FINANCIAL DEVELOPMENT, EXTERNAL FINANCING AND HEALTH EXPENDITURE: EVIDENCE FROM SELECTED SUB-SAHARAN AFRICAN COUNTRIES

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ABSTRACT
Sustainable healthcare financing is key to achieving the third sustainable development goal of good health and well-being. However, relatively low levels of health expenditure and poor financial sector development still characterize most sub-Saharan African (SSA) countries. This study examined the effect of financial development and external financing on health expenditure. Decomposing health expenditure and using a randomly selected sample of seven SSA countries for 2000-2019, the seemingly unrelated regression estimator was employed. For further robustness, an interaction model was estimated and the causal relationship was examined. Domestic credit to the private sector and external financing through borrowings significantly reduced the impoverishing effect of high out of pocket expenditures, but they significantly increased public health expenditures, which is very important for improving population health. The robustness check revealed that the positive effect of external debt holds only when the growth of GDP is rising but this is only significant for public health expenditure. A panel granger causality test revealed that out of pocket expenditures and domestic credit to the private sector had a bidirectional causal relationship. The study recommends that policy reforms towards strengthening the financial sector should be adopted for achieving sustainability in health expenditure.

Keywords: Health expenditure; Financial development; External financing; sub-Saharan Africa; Seemingly unrelated regression model; Granger causality
JEL Classification: I18, G21, H63

1. INTRODUCTION
The third sustainable development goal of good health and well-being seeks to ensure healthy lives and promote well-being for all at all ages. This explains the drive towards the universal health coverage agenda by the World Health Organization to enable all individuals have access to health services when they need it without hindrance due to financial hardship. This agenda remains a mirage in many developing countries including SSA countries where health expenditure is relatively low and highly skewed towards out of pocket expenditure which have impoverishment effect. We emphasize that having a sustainable health expenditure is should be based on a consistent financial support. Hence the need for the development of the financial sector cannot be underestimated. Thus, having a sustainable health expenditure pattern is key to achieving the third sustainable development goal.

The need for a consistent increase in health care expenditure share of the GDP cannot be overemphasized in both developing and developed countries. It is important to ensure that an economy has a good population health status and this highly depends on having a sustainable health expenditure level. There is usually more emphasis on the need to have a relatively higher public health expenditure. Even developed countries continue to clamor for more health care expenditure that is public in nature. This is because having a greater proportion of health

expenditure as being out of pocket can be impoverishing. Narci *et al.* (2015) showed the poverty increasing effect of an increase in out of pocket expenditure. In order to maintain a steady growth of the GDP, thereby ensuring economic development, the current labour force must be healthy. In addition, the future working population which include the current dependent population below 15 must be catered for health wise towards improving their health stock. This ensures their increased future contribution to growth. The elderly population experience more depreciation than the younger population and hence may need a lot more medical expenditure to replace any depreciated stock of health.

Despite the poor population health status of many developing countries, many of such countries especially the sub-Saharan African countries are still characterized by low public health expenditure. Very little of economic resources are usually committed to health care spending in sub-Saharan African countries (Wagstaff et al. (2018)).

According to the World Health Organization, Sub-Saharan Africa incurred a loss of more than US$2.4 trillion from the region's gross domestic product as a result of the fact that nearly 630 million years of healthy life were lost in one year due to diseases alone (UNDP, 2023). Hence, although it is the region with the highest proportion of low-income countries, it can afford to invest US$15.5 billion a year for healthcare insurance. Such investment is a prudent investment when we consider the huge loss (UNDP, 2023). The need for more government support through financing healthcare spending is evident considering the low utilization of maternal healthcare services in many SSA countries especially among poor households; Oburota (2022) provided evidence for Nigeria. The importance of improving the health status of the population through increased health expenditure cannot be overemphasized. This buttresses the need for a strong and diverse health financing system especially in sub-Saharan Africa (Asante *et al.,* 2020). A healthy population implies improved labour productivity and thus the total output of an economy. This positive impact on economic growth is an important ingredient for economic development. For all the seven selected countries, we find a very high out of pocket health expenditure relative to the low level of public health expenditure. This has serious impoverishing effect on individuals and households by increasing the depth of poverty and the poverty head count as seen in the case of 122 countries; with the degree of impoverishment depending on the poverty line (Wagstaff *et al*. 2018). It was shown to contribute to household impoverishment in India (Yadav 2021). Health insurance has however been shown by Ebaidalla (2021) to reduce catastrophic health spending.

As shown by WHO (2023), health spending as a share of the GDP is greater among high income countries and lowest among lower-middle income countries. Domestic public health expenditure as a share of the GDP from 2015 to 2020 ranged from 0 to 5 percent of the GDP among the selected seven SSA countries while among developed countries such as Canada, United States of America, United Kingdom and Japan, the range was higher from 8 to 11 percent of the GDP (WHO, 2023). Low public expenditure on health was a major reoccurrence in the seven selected countries despite their recorded growth in the GDP. For example, in Guinea-Bissau, public health expenditure was 50.83 percent in year 2000 but declined to 8.66 percent in 2017, however, out of pocket expenditure was 32.44% in 2000 but increased to 76.15 in 2017 (WDI 2021).

Despite the recorded increases in the GDP, why is public health expenditure very low while out of pocket health expenditures is very high? Could further financing, whether domestic or external make a difference? Few studies have examined the effect of financial development especially for the case of Africa. Most developing African countries are characterized by low investment levels especially from the private sector and the consequential high unemployment, poverty and low output become unavoidable. There is usually a huge dependence on the

government for most services including basic services such as health care. The role of the financial sector in making excess funds from savers available to investors cannot be underestimated. Greater investment levels enhanced through a strong financial sector also increase the opportunities for employment and income earning by individuals thus empowering them to be able to meet their basic needs including private health expenditures. Despite studies including Gbesemete *et al.* (1992), Toor and Butt (2005) and Sahn (1992), which examined the determinants of health expenditures, the role of financial development was not considered nor was external funding. Studies such as Rana *et al.* (2021) examined the effect of financial development on health expenditure but from a global perspective including 159 countries. Koomson *et al.* (2021) showed the importance of financial inclusion for improving health expenditures but it focused only on out of pocket expenses. Fosu (2008) empirically investigated the effect of external debt on public health expenditure, however, other aspects of health expenditure were not considered. There remains the need however to examine whether financial development plays an important role in increasing health expenditure levels especially in Africa. This study examines the effect of financial development on health expenditure specifically in sub-Saharan Africa. We also investigated whether external financing alongside could explain health expenditure levels. The interaction effect of financial development and income on health expenditure were also examined.

2. LITERATURE REVIEW
2.1 Theoretical Literature
In this section, we discussed two theories including the Grossman theory of health demand, which examines the determinant of the demand for health and examines the amount of health investment/expenditure an individual would make. The second theory is the consumer theory, which examines a consumer's demand behavior in the light of his expenditure function or Hicksian demand function.

The Grossman (1972) theory of health demand states that health is both a consumption good and a capital good. Hence its demand provides utility and the demand for health is a derived demand. The demand for medical care and other health inputs is derived from the basic demand for health. Individuals are assumed to inherit an initial stock of health that depreciates with age but the health stock can be increased with investment. This necessitates the need for additional health expenditures. The amount of health investment/expenditure depends on the individual's income, education and available time for health activities.

The consumer theory examines consumer behavior with respect to utility maximization given price and income. Hicksian demand function states that total expenditure is dependent on income and price. Given the market prices, the Hicksian demand function seeks to determine the minimum expenditure necessary to achieve a given level of utility. The emphasis is on achieving the least cost possible or minimizing cost. According to Hicks (1939), changes in market prices will require some utility (gain or loss) compensation to the consumer in the form of income adjustments.

2.2 Empirical Literature
Developing countries are characteristically labour intensive, hence they cannot afford to have an unhealthy working population. The level of healthcare expenditure to a large extent, reflect the potential health status of a population. For instance, Ibrahim (2021) showed that government health expenditure, receiving anti-malarial drugs and other malaria control measures improved health outcomes as shown by greater reduction of malaria prevalence in Nigeria. The case for malaria as a health indicator is important because despite the fact that it is a common disease in the region, its impoverishment capacity is high, with households spending a significant proportion of their income on treatment as shown by Urama *et al.* (2017).

Public health expenditure was also found to improve long run life expectancy (Akintunde & Olaniran, 2022). Several studies have identified various significant determinants of health care expenditure but these studies paid no attention to the role of financial development. Income has been found to play a significant role in determining health expenditure levels in countries, for instance, Akca *et al*. (2017) found it to be the most important determinant. Several studies, some of which are discussed below mostly focused on the role of income with no consideration for financial sector development nor the effect of external financing.

For instance, conducting a panel study for some states in Italy, Magazzino and Mele (2012) found that income elasticity, the elasticity of the ageing population, urban residence and the number of hospital beds were positively significant to explain real health expenditures while educational attainment was negatively significant. Mortality rate and birth rate were however insignificant. Further control for endogeneity was conducted using the GMM estimator.

Rather than the conventional asymptotic statistical methods, the jackknife resampling method was shown to be more reliable for estimating short data time series regressions in Okunade *et al*. (2004). Estimating a box-cox regression model, the real GDP growth was found to induce real health expenditure growth. The findings also revealed that health systems that had a low initial health expenditure later grew at a higher pace while those that had an initially high expenditure later grew at a slower pace. The relative price of health care also had a positive significant effect. The growth in physician density was positively significant, confirming the presence of supplier induced demand. Employing the jackknife resampling method showed that there were differential impacts of certain determinants across the different growth sub-periods. The effectiveness of the different health policy designs including gate-keeping, integrated systems, fee-for-service, capitation amongst others, was shown to vary across the different sub-periods.

Considering 18 Arab countries using the pooled mean group estimator and the common correlated effects estimator, Barkat *et al*. (2019) also found a long run relationship between health expenditure and income/GDP as well as technological progress proxies including mortality rate, life expectancy, and the population beyond 65 years of age. The technological proxies were included separately in the model. The results showed that technological progress evident in the form of increased life expectancy and ageing population were positively significant, however, when measured as the mortality rate denoting poor medical technological progress, the effect is significantly negative. The income effect was positive and significant with income elasticities less than one showing health expenditure as a necessary good in the high income, upper middle income and lower middle income groupings of the countries. They also found a bidirectional relationship between total health expenditure and the GDP. Income elasticity was shown to become very low when omitted variable bias and econometric problems were corrected. Thus the income elasticity of public health expenditure changes depending on whether other variables are included (Prieto and Lago-Penas, 2012).

Yetim *et al*. (2020) found income and education to be the most important factors explaining health expenditure in OECD countries. A negative significant effect was observed for the inflation rate. However, unemployment and the dependency ratio were not significant. Roberts (2000) however criticized the use of inflation rate precisely in the health expenditure model by Hitiris (1997) since it encompasses more than just the health care prices. He also maintained that the dependency ratio has a negative effect rather than the positive effect obtained in Hitiris (1997).

Hartwig and Sturm (2014) focused on confirming the two robust determinants of health expenditure in the literature, which are the real GDP and Baumol's variable (based on Baumol's (1967) model which states that the amount by which the growth of wage is greater than the growth of productivity has an effect on the growth of health care expenditure). Using the extreme bounds analysis in order to control for model uncertainty, they found the growth of the GDP and Baumol's variable to be significant. Some other robust determinants of health care expenditure growth obtained were the growth in expenditure on health administration and the change in the share of inpatient expenditure in total health expenditure. Employing an outlier-robust MM estimator, the (lagged) government share in GDP, the change in the insurance coverage ratio, the growth in land traffic fatalities and the growth in the population share undergoing renal dialysis were also significant factors.

Based on the Johansen cointegration test and the variance decomposition analysis conducted, Tang (2010) found a positive long run relationship between health care expenditure and real per capita income however the income shock was relatively small compared to the fact that a greater percent of variations in its forecast error was due to its own shock. The cointegrating relationship with the price of health care was negative but it was positive for the percentage of population above 65 years. A bi-directional causality was obtained between income and health care expenditure using the TYDL causality test.

Ang (2010) also found the income elasticity to be greater than one in Australia denoting health care as a luxury good. Applying an unrestricted error correction model and a dynamic ordinary least squares estimate, the per capita real GDP was positively significant as well as the demographic structure measured as the under 15 and above 65 population. The density of health sector employment was also positive supporting the supplier- induced demand hypothesis.

Herwetz and Theilen (2003) showed that the relationship between health care expenditure and other variables may not be homogenous across countries and may also differ for different sample periods.
Using the fixed effect and dynamic panel model, Xu, *et al.* (2011) estimated the determinants of health expenditure decomposed into total health expenditure, government health expenditure and out of pocket health expenditure in 143 countries. They found that the GDP had a positive effect on government health expenditure and the income elasticity was higher for low-income countries than for high income countries. Public expenditure of government caused an increase in government health expenditure and total health expenditure but had no significant effect on the out of pocket expenditure. An increase in out of pocket expenditure also had a positive effect on government health expenditure. Examining the role of external funding measured as external aid, it was found to have a negative effect on public health expenditure. However, the effect was positive for lower middle income countries but negative for higher income countries. The role of external debt was not considered. Matteo (2005) also focused on the effect of income, age distribution and time on real per capita health expenditure without financial development considerations. Health related challenges such as the state of the environment could also explain the level of health expenditure. For instance, the presence of air pollution was shown to explain high health care expenditures on respiratory diseases outpatient care in Taiwan during 2006 to 2012 (Liu and Ao, (2020)). Population aging has also been shown to impact on health care expenditure in Switzerland by causing future growth in per capita health care expenditure, however, the impact was relatively small (Steinmann *et al.*, 2007). The study accounted for both mortality and morbidity components. Examining the determinants of public health spending in Ghana, Boachie *et al.* (2014) found that life expectancy significantly

increased public health spending. Crude birth rate and the real GDP also had a positive significant effect. Poor population health as indicated by individuals having chronic conditions were also found to increase catastrophic out of pocket health expenditure in Peru, rural Malawi and China as shown by Falconi and Bernabe, (2018), Nakovics *et al.* (2020) and Liu *et al.* (2021) respectively.

Some studies have shown the pertinent role of external financing through capital inflows and its contribution to health expenditures but their focus was on foreign aid and not external debt. Murthy and Okunade (2008) found that real per capita GDP and real per capita foreign aid positively and significantly determined real per capita health expenditure in 44 African countries. The number of persons per physician and the population health status measured by the maternal mortality rate was not significant. The positive income elasticity they obtained revealed income as a luxury good rather than a necessity in Africa.

Examining the determinants of health expenditure in Africa, Gbesemete *et al.* (1992) also showed that the GNP per capita is still the most important factor. Using cross sectional data for 1984 covering 30 African countries, 78.3 percent of health care expenditure variations were explained by the GNP per capita, per capita foreign aid received and the percentage of births attended by a health staff. The three variables were positively significant. Using time series data, Toor and Butt (2005) showed that urbanization, literacy rate, crude birth rate, real GDP per capita and foreign aid are significant determinants in Pakistan. These studies however did not consider the effect of external debt financing. Fosu (2008) however considered the role of external debt and although actual debt servicing had a little effect on public health expenditure, increasing debt burden as a result of constraints faced in servicing debts in 35 sub-Saharan African countries had a decreasing effect on public health expenditure as shown by Fosu (2008). External aid however was found to have an increasing effect. The study does not consider other aspects of health expenditure. Capital inflows in the form of remittances was demonstrated by Yol (2017) to have an increasing effect on private health expenditure but a reduction effect on public health spending in 46 developing countries when the direct and indirect effects were investigated.

Employing the seemingly unrelated regression estimator to examine the effect of external debt servicing on public expenditure using panel data from 1975 to 1994, Fosu (2010) found that debt servicing shifted government spending away from the social sectors for the case of 35 SSA countries. This implies a consequential reduction in health expenditure due to the constraint of having to service foreign debts. This was also the case for education.

The population health status of a country can be detected from the level of human development because it is one of the compositions of human development. Using the panel smooth threshold regression model, Zaghdoudi (2018) showed that external debt had a non-linear relationship with human development for 95 developing countries, with a positive effect below the debt threshold. It however did not consider its effect on healthcare expenditure.

External debt was also found by Ma *et al.* (2022) to worsen health outcomes such as increasing infant mortality rate and decreasing life expectancy in emerging Asian economies in the long run based on a panel ARDL model. The study also found a two way causality between health expenditure and external debt.

On the effect of financial development, Rana *et al.* (2021) presented a global perspective using 159 countries, Chirese and Ocran (2020) examined the case for SSA while Koomson *et al.* (2021) focused only on Ghana. Rana *et al.* (2021) found a long run significant effect of financial development on health expenditure using a panel autoregressive distributed lag model. Controlling for cross sectional dependence using the common correlated effects mean group method, financial development was found to have a positive significant effect on health

expenditure. Countries with higher income levels were found to have increasing health care expenditure if they had a lower corruption level.

Koomson *et al.* (2021) showed that more financial inclusion significantly increased out of pocket expenditures of households in Ghana. A greater effect was obtained in female headed households and urban households. Employing the fixed effect, random effect and two stage least squares estimation methods, Chirese and Ocran (2020) examined the effect of financial development on health expenditure in SSA and found a positive significant effect of financial development (proportion of broad money and bank credit to the private sector as a ratio of the GDP) on both public and private healthcare expenditures.

This study considers the effect of financial development with a focus on the case for sub-Saharan Africa. It also provides further confirmation to the Chirese and Ocran (2020) study since it uses a sub-sample of seven selected SSA countries and a different estimation method which further controls for cross equation correlation.

3. METHODOLOGY
3.1 Theoretical Framework and the Model

The model employed is based on the Grossman (1972) theory of health demand, which posits the demand for health as a function of income among other health production inputs. The Grossman (1972) theory of health demand states that health is both a consumption good and a capital good. Hence its demand provides utility and the demand for health is a derived demand. The demand for medical care and other health inputs is derived from the basic demand for health. Individuals are assumed to inherit an initial stock of health that depreciates with age but the health stock can be increased with investment. This necessitates the need for additional health expenditures. The amount of health investment/expenditure depends on the individual's income, education and available time for health activities.

We therefore present health care expenditure as a function of the GDP annual growth rate and extend the model to capture the effect of financial development measured as domestic credit to the private sector. Other control variables included are the population health status (measured as the under five mortality rate and the number of maternal deaths), external debt, total fertility rate, and foreign aid.

The model is presented as:

$$HE = f (RGDP, DCPS, U5MR, NMD, EXD, TFR, FAID) \tag{1}$$

The functional form of the panel regression model is given as:

$$HE_{it} = \beta_0 + \beta_1 RGDP_{it} + \beta_2 DCPS_{it} + \beta_3 U5MR_{it} + \beta_4 NMD_{it} + \beta_5 EXD_{it} + \beta_6 TFR + \beta_7 FAID_{it} + e_{it} \tag{2}$$

Where:
HE = Health expenditure
RGDP = GDP growth
DCPS = Domestic credit to the private sector
U5MR = Under five mortality rate (number of under five deaths per 1,00 live births)
NMD = Number of maternal deaths
EXD = External debt
TFR = Total fertility rate

FAID = Foreign aid

Health expenditure was decomposed into three types including out of pocket health expenditure, private health expenditure and public health expenditure. The effect of external sources of funds was captured using external debt and foreign aid received. We expect them to contribute towards increasing public health expenditure and reducing out of pocket expenditure. An increase in the total fertility rate also increases the dependency ratio below 15 years. This group of the population do not earn income since they are not part of the labour force and so we expect public health expenditure to increase as well as out of pocket health expenditures since due to their developmental stage of growth, their need for health care services would be higher that that of grown up adults. Using the three measures of health expenditure, there were therefore three models or equations to be estimated, resulting to a system of linear equations. Model 1 is the out of pocket health expenditure model, model 2 is the private health expenditure model and model 3 is the public health expenditure model. The panel regression models were estimated using the seemingly unrelated regression estimator, which enabled the examination of the effect of financial development and external financing on the three measures of health expenditure simultaneously. The seemingly unrelated regression estimator extends the generalized least squares estimation to a system of linear equations. Conducting a robustness check, the study also estimated an interaction model where the interaction effect of income growth was examined.

A granger causality test based on a panel vector autoregression approach was also employed to examine the dynamic causal relationship among the variables.

3.2 Data and Source

Data for the study was obtained from the World Development Indicators (2020). Seven selected sub-Saharan African countries made up the sample and these countries are from the five regions (north, south, east, west and middle Africa) in SSA. The countries include Nigeria, Guinea-Bissau, Sudan, Congo Democratic Republic, Ghana, Botswana and Tanzania. The period of the study was determined based on data availability and was from 2000 to 2018. The World Development Indicators is published by the World Bank and includes economic and demographic data amongst others for several countries.

4. RESULTS AND DISCUSSION OF FINDINGS

The descriptive statistics are presented in Table 1 including the mean, standard deviation, minimum and maximum values of the variables.

Table 1 Definition of Variables and Descriptive Statistics

Variables	Definition	Mean	Standard Deviation	Minimum	Maximum
Out of pocket health expenditure	Share of out of pocket payments of total current health expenditures (%).	45.082	22.115	2.993	77.225
Private health expenditure	Share of current health expenditures funded from domestic private sources such as households, corporations and non-profit organizations (%).	51.909	18.321	14.729	80.429
Public health expenditure	Share of current health expenditures funded from	30.583	17.674	4.062	77.476

	domestic public sources for health (%).				
Domestic credit to the private sector	Financial resources provided to the private sector by financial corporations (% of GDP)	11.539	7.594	0	33.773
GDP growth	Annual percentage growth rate of GDP at market prices based on constant local currency	5.036	3.326	-7.652	15.329
External debt	Total external debt stocks to gross national income (%)	52.513	55.488	3.899	265.206
Log of Foreign aid	Net bilateral aid flows from the Development Assistance Committee (DAC) donors.	19.943	1.423	16.996	23.118
U5 mortality rate	Probability per 1,000 that a newborn baby will die before reaching age five	95.055	38.098	35.1	183.1
Total fertility rate	Total number of children ever born	5.021	1.062	2.874	6.751
Number of maternal deaths	Death of a woman while pregnant or within 42 days of termination of pregnancy.	14497.44	21441.41	81	67000

Source: World Development Indicators (2020)

4.1 Estimates of the Health Expenditure Models

Estimating the effect of financial development and foreign debt on health expenditure, three measures of health expenditure was used. Thus, there were three models or equations resulting to a system of linear equations. Model 1 is the out of pocket health expenditure model, model 2 is the private health expenditure model and model 3 is the public health expenditure model. The study employed the seemingly unrelated regression estimator, which extends the generalized least squares estimation to a system of linear equations. The test for error independence across the equations was conducted. The study also tested for cross equation constraints. The results of the three estimated equations are presented in Tables 2 to 6 below. For further robustness check, the study also estimated an interaction model where the interaction effect of income growth was examined. The dynamic causal relationship among financial development, external financing through debt and health expenditure was also investigated using the granger causality test. The granger causality test or block exogeneity wald test was conducted based on a vector autoregression model. The results are presented in Tables 7 to 12.

4.1.1 The Seemingly Unrelated Regression Model

The estimates of the seemingly unrelated regression model are presented in Table 2.
Domestic credit to the private sector had a significant effect on the three health expenditure measures. While it significantly caused a reduction in out of pocket health expenditure and private health expenditure, it had a significantly increasing effect on public health expenditure. The positive effect on public health expenditure is similar to Rana *et al.* (2021) and Chireshe and Ocran (2020). An increase in domestic credit to the private sector enables more individuals

and firms to have access to funds for investment thus increasing the investment level. The government consequently enjoys more tax from the increased number of investors thereby equipping them to be able to spend more on health and other social services. The reduction effect on private expenditure and out of pocket health expenditures may be due to the fact that individuals would need to spend more on investment activities for which the loans and credits was obtained inorder to be able to meet their repayment obligations as at when due. It is however contrary to Koomson *et al.* (2021), which found a positive effect of financial development on out of pocket expenditures. It is also contrary to Chireshe and Ocran (2020), which found bank credit to the private sector as a ration of the GDP to have a positive effect on private healthcare expenditure.

The growth in GDP had a negative significant effect on private health expenditure. This is similar to Chireshe and Ocran (2020) but contrary to Alimi *et al.* (2019), which found a positive effect for the case of ECOWAS. On the otherhand, the GDP growth caused public health expenditure to rise as obtained in Xu *et al.* (2011), Alimi *et al.* (2019) and Chireshe and Ocran (2020). This is also consistent with Boachie *et al.* (2014) that also found a positive significant effect of the real GDP on public health expenditure in Ghana. This positive effect implies that the government has a perception of health as a luxury good Thus, while the growth in national income caused government expenditure on health to increase, it caused a decline in health expenditure levels by individuals, corporations and non-governmental organizations. Thus, it is either the GDP growth may not be impacting the income of private individuals and firms enough to influence their health expenditures or health is not seen as a necessary good. Income growth was however insignificant to explain out of pocket expenditures. Alimi *et al.* (2019) however found a positive significant effect for both private and public health expenditures for the case of ECOWAS.

Table 2 Estimates of the Seemingly Unrelated Regression Model

Variables	Model 1 Coefficient (z statistic)	Model 2 Coefficient (z statistic)	Model 3 Coefficient (z statistic)
Domestic credit to the private sector	-2.072(-5.89)*	-1.709(-5.31)*	1.660(7.96)*
GDP growth	-0.725(-1.70)	-0.833(-2.18)**	0.897(3.26)*
External debt	-0.100(-2.86)**	-0.052(-1.63)	0.183(7.01)*
Log of Foreign aid	4.620(3.51)*	1.184(1.06)	-2.096(-2.58)*
U5 mortality rate	0.215(4.49)*	-	-0.167(-3.08)*
Total fertility rate	-8.716(-3.17)*	-5.477(-2.46)**	-
Number of maternal deaths	-	0.000(4.53)*	0.000(2.29)**
Constant	9.086(0.34)	79.151(3.35)*	52.583(2.65)*
Equation	**Observations**	**R²**	**Chi2(prob)**
Out of pocket health expenditure	133	0.4473	122.36(0.0000)
Private health expenditure	133	0.3334	74.17(0.0000)

Public health expenditure	133	0.6526	266.34(0.0000)

- and ** imply significance at the !% and 5% significance level respectively.

An increase in external debt caused reductions in out of pocket expenditures of individuals thereby improving their welfare level since it caused a corresponding increase in public health expenditure for the period. Thus, external financing through borrowings significantly reduced the impoverishing effect of high out of pocket expenditures. On the otherhand, it significantly increased public health expenditures which is very important for improving population health. This is contrary to Xu *et al*. (2011) that found a negative effect. The log of financial aid significantly increased out of pocket expenditures but had a reduction effect on public health expenditure. This is possible when financial aids received are not actually directed to improving the health sector; or when the funds directed to the health sector are not efficiently utilized due to corruption. The population health status as shown by the under five mortality rate had a significant increasing effect on out of pocket expenditures. Thus, as the population health worsened, individuals and households therefore increased their health expenditures but surprisingly, the percentage of public health expenditures from total heath expenditures rather declined. This shows a weak government response. When population health is captured by the number of maternal deaths, we found that both private and public health expenditure increased with increasing maternal deaths. This is similar to Liu *et al.* (2021), Nakovics *et al*. (2020) and Falconi and Bernabe (2018), which found a positive effect of poor population health (indicated by individuals having chronic health conditions) on the magnitude of catastrophic health spending.
Total fertility rate had a negative significant effect on both out of pocket and private health expenditures. Thus, as the dependency ratio below 15 increases, the demand for more basic needs such as food and shelter increases, thereby requiring more expenditures on them such that less is finally spent on health.

Financial development as measured by domestic credit to the private sector is a significant determinant of health expenditure as shown for all the three measures used. External financing through external debt and foreign aid are significant determinants of out of pocket expenditures and public health expenditures as presented in both models 1 and 3 but are not significant to explain private health expenditure as shown in model 2.

Test for Correlation of the Residuals

Table 3 Correlation Matrix of Residuals

	Out of pocket health expenditure	Private health expenditure	Public health expenditure	
out of pocket health expenditure	1.0000			
private health expenditure	0.9020	1.0000		
public health expenditure	-0.6645	-0.6540	1.0000	
Breusch-Pagan test of	223.811(0.0000)			

independence: chi2(3)				

Table 4 Test for Cross Equation Constraints

Chi2(6)	240.09
Prob> chi2	0.0000

The test for correlation of the residuals in Table 3 showed that the errors in the out of pocket and private health expenditure equations are positively correlated. The errors in the out of pocket and public health expenditure equations are negatively correlated while the errors in the private health expenditure and public health expenditure equations are negatively correlated. The Breusch-Pagan Lagrange multiplier test for error independence showed that the correlation between the errors in the three equations are highly significant. This shows that the three health expenditure measures have the same underlying determinants. The test for cross equation constraints in Table 4 revealed that the three regressors (domestic credit to the private sector, external debt and log of foreign aid) were jointly significant in all the three equations to explain changes in the three health expenditure measures.

4.2 Robustness Check Using an Interaction Model

For further robustness checks, an interaction model was estimated and the results are presented in Table 5. Interacting domestic credit to the private sector with the real GDP we found that the growth of income positively influenced the effect of financial development on public health expenditure. Income growth increased the available domestic credit because it increases the excess funds of savers that are usually transferred to the private sector through financial institutions. Therefore as the private sector get more access to funds, they are also able to pay their taxes thereby causing public health expenditure to increase. This is similar to Rana *et al.* (2021) and Chireshe and Ocran (2020). However, the negative significant effect on out of pocket and private health expenditures still holds, which is consistent with Koomson *et al.* (2021) but contrary to Chireshe and Ocran (2020).

Table 5 Estimates of the Seemingly Unrelated Regression Interaction Model

Variables	Model 1 Coefficient (z statistic)	Model 2 Coefficient (z statistic)	Model 3 Coefficient (z statistic)
Domestic credit to the private sector *GDP	-0.168(-4.70)*	-0.121(-3.77)*	0.137(6.08)*
External debt * GDP	0.002(0.37)	0.010(1.64)	0.017(2.95)*
Log of Foreign aid * GDP	5.061(4.26)*	1.980(2.01)**	-4.780(-7.35)*
U5 mortality rate	0.180(3.99)*	-	-0.184(-3.75)*
Total fertility rate	-4.040(-1.53)	-2.032(-1.02)	-
Number of maternal deaths	-	0.000(4.56)*	0.000(2.12)**
Constant	-50.754(-2.62)*	21.256(1.27)	136.068(9.13)*
Equation	**Observations**	**R^2**	**Chi2(prob)**

Out of pocket health expenditure	124	0.3950	83.47(0.0000)
Private health expenditure	124	0.2863	50.53(0.0000)
Public health expenditure	124	0.5346	146.35(0.0000)

* and ** imply significance at the !% and 5% significance level respectively.

Table 6 Correlation Matrix of Residuals

	Out of pocket health expenditure	Private health expenditure	Public health expenditure	
Out of pocket health expenditure	1.0000			
Private health expenditure	0.9058	1.0000		
Public health expenditure	-0.6369	-0.6322	1.0000	
Breusch-Pagan test of independence: chi2(3)	201.579(0.0000)			

The positive effect of external debt holds when the growth of GDP is rising but this is only significant for public health expenditure. When the log of foreign aid is interacted with GDP, it becomes significant to explain all the three measures of health expenditure. The interaction model shows that the effect of financial development on health expenditure is influenced by the growth of the GDP. The Breusch-Pagan Lagrange multiplier test for error independence in Table 6 showed that the correlation between the errors in the three equations are highly significant. This shows that the three health expenditure measures have the same underlying determinants.

4.3 Causal Relationship between Financial Development, External Debt and Health Expenditure
4.3.1 Unit Root Test
In order to examine the causal relationship between financial development, external debt and health expenditure, a panel VAR model was estimated and thereafter a granger causality test was conducted using the three measures of health expenditure. The estimation began with a unit root test conducted using the Levin, Lin & Chu unit root method and the Im, Pesaran and Shin method. The results showed a mixed order of integration among the variables as presented in Table 7. Hence, we proceed to examine the long run relationship among the variables using the Pedroni residual cointegration test.

Table 7 Unit Root Test

Variable	Levin, Lin & Chu Statistic	Order of Integration	Im, Pesaran and Shin W-Statistic	Order of Integration

Domestic credit to the private sector	(-2.691)*	I(0)	(-4.432)*	I(1)
GDP growth	(-2.775)*	I(0)	(-3.330)*	I(0)
External debt	(-1.761)**	I(0)	-	-
Log of Foreign aid	(-3.382)*	I(0)	(-3.074)*	I(0)
U5 mortality rate	(-6.104)*	I(0)	(-4.008)*	I(0)
Total fertility rate	(-15.765)*	I(0)	(-17.305)*	I(0)
Number of maternal deaths	(-2.408)*	I(0)	(-3.732)*	I(1)
Out of pocket expenditure	(-4.171)*	I(1)	(-5.104)*	I(1)
Private health expenditure	(-4.375)*	I(1)	(-5.175)*	I(1)
Public health expenditure	(-5.486)*	I(1)	(-5.860)*	I(1)

* and ** denote significance at 1% and 5% level respectively

4.3.2 Pedroni Residual Cointegration Test
For the first model, we test for cointegration among out of pocket expenditure, Domestic credit to the private sector and external debt, we employed the Pedroni Residual Cointegration Test. The result is presented in Table 8.
For the second model, we test for cointegration among private health expenditure, domestic credit to the private sector and external debt. The result is presented in Table 9. For the third model, we also test for cointegration among public health expenditure, domestic credit to the private sector and external debt, we employed the Pedroni Residual Cointegration Test. The result is presented in Table 10. The null hypothesis of no cointegration was rejected for all the three models since three of the 4 test statistics including the panel and group PP and ADF statistics were significant at 5%. There is therefore cointegration among the variables.

Table 8   Pedroni Residual Cointegration Test

	Statistic	**Probability**	**Weighted Statistic**	**Probability**
Panel PP-Statistic	-2.717	0.0033	-3.663	0.0001
Panel ADF-Statistic	-4.619	0.0000	-4.311	0.0000
Group PP-Statistic	-4.555	0.0000	-	-
Group ADF-Statistic	-4.449	0.0000	-	-

Source: Computed by Author (2022)

Table 9   Pedroni Residual Cointegration Test

	Statistic	Probability	Weighted Statistic	Probability
Panel PP-Statistic	-2.188	0.0143	-2.201	0.0139
Panel ADF-Statistic	-3.250	0.0006	-2.342	0.0096
Group PP-Statistic	-3.300	0.0005	-	-
Group ADF-Statistic	-3.642	0.0001	-	-

Source: Computed by Author (2022)

Table 10   Pedroni Residual Cointegration Test

	Statistic	Probability	Weighted Statistic	Probability
Panel PP-Statistic	-1.582	0.0569	-1.419	0.0780
Panel ADF-Statistic	-2.662	0.0039	-1.390	0.0822
Group PP-Statistic	-2.094	0.0181	-	-
Group ADF-Statistic	-2.706	0.0034	-	-

Source: Computed by Author (2022)

4.3.3 Granger Causality Test

Based on an estimated panel VAR model, a granger causality test or block exogeneity wald test was conducted to examine the relationship between out of pocket expenditure, domestic credit to the private sector and external debt. The optimal lag applied in the panel VAR model estimation was determined as 2 based on the Akaike information criterion.

Relationship among Out of Pocket Health Expenditure, Domestic Credit to the Private Sector and External Debt

The results in Table 11 showed that external debt granger caused out of pocket expenditures but not vice versa. Thus, there was a one-way causality running from external debt to out of pocket expenditure such that despite the increase in borrowings and foreign loans, the impoverishing effect of health spending continue to increase as individuals continue to bear the burden of their health needs directly.

Table 11 VAR Granger Causality/Block Exogeneity Wald Tests Using Out of Pocket Health Expenditure

Dependent variable: DCPS

Excluded	Chi-sq	df	Prob.
ED_	6.277734	2	0.0433
OOP	5.880716	2	0.0528
All	11.01090	4	0.0264

Dependent variable: ED_

Excluded	Chi-sq	df	Prob.
DCPS	1.106472	2	0.5751
OOP	1.425330	2	0.4903
All	2.789587	4	0.5936

Dependent variable: OOP

Excluded	Chi-sq	df	Prob.
DCPS	0.185756	2	0.9113
ED_	12.00807	2	0.0025
All	12.36757	4	0.0148

Domestic credit to the private sector granger cause out of pocket expenditure jointly with external debt. Thus, the amount of domestic credit made available to support the private sector affect out of pocket expenditures only when we control for external debt levels. Thus SSA countries must be cautious to ensure that external debts are only obtained when necessary and only to provide sustainable income generating infrastructures that can not only service the debt but also support national budget expenditures including health. Out of pocket expenditures and external debt had a joint significant causality on domestic credit to the private sector. Therefore, out of pocket expenditures and domestic credit to the private sector have a feedback effect jointly with external debt. External debt was found to granger cause domestic credit to the private sector.

Relationship among Private Health Expenditure, Domestic Credit to the Private Sector and External Debt
The neutrality hypothesis holds in the relationship between private health expenditure and domestic credit to the private sector. This is not surprising since there is already the challenge of low access and unaffordability of credit to the private individuals including those in the health sector as a result of high interest rate. However, there was a unidirectional causality running from external debt to private health expenditure. Thus, external debt levels

significantly cause changes in private health expenditure just as in the case of out of pocket expenditure.

Relationship among Public Health Expenditure, Domestic Credit to the Private Sector and External Debt

Considering public health expenditure, Table 12 shows that there was a unidirectional causality running from public health expenditure to domestic credit to the private sector. Hence, as government increases the funding of the health sector, more individuals get employed in the provision of such health infrastructures and services. They also save some of such income in financial institutions, which are given as loan or credit to investors. Therefore, increased public health expenditure create more jobs and opportunities for individuals to earn income. As income increases, the ability of individuals to save also increases since not all of income is consumed. Such savings form the credit available for investors. External debt was also found to granger cause domestic credit to the private sector and not vice versa, implying a one-way causality. Therefore credit access to private sector investors increase with higher government foreign borrowings. Thus as the government spend these borrowing on income generating infrastructures, more individuals in the economy get to earn income thereby, increasing their ability to save. The increase in savings ultimately increase credit availability by financial institutions to investors.

5. CONCLUSION AND POLICY RECOMMENDATIONS

Using a panel approach, this study examined the effect of financial development and external financing on health expenditure. Decomposing health expenditure and using a randomly selected sample of seven sub-Saharan African countries for 2000-2019, the seemingly unrelated regression estimator was employed. For further robustness, an interaction model was estimated and the causal relationship among the variables was examined using a granger causality test.

Financial development measured as domestic credit to the private sector was found to significantly determine the three health expenditure measures. While it significantly caused a reduction in out of pocket health expenditure and private health expenditure, it had a significantly increasing effect on public health expenditure. An increase in external debt caused reductions in out of pocket expenditures of individuals thereby improving their welfare level since it caused a corresponding increase in public health expenditure for the period. Thus, domestic credit to the private sector and external financing through borrowings significantly reduced the impoverishing effect of high out of pocket expenditures. This implies that it provided individuals with more access to funds to be able to cater for their healthcare spending without necessarily reducing their consumption of other basic needs. On the otherhand, they significantly increased public health expenditures, which is highly recommendable for improving population health. Thus, financial development and external financing enhanced government's capacity to increase its health sector expenditures. The robustness check revealed that the positive effect of external debt holds only when the growth of GDP is rising but this is only significant for public health expenditure. Therefore, acquiring more external debt improves public health expenditure if such debts translate to sustained GDP growth. This enables such debts to be easily serviced and the credibility of the nation sustained. The effect of domestic credit to the private sector remained the same.

There was a one-way causality running from external debt to out of pocket expenditure. However, there was a unidirectional causality running from external debt to private health expenditure. The neutrality hypothesis holds in the relationship between private health expenditure and domestic credit to the private sector. There was a unidirectional causality

running from public health expenditure to domestic credit to the private sector. However, out of pocket expenditures and domestic credit to the private sector had a bidirectional causality implying that there was a feedback effect although jointly with external debt. Hence, increasing credit access to the private sector is pertinent for reducing out of pocket expenditures provided foreign debts are judiciously and efficiently utilized.

Despite the increase in foreign aid, it did not reduce the impoverishing effect of increased out of pocket expenditures but increased it. It also encouraged a reduction in public health expenditures. This calls for a critical look at the usage of foreign aid towards preventing corrupt practices. Poor population health shown by increasing maternal deaths and under five mortality further increased health expenditure.

Further studies could also use other measures of financial development that capture the informal financial sector. Examining the differentials across low income and high-income SSA countries is also suggested.

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