GDP_PC	3112.891(4885.75)	194.873	20532.98	N = 141
CAH_GDP	0.333196(0.50850)	0.005856	3.506457	N = 45
CHE_GDP	3.873493(1.89099)	1.263574	10.99253	N = 134
THE_GDP	3.68119(2.027318)	0	10.99253	N = 141
THE_PC	78.0559(103.2268)	0	423.143	N = 141
PRHE_GDP	2.786741(1.693)	0	10.30414	N = 141
PUHE_GDP	0.941176(0.63377)	0.061829	2.668057	N = 134
PRHE_PC	53.29285(72.43.88)	2.961304	340.7427	N = 134
PGR	2.826059(0.92375)	0.25949	4.654911	N = 141
LEB	56.53823(5.79706)	44.061	69.024	N = 141
LF	41.59879(13.6573)	18.24	73.96	N = 141
		EAST AFRICA		
GDP_PC	2906.073(4576.157)	208.075	20532.95	N = 259
CAH_GDP	0.323108(0.42896)	0.001199	3.340199	N = 72
CHE_GDP	6.199292(2.77912)	2.49064	20.41341	N = 246
THE_GDP	5.888131(3.02879)	0	20.41341	N = 259
THE_PC	68.23239(101.258)	0	650.0706	N = 259
PRHE_GDP	4.338321(2.73926)	0	18.77272	N = 259
PUHE_GDP	1.63171(0.782868)	0.424952	4.461491	N = 246
PRHE_PC	42.8837(56.19234)	4.342175	368.1695	N = 246
PGR	2.256873(0.99805)	0.37033	4.720052	N = 251
LEB	58.67675(7.70149)	39.441	74.51463	N = 259
LF	53.68469(19.5655)	15.14	79.95	N = 239

Note: the value of the standard deviation is in parenthesis
Source: Author's Computation

Unit root test

Considering *table 2* (IPS, Fisher ADF and Fisher PP), which show the variables are integrated of order 1 and significant at 5% level, the study confirmed that the variables are non-stationary. Therefore, they are amenable to ARDL analyses.

Table 2 Unit root Analysis

Variables	Fisher PP		Fisher ADF		IPS		Remark
	Level	First difference	Level	First difference	Level	First difference	
LGDP_PC	116.630 (0.0524)	370.19 (0.000)	86.399(0.645)	211.37 (0.000)	3.721(0.999)	-7.012 (0.000)	I (1)
CHE_GDP	110.597(0.091)	1195.32 (0.000)	87.006 (0.628)	271.78(0.000)	0.377 (0.647)	-9.560 (0.000)	I (1)
CAH_GDP	64.483 (0.003)	169.27 (0.000)	43.722 (0.176)	61.42 (0.000)	-0.226 (0.411)	-2.791 (0.003)	I (1)
PUHE_PC	72.091 (0.938)	665.46 (0.000)	67.737 (0.973)	304.55 (0.000)	1.956 (0.975)	-11.194 (0.000)	I (1)
PRHE_PC	78.886 (0.871)	671.65 (0.000)	86.057(0.655)	259.45 (0.000)	0.389 (0.651)	-9.901 (0.000)	I (1)
CHE_PC	68.458(0.939)	483.33 (0.000)	75.862(0.819)	249.49 (0.000)	0.512 (0.696)	-8.787 (0.000)	I (1)
LLEB	51.399(0.999)	146.13 (0.000)	73.616 (0.920)	1098.14 0.000)	3.203 (0.999)	-28.576 (0.000)	I (1)
LGE	166.615 (0.100)	-12.504 (0.000)	109.008(0.084)	324.49 (0.000)	1.461(0.072)	-12.504 (0.000)	I (1)

The probability values are in parentheses
Source: Author's Computation

Data analysis and presentation of results

1. The effect of total per capital health expenditure on economic growth across the regions in sub- Sahara

This section presents the estimated coefficients of total per capital health expenditure (THE_PC), current health expenditure per capital (CHE_PC), life expectancy at birth (LEB) on GDP per capita (LGDP_PC) that are considered in this study using Mean Group (MG), Dynamic-Fixed-Effect (DFE) and Pooled-Mean-Group (PMG). However, to choose the applicable model among them, the study employed the use the Hausman test. The Hausman's test is conducted to choose between MG, DFE and PMG. A significant test result suggests MG or DFE; otherwise, PMG will be considered.

2. Total per capital health-expenditure and its effect on the growth of the economy across Central African region

Mean Group effect of total health expenditure per capital on the growth of the economy in Central Africa

Table 3 presents the short and long-run effects of total health-expenditure on the growth of the economy in Central Africa. From the short run result, the ECT value (0.001) is significantly negative at a five per cent level of significance based on the Z-statistics, which indicates a convergence to equilibrium. This implies that the short run irregularities are being amended and integrated into the long run relationship. Total health per capita expenditure (LTHE_PC) has a positive effect on LGDP_PC at 1 per cent level of significance, which indicates that a percentage rise in LTHE_PC will

upsurge GDP_PC by 1 per cent in the short run. Also, current health expenditure per capita has a positive effect on LGDP_PC at ten (10) per cent level of significance in short run, which suggests that a percentage increase in LCHE_PC will LGDP_PC by 28.5 per cent. Similarly, in the long-run, total health per capital expenditure (LTHE_PC) has a positive effect on economic growth (LGDP_PC) at 5 percent level of significance, which indicates that a percentage increase in LTHE_PC will increase LGDP_PC by 59.2 per cent the long run. Also, life expectancy at birth (LEB) has a positive effect on LGDP_PC at all levels of significance in the long-run, which indicates that a unit increase in LEB will increase LGDP_PC by 89.8 per cent. The results suggest that an increase in per capita health spending and current health spending will increase economic growth in Central Africa in the short term. Similarly, in the long run, an increase in life expectancy at birth and per capita health-expenditure has a positive impact on the growth of the economy in Central Africa.

Table 3: Mean-Group Estimation: Error Correction Form (Estimate results saved as MG)

LGDP_PC	Coef.	Std. Err.	Z	P>|z|
	SHORT- RUN			
ECT	-0.001	0.001	-1.820	0.037
LEB |D1. |	0.162	0.289	0.560	0.575
LTHE_PC |D1. |	0.020	0.007	2.770	0.008***
LCHE_PC |D1. |	0.285	0.172	1.650	0.098*
Constant	0.815	1.354	0.600	0.548
	LONG-RUN			
LEB	0.898	0.242	3.710	0.000***
LTHE_PC	0.592	0.295	2.000	0.014**
LCHE_PC	-3.415	3.018	-1.130	0.258

*** p<0.01, ** p<0.05, * p<0.1. The standard errors are robust estimates

Dynamic Fixed Effect of total health expenditure per capital on economic growth in Central Africa

The dynamic short run and long run results are presented in table 3. The table shows that the ECT value is negative and significant at 5 per cent level of significance, based on the Z-statistics, which indicate a convergence to equilibrium. This means that the short run inconsistencies are being corrected and incorporated into the long run relationship. In the short run, total health per capita expenditure (LTHE_PC) has a positive effect on LGDP_PC at all levels of significance in the short run. This infers that a percentage increase in LTHE_PC will increase LGDP_PC by 7 per cent. Also, current health per

capita expenditure (LCHE_PC) has a positive effect on LGDP_PC in the long-run at 5 per cent level of significance, which suggests that a percentage increase in LCHE_PC will increase LGDP_PC by 89.2 per cent. Finally, life expectancy at birth (LEB) has a negative effect on LGDP_PC at 10 percent significance level in the long run. By indicating, a unit increase in LEB will decrease LGDP_PC by 41.9 per cent.

The results suggest that an increase in per capita health spending will increase economic growth in Central Africa in the short run. Similarly, in the long run, an increase in life expectancy at birth decreases economic growth in Central Africa while an increase in per capita current health spending will increase economic growth in the long run.

Table 4. Dynamic Fixed Effects Regression: Estimated Error Correction Form

D.LGDP_PC	Coef.	Std. Err.	Z	P>|z|
	SHORT RUN			
ECT	-0.01466	0.007895	-1.86	0.035
LGE_D1.	-0.00297	0.032812	-0.09	0.928
LEB_D1.	0.000243	0.030886	0.01	0.994
LTHE_PC_D1.	0.075	0.00024	3.12	0.002***
LCHE_PC D1.	0.019527	0.038141	0.51	0.609
Constant	0.270926	0.178155	1.52	0.128
	LONG RUN			
LEB	-0.41911	0.827781	-1.71	0.073*
LTHE_PC	0.065502	0.129551	0.51	0.613
LCHE_PC	0.894545	0.309982	2.89	0.019**
Likelihood	259.6074			

*** p<0.01, ** p<0.05, * p<0.1 The standard errors are robust estimates

Source: Author's Computation 2021, data from World Development Indicator (WDI) Database

Pooled Mean Group effect of total health expenditure per capital on economic growth in Central Africa

From the table 4, the Pooled mean group effect shows that the The ECT value (-0.10338) is negative and significant at 5 per cent level of significance based on the Z-statistics, which indicates a convergence to equilibrium. Thus, the short run inconsistencies are being corrected and incorporated into the long run relationship. From the short run result, total health per capita expenditure (LTHE_PC) has a positive effect on LGDP_PC at all 5 and 10 levels of

significance in the short run, which indicates that a percentage increase in LTHE_PC will increase LGDP_PC by 8 per cent. Also, total health per capita expenditure (LTHE_PC) has a positive effect on LGDP_PC in 5 per cent significant level in the long run. This indicates that a percentage increase in LTHE_PC will increase LGDP_PC by 50.2 per cent. Also, life expectancy at birth (LEB) has a positive effect on LGDP_PC in 5 and 10 per cent significant levels in the long run indicating that a percentage increase in LEB will increase LGDP_PC by 4.3 per cent. The results suggest that an increase in per capita health spending will increase economic growth in Central Africa in the short run. Similarly, in the long run, an increase in life expectancy at birth and per capita current health-expenditure has a progressive impact on economic growth in Central Africa.

Table 5 Pooled Mean Group Regression

D.LGDP_PC	Coef.	Std. Err.	Z	P>|z|
	SHORT RUN			
ECT	-0.10338	0.045494	-2.2	0.017
LGE D1.	0.068425	0.048233	1.42	0.156
LEB D1.	0.036528	0.074766	0.49	0.625
LTHE_PC D1.	0.08219	0.003959	2.08	0.024**
LCHE_PC D1.	0.033981	0.030895	1.1	0.271
Constant	0.098239	0.041939	2.34	0.019
	LONG RUN			
LEB	0.043179	0.017613	2.45	0.014**
THE_PC	0.011878	0.005856	2.03	0.026**
LCHE_PC	0.501902	0.32785	1.53	0.126
LIKELIHOOD	259.6074			

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's Computation 2021, data from World Development Indicator (WDI) Database

The Hausman test for the Mean Group and Pooled Mean Group effects

The result of Hausman test results as presented in table 6a-b, the Chi-Square statistics of 1.32 with P-Value of 0.7243 indicates that the best model for the variables is the pooled mean group model.

Table 6. The Hausman test for the Mean Group and Pooled Mean Group effects

	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	Mg	Pmg	Difference	S.E.
LEB	0.898685	0.043179	0.855507	1.285607
THE_PC	0.591695	-0.01188	0.603573	0.857875
LCHE_PC	-3.41506	0.501902	-3.91696	5.217064
chi2(3)	1.32			
Prob>chi2	0.7243			

Source: Author's Computation 2021, data from World Development Indicator (WDI) Database

The Hausman test for the dynamic fixed effect and pooled mean group

The result of Hausman test results is presented in table 4.25b, the Chi-Square statistics of 13.14 with P-Value of 0.402 indicates that the best model for the variables is the pooled mean group model. Therefore, the results of the pooled mean group model are adopted and emphasized in this study.

Table 7. Hausman test of total health expenditure per capital on economic growth (DFE and PMG)

	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	DFE	Pmg	Difference	S.E.
LEB	0.419	0.043	0.376	0.009
THE_PC	0.066	-0.012	0.077	.
LCHE_PC	0.895	0.502	0.393	.
chi2(3)	13.14			
Prob>chi2	0.4020			

Source: Author's Computation 2021, data from World Development Indicator (WDI) Database

Total per-capital health expenditure and its effect on the growth of the economy across the East African region

Mean Group effect of total health expenditure per capital on economic growth in East Africa

From the short run and long run result in table 7, current per capita expenditure (LCHE_PC) has a negative effect on LGDP_PC at 5 and 10 per cent significant levels in the short run which indicates that a percentage increase in LCHE_PC will decrease LGDP_PC by 8.5 per cent. The ECT value (-0.02463) is negative and significant at 5 per cent level of significance based on the Z-statistics, which indicates a convergence to equilibrium,

indicating that the short run inconsistencies are being corrected and incorporated into the long run relationship. From the long run result, total health per capita expenditure (LTHE_PC) has a positive effect on LGDP_PC at all levels of significance which indicates that a percentage increase in LTHE_PC will increase LGDP_PC by 9 per cent. However, life expectancy at birth (LEB) harms LGDP_PC at 10 percent significant levels in the long-run indicating a percentage rise in LEB will decrease LGDP_PC by 24. 4 percent. Conclusively, the results suggest that an increase in current health spending will increase economic-growth in the short run in East Africa. Similarly, in the long-run, an increase in life expectancy at birth and per capita health expenditure will increase economic growth in East Africa.

Table 8. Mean-Group Estimation: Error Correction Form (Estimate results saved as MG)

D.LGDP_PC |	Coef.	Std. Err.	Z	P>|z|
|	**SHORT RUN**			
ECT |	-0.02463	0.012102	-2.04	0.029**
LGE |D1. |	0.029957	0.035257	0.85	0.396
LEB |D1. |	-2.03102	2.088716	-0.97	0.331
LTHE_PC |D1. |	-0.00058	0.001357	-0.43	0.668
LCHE_PC |D1. |	-0.08512	0.042042	-2.02	0.043**
Constant	-2.21922	2.406632	-0.92	0.356
|	**LONG-RUN**			
LEB |	-0.244188	13.98822	-1.75	0.081*
LTHE_PC |	0.08947	0.00011	8.11	0.000***
LCHE_PC |	0.768102	0.598473	1.28	0.199

Source: Author's Computation 2021, data from World Development Indicator (WDI) Database

Dynamic Fixed Effect of total health expenditure per capital on economic growth in East Africa

From the short run result in table 8, The ECT value (-0.02371) is negative and significant at all levels of significances based on the Z-statistics, which indicates a convergence to equilibrium, showing that the short run inconsistencies are being corrected and incorporated into the long run relationship. Total health per capita expenditure (LTHE_PC) has a positive effect on LGDP_PC at 5 percent significant level in the short run meaning that a percentage increase in LTHE_PC will increase LGDP_PC by 59.8 per cent. In the same vein, in the long run, LCHE_PC has a positive impact on

LGDP_PC on all levels of significance in the long-run, which indicates that a percentage rise in LCHE_PC will increase LGDP_PC by 6 per cent. The results suggest that an increase in per capita health spending will increase economic growth in East Africa in the short term. Similarly, in the long run, an increase in current health spending per capita has a positive impact on economic growth in East Africa.

Table 9 Dynamic Fixed Effects Regression: Estimated Error Correction Form (Estimate results saved as DFE)

D.LGDP_PC	Coef.	Std. Err.	Z	P>|z|
	SHORT RUN			
ECT |	-0.02371	-0.01378	-1.72	0.085
LGE |D1. |	0.020559	0.019333	1.06	0.288
LEB |D1. |	-0.15708	0.132534	-1.19	0.236
LTHE_PC |D1. |	0.598	0.00334	1.81	0.031**
LCHE_PC |D1. |	-0.00166	0.019636	-0.08	0.933
Constant	-0.00538	0.159233	-0.03	0.973
|	**LONG RUN**			
LEB |	0.243898	1.580455	0.15	0.877
LTHE_PC |	-0.00236	0.00333	-0.71	0.479
LCHE_PC |	0.060403	0.019388	3.12	0.002***

Source: Author's Computation 2021, data from World Development Indicator (WDI) Database

Pooled Mean Group effect of total health expenditure per capital on economic growth in East Africa

Table 9 shows that in the short run. Total health per capita expenditure (LTHE_PC) has a positive effect on LGDP_PC at 5 percent level of significance, which indicate that in short run there exists a significant relationship between LTHE_PC and LGDP_PC such that a change in total health per capita expenditure positively influences the LGDP_PC. However, LCHE_PC has a negative effect on LGDP_PC at 10 per cent level of significance, which indicates that a unit increase in LCHE_PC decreases in LGDP_PC by 5.5% in the short run. In the long run, total health per capita expenditure (LTHE_PC) has a negative effect on LGDP_PC at all levels of significance which indicates a percentage change in LTHE_PC will decrease LGDP_PC by 5 percent. Contrarily, current health per capital expenditure (LCHE_PC) has a positive effect on LGDP_PC at all levels of significance in the long run, which indicate that in the long run, a unit change in LCHE_PC

of a country increases LGDP_PC by 24 per cent. The results suggest that an increase in per capita health spending will increase economic growth in East Africa in the short term, while per capita current health spending will decrease economic growth. Similarly, in the long-run, an increase in per capita health expenditure decreases economic-growth, while a unit increase in per-capita current health outlay has a positive impact on economic-growth in East Africa.

Table 10. Pooled Mean Group Regression (PMG)

D.LGDP_PC	Coef.	Std. Err.	Z	P>|z|
	SHORT RUN			
ECT	-0.02748	0.008889	-3.09	0.005***
LGE D1.	0.047829	0.042292	1.13	0.258
LEB D1.	0.500129	0.663827	0.75	0.451
LTHE_PC D1.	9.72E-05	5.39E-05	1.8	0.038**
LCHE_PC D1.	-0.0555	0.031368	-1.77	0.077*
Constant	-0.02371	0.145148	-0.16	0.87
	LONG RUN			
LEB	-0.31663	0.203646	-1.55	0.12
LTHE_PC	-0.0532	0.001495	-3.56	0.000***
LCHE_PC	0.241629	0.093002	2.6	0.009***

Source: Author's Computation 2021, data from World Development Indicator (WDI) Database

The Hausman test for the Mean Group and Pooled Mean Group effects

The result of Hausman test results is presented in table 10a, the Chi-Square statistics of 1.74 with P-Value of 0.6272 indicates that the best model for the variables is the pooled mean group model.

Table 11. The Hausman test for the Mean Group and Pooled Mean Group effects

	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
|	Mg	Pmg	Difference	S.E.
LEB |	-24.4187	6 -.3166305	-24.1021	21.41206
LTHE_PC |	0.008946	9 -.0053236	0.014271	0.061984
LCHE_PC |	0.768102	2 .2416292	0.526473	0.911403
chi2(3)	1.74			
Prob>chi2	0.6272			

Source: Author's Computation 2021, data from World Development Indicator (WDI) Database

The Hausman test for the dynamic fixed effect and pooled mean group

The result of Hausman test results is presented in table 10 b, the Chi-Square statistics of -11.06 with P-Value of 0.000 indicates that the best model for the variables is the dynamic fixed effect model. Therefore, the results of the dynamic fixed effect model are adopted and emphasized in this study.

Table 12. The Hausman test for the dynamic fixed effect and pooled mean group

	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	DFE	PMG	Difference	S.E.
LEB	0.243898	-0.31663	0.560529	.
LTHE_PC	-0.00236	-0.00532	0.002968	.
LCHE_PC	0.060403	0.241629	-0.18123	.
chi2(3)	-11.06			
Prob>chi2	0.000			

Source: Author's Computation 2021, data from World Development Indicator (WDI) Database

5. Conclusion

In the short term, total per capita health expenditure (THE PC) has an upbeat consequence on the growth of the economy (LGDP PC) at all levels, according to a short and long run examination of total per capita health expenditure on the growth of economy in Central Africa. In the long term, current health per capital expenditure (CHE PC) has an upbeat consequence on the growth of economy (LGDP PC) at 5% and 10% significance levels, whereas life expectancy at birth harms economic growth. The outcomes of this study support the otherwise counterintuitive notion that total health expenditure per capital expenditure stimulates long-run economic growth in Central Africa.

Total health per capital expenditure (THE PC) has a favorable effect on the growth of economy (LGDP PC) in East Africa at 5 and 10% significant levels in the short and long run, whereas CHE GDP harms the growth of economy (LGDP PC) at all levels in the long run. In the short run, both total health per capital expenditure and life expectancy at birth (LEB) has an upbeat effect on the growth of economy (LGDP PC) in Southern Africa at all relevant levels. At all significant levels, both total health per capital expenditure and life

expectancy at birth (LEB) have an upbeat effect on the growth of economy (LGDP PC). The short-run analysis shows that current health per capital expenditure and government expenditure has an upbeat effect on the growth of economy (LGDP PC) at a 5 and 10% significant level, indicating that in the short run in West Africa, while total and current health per capital expenditure has an upbeat effect on the growth of economy (LGDP PC) at a 5 and 10% significant level, indicating that in the long run.

The short and long analysis of total per capita health expenditure on economic growth in Central Africa shows that total health per capital expenditure (THE_PC) has a positive effect on economic growth (LGDP_PC) at all levels in the short run. Current health per capital expenditure (CHE_PC) has a positive effect on economic growth (LGDP_PC) at 5 and 10 percent significant levels in the long run while life expectancy at birth harms economic growth. The findings of this study support the otherwise-intuitive suggestion that total health per capital expenditure stimulates long-run economic growth in Central Africa. This is consistent with the work of Piabuo, & Tieguhong (2017). On the contrary, Ogundipe and Lawal (2011) obtained a negative of total health expenditure on economic growth in Nigeria, while Oni (2014), three years earlier confirmed health expenditure as an important determinant of economic growth in Nigeria.

The effect of total per capita health spending on the growth of economy in the Central African region was embraced and underlined in this study, as were the results of the pooled mean group model. The findings indicate that increasing per capita health spending will boost economic growth in Central Africa in the short run. Similarly, an increase in life expectancy at birth and per capita current health expenditure has a long-term favorable influence on Central African economic growth. The effect of total per capita health expenditure on economic growth in the East African region was embraced and underlined in this study, as were the results of the dynamic fixed-effect model. According to the findings, increasing per capita health spending will boost economic growth in East Africa in the short term. Similarly, an increase in current health spending per capita has a long-term positive impact on East African economic growth. The findings imply that increasing per capita health spending will boost Central African economic growth in the short term while increasing life expectancy at birth and per capita current health expenditure will boost Central African economic growth in the long run. Because per-capita health spending has a beneficial impact on economic

growth, more monies should be spent, particularly to improve the doctor-patient ratio to assure the quality of health services obtained by each patient.

Refrences:

Atilgan, E., Kilic, D., & Ertugrul, H. M. (2017). The dynamic relationship between health expenditure and economic growth: is the health-led growth hypothesis valid for Turkey?. *The European Journal of Health Economics*, *18*(5), 567-574.

Akpokerere, O. E., & Ighoroje, E. J. (2013). The effect of government expenditure on economic growth in Nigeria: A disaggregated analysis from 1977 to 2009. *International Journal of Economic Development Research and Investment*, 4(1), 60-70.

Bedir, S. (2016). Healthcare expenditure and economic growth in developing countries. *Advances in Economics and Business*, *4*(2), 76-86.

Barros, P. P. (1998). The black box of health care expenditure growth determinants. *Health economics,* 7(6), 533-544

Devarajan, S., Swaroop, V., & Zou, H. (2006). The Composition of Public Expenditure and Economic Growth. *Journal of Monetary Economics, 37*, 313-344. http://dx.doi.org/10.1016/S0304-3932(96)90039-2.

Easterly, W., & Rebelo, S. (1993). Fiscal Policy and Economic growth: An Empirical Investigation. *Journal of Monetary Economics, 32*, 417-458. http://dx.doi.org/10.1016/0304-3932(93)90025-B

Erçelik, G. (2018). The relationship between health expenditure and economic growth in Turkey from 1980 to 2015. *Journal of Politics Economy and Management*, *1*(1), 1-8.

Frimpong, P. B., & Adu, G. (2014). Population health and economic growth in Sub-Saharan Africa: A panel cointegration analysis. *Journal of African Business, 15(1), 36-48*

Juma, R. S., Ouyang, H., & Cai, J. (2018). The effect of government expenditure on economic growth: The case of Tanzania using VECM approach.

Khan H. N., Razali R. B. & Shafie, A. B. (2016). Modeling Determinants of Health Expenditures in Malaysia: Evidence from Time Series Analysis. *Frontiers in Pharmacology*. 7(69)

Lingxiao, W. A. N. G., Peculea, A. D., & Xu, H. (2016). The relationship between public expenditure and economic growth in Romania: Does it obey Wagner's or Keynes's Law? *Theoretical & Applied Economics*, *23*(3).

Lopreite, M., & Zhu, Z. (2020). The effects of ageing population on health expenditure and economic growth in China: A Bayesian-VAR approach. *Social Science & Medicine*, *265*, 113513.

Odhiambo, N. M. (2021). Health expenditure and economic growth in sub-Saharan Africa: an empirical investigation. *Development Studies Research, 8(1), 73-81.*

Ogundipe, M. A., & Lawal, N. A. (2011). Health expenditure and Nigerian economic growth. European *Journal of Economics, Finance and Administrative Sciences.*

Oni, L. B. (2014). Analysis of the growth impact of health expenditure in Nigeria. *IOSR Journal of Economics and Finance*, *3*(1), 77-84.

Phi, G. (2017). Determinants of Health Expenditures in OECD Countries. Bryant University Honors Program, 1-39

Piabuo, S. M., & Tieguhong, J. C. (2017). Health expenditure and economic growth-a review of the literature and an analysis between the economic community for central African states (CEMAC) and selected African countries. *Health economics review*, *7*(1), 1-13. United Nations (2020), Africa Renewal; https://www.un.org/africarenewal/author/agnes-gatome-munyua-and-nkechi-olalere

Rengin, A. K. (2012). The relationship between health expenditures and economic growth: Turkish case. *International Journal of Business Management & Economic Research*, *3*(1), 404-409.

World Health Organization, (2011). *Determinants of health care expenditure*. A country Level Panel Analysis.

World Health Organization, (2014). *WHO African Region Expenditure Atlas.* Regional Office for Africa

Wang, K. M. (2011). Health care expenditure and economic growth: Quantile panel-type analysis. *Economic Modelling*, *28*(4), 1536-1549.

Zaidi, S., & Saidi, K. (2018). Environmental pollution, health expenditure and economic growth in the Sub-Saharan Africa countries: *Panel ARDL approach. Sustainable cities and society*, 41, 833-840