Chireshe & Ocran, *Cogent Economics & Finance* (2020), 8: 1771878
https://doi.org/10.1080/23322039.2020.1771878

cogent economics & finance

GENERAL & APPLIED ECONOMICS | RESEARCH ARTICLE

Financial development and health care expenditure in Sub Saharan Africa Countries

Jaison Chireshe[1]* and Matthew K. Ocran[2]

Received: 16 March 2020
Accepted: 15 May 2020

*Corresponding author: Jaison Chireshe, Department of Economics, University of the Western Cape, Bellville 7535, Republic of South Africa.
E-mail: jaisonchireshe@yahoo.com

Reviewing editor:
Francesco Tajani, University of Bari, Italy

Additional information is available at the end of the article

Abstract: The study aimed to examine the relationship between financial development and health care expenditure in 46 Sub Saharan Africa (SSA) countries. The paper argues that health care expenditure is a key transmission mechanism through which financial development influences better health outcomes. The study used random and fixed effects as well as instrumental variable estimation methods using data from 1995 to 2014. The results showed that financial development leads to increased health care expenditure. In terms of policy implications, the findings underscore the need to foster financial development in SSA economies to assist with domestic resource mobilisation to finance health care expenditure.

Subjects: Health & Development; Economics; Finance;

Keywords: financial development; health care expenditure; random and fixed effects; Sub Saharan Africa
Jel classification: E22; E44; G00; I00

1. Introduction

Human capital plays an important role in economic growth by determining levels of physical investment, productivity, technological innovation and adoption of new technologies (Mushkin, 1962; Becker, 1962; Nelson & Phelps, 1966; Romer, 1990; Benhabib & Spiegel, 2002). Countries with high levels of human capital as shown by high life expectancy, low disease burden and low risks of mortality grow faster than those with short life spans and high disease burden (Fogel, 1997; De la Croix & Licandro, 1999). Low levels of human capital hinder the flow of physical capital and new technologies from developed countries to least developed countries subsequently hindering economic growth (Lucas, 1990). Human capital investment in the form of health spending reduces mortality and increases life span thereby enhancing economic growth (Chakraborty, 2004).

ABOUT THE AUTHORS

Matthew K. Ocran is a Professor of Economics at the University of the Western Cape. His research interests cover applied econometrics, development economics, development finance, financial economics, monetary policy and macro-econometric modelling. Published in a number of local and international academic journals, Prof Ocran is rated as an established researcher by South Africa's National Research Foundation.

Jaison Chireshe has a PhD in Economics from the University of the Western Cape. Jaison's research interest are in financial development, health financing and economic development.

PUBLIC INTEREST STATEMENT

The study aimed to examine the relationship between financial development and health expenditure in 46 Sub Saharan Africa (SSA) countries. The paper argues that health expenditure is a key transmission mechanism through which financial development influences better health outcomes. The results showed that financial development leads to increased health expenditure. The findings underscore the need to foster financial development in SSA economies to assist with domestic resource mobilisation to finance health expenditure.

Sub Saharan Africa (SSA) is characterised by low levels of health care expenditure which inevitably results in low human capital levels (Kiross et al., 2020). Investment and recurrent expenditure in SSA health sector is crippled by scarcity and high cost of finance, limited government revenues and poverty. As of 2019, SSA's health care sector had a financing gap of 66 billion USD (UNECA, 2019). In 2014, total health expenditure per capita (in current prices) in the SSA region stood at 97 USD.7 as compared to the world average of 1 USD,061.0 (WHO, 2016). Since health care expenditure is a major determinant of health outcomes (Akinkugbe & Mohanoe, 2009; Anyanwu & Erhijakpor, 2009), low levels of health expenditure in SSA has resulted in the region bearing the bulk of the global morbidity (TB, malaria and HIV/AIDS) and mortality (maternal and child mortality) burdens as well as low life expectancy (WHO, 2013; Kiross et al., 2020). The region bears 80% of the estimated 207 million malaria cases and 90% of the estimated 627 000 malaria deaths worldwide (WHO, 2013). Additionally, more than 60% of the people living with HIV/AIDS globally are in SSA (USAID, 2012). In terms of mortality, SSA has the highest level of under-five-years and infant mortality rates when compared to global levels. In 2018, under-five-years mortality rate stood at 78 deaths for every 1 000 live births as compared to the world average of 38 deaths per 1 000 live births. The region also has an average life expectancy of 60 years as compared to the world average of 72 years (World Development Indicators, 2020).

Our study is motivated by the need to fill a conspicuous gap in literature on the role of financial development on health care expenditure. We are also motivated by the need to inform policy formulation in the area of health care financing in the face of high disease burden, low health care expenditure, high catastrophic out-of-pocket health care expenditures and declining overseas development assistance for health (DAH) in SSA. Government revenues for SSA countries have been on the decline due to the decline in the global prices of commodities like oil and metals (UNECA, 2019) and this is compounded by already thin tax revenue bases. The proportion of DAH to total health care expenditure in SSA has been on the decline since 2013, in addition to DAH inflows being characteristically unpredictable. This calls for policies which foster the development of sustainable health financing mechanisms to cope with increasing disease burden, mitigate the effects of dwindling revenue and fund investment in health care infrastructure, human resources development and service delivery as well as reducing catastrophic out-of-pockets (OOP) health care payments.

This study argues that financial development is crucial in health care financing as it avails avenues for resource mobilisation for households, private firms and government to finance health care expenditure. Well-developed financial sectors are capable of mobilising resources needed to fund current health care expenditure and related long-term investments as compared to under-developed financial markets. Well-developed financial sectors increase government expenditure in health by expanding tax revenue bases (Dabla-Norris & Feltenstein, 2005; Straub, 2005; Catao et al., 2009; Blackburn et al., 2012). They also promote prepayment mechanisms in health financing like health insurance (social and private) and tax-financed health systems (Elovainio & Evans, 2017; Mcintyre et al., 2017; Musgrove, 1996). Prepaid mechanisms displace OOP payments which constraints growth in health care expenditure. Despite the debate on the impact of financial development pervading many sectors of the economy, the role of financial development in health financing is little known. The role of financial development in health financing literature is conspicuously absent regardless of the importance of financial sector in mobilising resources for current health care expenditure and investment at both household and national levels. Studies on hospital financing highlight the importance of financial institutions in health care financing by exploring the use of derivatives and bonds (Stewart & Owhoso, 2004; Stewart & Trussel, 2006). However, these studies fall short in shedding light on the impact of financial development on health care expenditure. They neglect to explain how the varying levels of financial development of different countries have affected health care expenditure and subsequently health outcomes in those countries. Similarly, literature on the determinants of health care expenditure is marked by the exclusion of financial development as one of the factors that affect aggregate health care expenditure. In the same manner, literature on the impact of financial development on national

level health outcomes (Claessens and Feijen, 2006a; Bhatta, 2013) ignore that health care expenditure mirrors the consumption of health care services and is a causal pathway through which financial development affects health outcomes. Existing studies only consider income, education and gender as channels through which financial development leads to better health outcomes.

This paper makes an important contribution to the literature by addressing the aforementioned gap in the literature on health care financing and financial development. The contribution is made through examining the impact of financial development on health expenditure in SSA countries. The study findings will also inform policy formulation in the area of health system financing.

The remainder of the paper is organised as follows: The second section reviews literature on human capital accumulation, financial development as well as health care expenditure. The third section provides an overview of the methods used in the study. The fourth section provides empirical analysis findings. The fifth and final section provides a conclusion of the study.

2. Literature review

2.1. Human capital theory

The human capital theory postulates that investment in human beings through expenditure on education, on the job trainings and health care inputs has future returns not only for the individual but for other people and the entire economy (Becker, 1962; Mushkin, 1962; Ben-Porath, 1967; Nelson & Phelps, 1966; Romer, 1990; Lucas, 1990; Benhabib and Spiegel, 1994). Focusing on health human capital, the theory postulates that investment in health by households and expansion of the health sector by government and the private sector affect a variety of health outcomes and health-related factors, including life expectancy, mortality, labour market participation and productivity, human capital accumulation, fertility decisions and demographic structure (Agenor, 2009; Van Zon & Muysken, 2001).

At microlevel, household investment in human capital through health expenditure is determined mainly by income, price of health care inputs, level of education, price of other goods and individual characteristics (Cropper, 1975; Grossman, 1972; Wagstaff, 1986). The demand for health inputs used in health production function is mirrored by the level of expenditure on these inputs.

3. Financial development and health care expenditure: a hypothesis

This study hypothesises that financial development leads to increased health care expenditure by households, private firms and governments through improved access to credit, savings and expansion of revenue bases. Financial development eases credit constraints, enabling private firms and governments to borrow to finance investment and recurrent expenditure in the health sector. Private players in the health sector are mainly affected by the scarcity of loans to finance their investment projects. However, once the credit becomes available at affordable prices, they are able to increase their expenditure. In underdeveloped markets, long-term credit is not available which means investments that are profitable in the long term cannot be undertaken.

Developed financial systems facilitate the mobilisation of resources by health care financing systems towards investment and expenditure in the health sector. Small domestic and poor financial markets imply a relatively high cost of financing while countries with better-developed financial systems can provide opportunities for their health care financing systems to tap resources for channelling towards recurrent health care expenditure and investment. On the global stage, the GAVI Alliance raised 5 USD.3 billion from capital markets for child immunisation since the international financing facility was launched in 2006. The proceeds of the vaccine bonds ensured predictable funding and have nearly doubled GAVI Alliance spending on immunisation programmes (GAVI, 2009).

Construction of hospitals and related medical facilities often require long-term funding during the period of construction. The need for long-term funding also relates to research and development of new drugs and innovations in medical technology. The purchase of new sophisticated medical equipment or replacing expensive outdated equipment may require a loan to be repaid after several years (Reliwak, 2014). Health care providers can make use of financial instruments to manage the risks associated with such long-term borrowing. The use of such instruments has gained momentum in the health care industry in the USA in the past years because of financial development. Stewart and Owhoso (2004) surveyed the use of financial derivatives by USA health care providers and found that 8% of New Jersey's non-profit health providers utilised interest rate derivatives with an aggregate principal value of 229 USD million. These derivative users combine interest rate swaps and caps to lower the effective interest costs of their long-term debt while limiting their exposure to future interest rate increases.

Countries with underdeveloped financial systems have large informal sectors which narrow their tax bases (Blackburn et al., 2012; Catao et al., 2009). Limited government revenue results in constrained government expenditure, including in the health sector. However, in economies where bank credit is widely available at a lower cost, firms are more likely to incur formalisation costs thereby expanding governments' tax revenue bases. As more firms formalise their operations, government tax base and revenue expand facilitating the release of additional resources towards government health care expenditure. According to Musgrove (1996), as government revenue increases, the share of government expenditure in total health care expenditure also increases displacing OOP expenditure with tax-financed expenditure or social security contributions. In addition, employers in the formal sector can easily contribute to health insurance schemes (private, social or mandatory), thereby improving health sectors' revenue structures and reducing OOP payments.

At the household level, financial innovation which comes as a result of financial development, widens the array of financial products available on the market. The existence of diverse financial products enhances improved financial access by poor households previously excluded from the financial system. This implies that more households can save and borrow to finance health care expenditure among other household expenditures. In instances where households cannot save or borrow, they are likely to shun health care services which will be reflected in low health care expenditure.

4. Determinants of health expenditure: an empirical review

The early debate on health care expenditure is focused on estimating the income elasticity of health care expenditure. These studies aimed at establishing whether health care expenditure is a luxury or basic good (Baltagi & Moscone, 2010; Di Matteo, 2003; Murthy & Okunade, 2009; Newhouse, 1977; Sen, 2005). The results of these studies have been inconclusive as health expenditure turned out to be either a necessity or luxury good in different studies. Recent debate is driven by ballooning health care expenditure in developed countries and very low levels of expenditure in less developed countries as researchers attempt to establish major drivers of health care expenditure (Braendle & Colombier, 2016; Gbesemete & Gerdtham, 1992; Liang & Mirelman, 2014; Xu & Holly, 2011). The later studies have shown that health care expenditure is largely determined by gross domestic product (GDP), medical technology and practices, demography, prices, and the architecture of health financing systems (Fan & Savedoff, 2014; Samadi & Rada, 2013; Xu & Holly, 2011).

Existing theoretical and empirical literature on health care expenditure has been inward looking. This limited focus led to a paucity of both theoretical and empirical literature on the role of financial development, financial sector policies, financial sector depth and width (financial inclusion) on health care expenditure by both private and public players. Additionally, existing literature on health care expenditure is dominated by studies focusing on the Organisation of Economic

Cooperation and Development (OECD) countries with a scanty focus on SSA countries and other regions of the world (Jaunky & Khadaroo, 2008; Xu & Holly, 2011). The study by Gbesemete and Gerdtham (1992) is seminal as far as studies dedicated to health expenditure in Africa are concerned. The absence of literature on health expenditure in Africa persist despite that research on health expenditure dating back to the 1970 s with the pioneering study of Newhouse (1977).

Whilst macrolevel studies ignored the role of financial development in health care expenditure, microlevel studies have examined the impact of access to informal financial services on household health care expenditure. Randomised control trials in Kenya on the impact of financial inclusion showed that access to informal saving facilities like rotational savings and credit schemes (ROSCAs) increased household expenditure on preventative health products (Dupas and Robinson, 2009). In another experimental study in Nepal, Prina (2012) found that financial access increases health care expenditures in the form of medicines and traditional remedies by more than 45%. The findings from these field experiments show that financial access is critical in increasing health care expenditure and ultimately health outcomes irrespective of income levels.

The limitation of microlevel studies emanates from their focus on the impact of access to informal financial services. Microcredit schemes and ROSCAs are not part of the mainstream financial sector and they offer limited services when compared to the formal financial system. These studies also do not dwell on the impact of financial depth on health expenditure given the fact that their focus is on informal financial systems and access to finance.

5. The theoretical framework

The model used in this study emanates from the work of Rosenzweig and Schultz (1983) on the mother's demand for her child's health. In their model, a family is assumed to derive utility from the child's health, *H;* consumer goods with an effect on a child's health, *Y*; and consumer good with no effect on health, *X*. Using Rosenzweig and Schultz (1983)'s notation, the family's utility function can be expressed as follows;

$$U = U(X, Y, H) \tag{1}$$

The relationship between child health and the levels of income, Y and medical care inputs, Z is described by a production function expressed as follows;

$$H = F(Y, Z, \mu) \tag{2}$$

μ is an initial health endowment due to genetic or environmental factors.

The family maximises Equation (1) given two subject to a budget constraint specified as;

$$I = XP_x + YP_y + ZP_z \tag{3}$$

WhereP_x,P_y and P_z are the prices of the health-neutral and health-related consumption goods and medical care services, respectively, and I is income. Maximising the above equation yields the following demand equations (see Rosenzweig and Schultz (1983) for derivation);

$$X = D_x(P_x, P_y, P_z, I, \mu) \tag{4}$$

$$Y = D_y(P_x, P_y, P_z, I, \mu) \tag{5}$$

$$Z = D_z(P_x, P_y, P_z, I, \mu) \tag{6}$$

Equation (6) represents the demand for health investment good or health care, which is determined by its price, price of other goods, income and the initial endowment of health and environmental factors.

5.1. Empirical model and techniques

In this study, the demand for health investment Z in Equation (6) is proxied by aggregate health care expenditure (*HE*) and explained by social, economic and environmental factors. The study uses macroeconomic data to estimate the relationship between health care expenditure and its explanatory variables. The macrolevel explanatory variables include income, financial development (*FD*), demography (*U14* and *OVER65*), government tax revenue (*TAX*) and health care financing systems (HFS). The equation is expressed in logarithmic form as follows;

$$lnHE_{it} = \alpha_i + \beta_{it}FD + \beta_{it}lnGDP + \beta_{it}lnHFS + \beta_{it}lnU14 + \beta_{it}lnOVER65 + \beta_{it}lnTAX + \varepsilon_{it} \tag{7}$$

Where;

HE represents health expenditure or the demand for health investment good in Equation (6).

FD represents the level of financial development.

HFS measures the country's health financing structure whether it is centrally/tax financed or out of pocket financed.

U14 represents the proportion of a country's population below 15 years.

OVER65 represents the proportion of a country's population aged 65 years and above

TAX this variable represents the proportion of government tax revenue to Gross Domestic Product (GDP).

We estimated Equation (7) uses the random and fixed effects and two-stage least squares (2SLS) approaches.

6. Fixed vs random effect estimation approach

We used the fixed and random effects estimation approach because of the existence of countries specific variables that influence health expenditures but are not observable. We used the robust Hausman test to choose between the random and fixed effects estimation approaches. The test checks whether there is a systematic difference between random and fixed effects estimators. The fixed effects method was selected as the appropriate method for estimating the effect of financial development on total health expenditure per capita. The estimation of the effect of financial development on private and public health care expenditure was done using both fixed and random effects as determined by the robust Hausman test. In instances where the random effects method was selected, the presence of random effects was tested using the Breusch–Pagan LM test, this test assesses whether the random effects are more appropriate as compared to the pooled ordinary least squares (POLS) method of estimation.

7. Two-stage least squares approach (2SLS)

Results of the fixed and random effects methods of estimation suffer from potential bias emanating from endogeneity resulting from reverse causation, simultaneity bias and measurement errors. Ignoring endogeneity leads to biased parameters that yield erroneous results and incorrect

conclusions about the veracity of theory (Antonakis et al., 2010). Endogeneity can be addressed with an instrumental variable approach in a two-stage least squares (2SLS) analysis which extracts the exogenous component of financial development. Previous studies have identified instruments for financial development that includes origin of the country's commercial law, absolute latitude value of a country's capital city and religious composition of the country's population (Levine, 2004; La Porta, 1997). The study identified the perceived rule of law variable from the World Bank's World Governance Indicators as one of the instrumental variables used in this study. According to the World Bank (2020), the rule of law variable captures perceptions of the extent to which agents have confidence in and abide by the rules of society and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. Experts give the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately −2.5 to 2.5.

The second instrumental variable used is the mobile cellular subscriptions per 100 people sourced from the World Development Indicators (2017) as well. Access to mobile phones is a good instrument of financial infrastructure development since they perform related functions. The development of ICT infrastructure reduces market imperfections, improve market efficiency by reducing transaction costs and improving the availability of information on the market (Jensen, 2007; Seifallah & Mohamed, 2013). Aker and Mbiti (2010) identified roles played by mobile phones in an economy similar to those performed by financial systems. They argued that mobile phones improve access to and use of information, thereby reducing search costs, improving coordination among agents and increasing market efficiency. The instruments were tested for appropriateness and strength. Appropriateness was tested using the Sargan–Hansen test for overidentification (OIR). The test for weak instruments was done using the Cragg–Donald Wald F test (Cragg–Donald, 1993). The results of these tests showed that all our instruments are valid and strong.

7.1. Measurement of variables

8. Financial development indicators

The financial sector in Africa is largely bank-based as the capital markets are relatively under-development despite a steady growth in the recent years (Allen et al., 2011; Beck et al., 2009). Only a few countries like South Africa and Egypt have deep capital markets. This makes the use of bank-based proxies more appropriate in capturing the depth and outreach of the financial sector in SSA. The financial development proxies used in the study aimed to capture the access and depth dimension of a financial sector and understand their respective impact on health care expenditure. The rationale for this approach is discussed below.

9. Financial access

The use of access to finance indicators (number of ATMS and commercial bank branches per 100 000 people) in the study aims to capture the extent to which a country's population has access to the mainstream financial system. Access to financial services enables households and firms to save and invest in health. Macrolevel studies by Beck, Demirgüç-Kunt and Levine (2004), Classens and Feijin (2006a) on financial development, poverty and health outcomes have extensively relied on indicators measuring the depth of the financial sector and not its inclusiveness (Mookerjee and Kalipioni, 2010). However, according to World Bank (2008) in the absence of inclusive financial systems, poor individuals and small business entities must rely on their personal wealth or internal resources to invest in their health, establish or expand existing businesses or take advantage of promising growth opportunities. Deep financial systems may not be necessarily inclusive leaving the poor and unbanked behind in the process of growth and prosperity. As noted by Classens and Feijin (2006a) the lack of access to finance in lower-income countries derives in part from low banking sector outreach. This limited outreach leaves out the financially unserved populations from benefitting from financial development.

10. Financial depth

Large financial sectors are well functioning, efficient and allocate funds to their most productive uses (World Bank, 2008). They also offer savings, credit, payments, and risk-management products to as large a set of participants as possible and seeking out and financing good growth opportunities wherever they are found. This study settled for two variables to measure the depth of a country's financial sector and these include broad money (M3) and bank credit to the private sector to GDP ratios. The use of broad money (M3) to GDP ratio aims to measure the size of the financial sector and its ability to provide transaction services and saving opportunities whereas the bank credit to the private sector to GDP has the advantage of measuring more accurately the role of financial intermediaries in channelling funds to productive agents and possibly to the poor (King and Levine, 1993; Beck, Kunt and Jeanneney & Kpodar, 2008; Levine, 2004).

11. Health expenditure indicators

The primary functions of any health financing system involve collecting revenue, pooling resources, and purchasing goods and services (World Health Organisation, 2000). The study uses health care expenditure as a proxy of the health financing system's ability to perform these functions. The pooling and functions of the health financing system can only be achieved when the resources have been mobilised (WHO, 2008). Health care expenditure reflects the volume of resources that have been mobilised or available for the health sector (Anyanwu & Erhijakpor, 2009). Additionally, in both the human capital (Grossman, 2000) and health production (Nixon & Ulmann, 2006) models, health care expenditure has been identified as an important measure of the level of health capital investment and health inputs, respectively. Drawing from this literature, the study used three indicators of health care expenditure, namely, total health care expenditure per capita, public and private health care expenditure to GDP ratios. The use of multiple indicators aimed at determining the impact of financial development on different categories of health care expenditure given that private and public health care expenditure affect health outcomes differently (Arthur & Oaikhenan, 2017; Rad et al., 2013). According to the World Development Indicators (2016), total health care expenditure per capita is the sum of all expenditures by public and private entities expressed as a ratio of total population. Public and private health care expenditure to GDP ratios represent the disaggregated expenditures on health by public and private entities, respectively. However, we acknowledge that the expenditure variables fall short is capturing efficiency and financial protection aspects of health financing given the multidimensional nature of health financing.

12. Control variables

In addition to the financial development variables, the study used control variables to increase the precision of coefficients of financial development variables. Control variables used in the study include real GDP per capita, government tax revenue, demographic structure, health system financing mechanism and education level. A brief description of each control variable is presented below.

12.1. Income

The level of income was measured by real GDP per capita. Increased income is important for households to access medical services, nutritious foods and make other human capital-related investments. High-income levels shown by real GDP per capita also expand the governments' tax bases which boost the capacity to spend on health services delivery and subsidisation of health capital investment by households.

12.2. Demographic Structure

The variable captures the age composition of a country's population. In the absence of data on the median age of countries' populations, two indicators on demographic structure were used in the analysis. These indicators include the proportion of the population aged 65 years and above and

the proportion of population below 15 years or 0–14 years. An aged population increases health expenditure and a younger population reduces expenditure on health (Getzen, 1992; Zweifel et al., 1999).

12.3. Taxation

Represents the percentage of government tax revenue to GDP. According to the revenue-spending hypothesis, increased government revenue is expected to lead to increased government expenditure (Friedman, 1978; Owoye, 1995). The increase in government expenditure is expected to span across all the sectors of the economy including health.

12.4. Health Care Financing System

Health care systems are mainly financed through three mechanisms which include social insurance (Bismarck models), general taxation (Beveridge models) and out of pocket expenditure (OOP). Two dummy variables were included in the regression analysis to avoid the dummy variable trap. The dummy variables capture the most dominant health financing the tax-financed health systems (*pub_financed*) and out of pocket financed (*oop_financed*). The distinction among these methods is not very clear in SSA as health systems rely on more than one approach. In this study, the classification is based on 40% threshold; if more than 40% of a country's health care expenditure emanates from the government it is classified as tax financed and if 40% came from OOP, it is classified as OOP financed. The health financing systems that fell in between are classified as social health insurance financed health systems. Health financing systems with prepayment mechanisms promote better health outcomes as compared to those requiring upfront payment.

12.5. Education

Education was measured by primary school enrolment for female students. Educated households value health more and adjust their nutrition and lifestyles, and/or are able to make better use of health information and the health care system. (UNICEF, 1990; Claessens and Feijen, 2006a). As a result, they are likely to spend more on health care than their uneducated counterparts. This variable is added to the regression analysis for the determinants of private health expenditure only.

12.6. Data sources

The study used panel data from 46 Sub Saharan African countries from 1995 to 2014. The data were sourced from the World Bank's World Development Indicators (2020) database. Some countries were dropped from the complete list of all SSA countries due to inadequate data. Additionally, analysis relating to automated teller machines (ATMS) and commercial bank branches only cover the period from 2004 to 2014 due to data constraints.

13. Descriptive statistics

A descriptive analysis of the data shows that there was an average of 9.2 ATMS and 5.5 commercial bank branches per 100 000 people over the study period. Over the same 20-year period, SSA had an average broad money to GDP ratio of 31.4% and private credit to GDP ratio stood at 16.9%. Table 1 below shows a full description of the data.

The study tested the stationarity of all the variables used in the analysis to avoid running spurious regressions. The Fisher type test (ADF) was conducted. The tests showed that all the variables in their logarithmic form were stationary. The results of the stationarity test are presented in Table A1 in the Annex. We also tested the data for the presence of heteroscedasticity and autocorrelation. The null hypotheses of no heteroscedasticity and autocorrelation were rejected. These problems were addressed using robust standard errors. The study also tested for cross-sectional dependency as proposed by Chudik and Pesaran (2013) and the results showed that some of the regressions suffer from cross-sectional dependency. See Table A2 in the Annex

Table 1. Descriptive statistics

Variable	No. of Obs	Mean	Standard Dev	Min	Max
Broad money to GDP ratio *(BroadMoney)*	867	31.4	23.7	1.6	151.5
ATMs density per 100 000 *(ATMS)*	399	9.2	14.3	0	66.2
Commercial bank branches per 100 000 people *(BankBranches)*	482	5.5	8.2	0.1	54.8
Private bank credit GDP (BankPvt_credit)	868	16.9	16	0.2	108
Real GDP per capita *(GDP)*	920	1623.6	64.8	64.8	23,347.7
Tax revenue (%)	818	14.9	8.5	0.58	58.11
Population below 15 years (%)	917	42.7	5.17	19.8	50.4
Population over 65 years (%)	917	3.3	1.0	1.6	9.13
Health Expenditure per capita (US$)	912	174.3	220	5.9	1768.6
Public Health Expenditure to GDP (%)	912	2.4	12	0.04	9.0
Private Health Expenditure to GDP (%)	912	2.9	1.6	0.18	11.0
Level of education (%)	570	57.8	25.7	6.6	115

for cross-sectional dependency test results. The problem of cross-sectional dependency was addressed using Driscoll and Kraay standard errors which are robust to both spatial and temporal dependence as well as heteroscedasticity.

14. Results and discussion

14.1. Financial development and total health care expenditure per capita

The results of fixed effects regression analysis revealed that all the four indicators of financial development are positively and significantly correlated to total health care expenditure per capita. The results confirm the study hypothesis which postulates that financial development leads to increased health care expenditure. A 10% increase in the number of ATMS per 100 000 people, commercial bank branches per 100 000 people, broad money and proportion of bank credit to GDP is associated with an increase in health care expenditure per capita of 1%, 0.9%, 3.5% and 2.1% respectively. Table 2 shows the entire results from the regression analysis.

The results of the 2SLS regressions also showed that indicators of financial development are positively and significantly related to health care expenditure per capita. A 10% increase in the number of ATMS and commercial bank branches per 100 000 people, in broad money bank credit to the private sector increases total health care expenditure per capita by 1.9%, 2.5%, 5.7% and 7.2% respectively. Table 3 shows the results of the 2SLS regressions.

The paper also assessed the effect of financial development on different categories of health care expenditure. The analysis focused on public health care expenditure and private health care expenditure to GDP. The results are discussed in the subsequent paragraphs.

15. Financial development and public health care expenditure

Analysis of the effect of financial development on public health expenditure using the random and fixed effects estimation approaches showed that financial development as measured by the number of ATMS per 100 000 people, broad money and bank credit to private sector to GDP is significantly and

Table 2. Financial development and total health care expenditure per capita

Independent Variables	Fixed Effects Estimation			
	Model 1	**Model 2**	**Model 3**	**Model 4**
logATMS	0.10** (0.04)	-	-	-
logBankBranches	-	0.09* (0.05)	-	-
logBroadMoney	-	-	0.35*** (0.07)	-
logBankPvt_credit	-	-	-	0.21*** (0.04)
log GDP per capita	0.06 (0.12)	0.26** (0.11)	0.39*** (0.05)	0.37*** (0.06)
logtax_revenue	0.27*** (0.07)	0.14* (0.08)	0.2* (0.1)	0.23** (0.1)
logU14	−2.5*** (0.88)	−2.6*** (1.1)	−0.79 (0.57)	−0.83 (0.71)
logover65	0.62 (0.71)	0.06 (0.78)	−0.17 (0.37)	0.18 (0.38)
Govt financed HS	−0.03 (0.074)	−0.04 (0.06)	0.0008 (0.039)	0.01 (0.03)
OOP financed HS	−0.12** (0.06)	−0.1** (0.42)	−0.07 (0.04)	0.09 (0.04)
Constant	12.3*** (3.7)	12.4*** (4.6)	3.16**** (2.3)	3.9*** (2.9)
R-squared	0.5	0.5	0.66	0.66
Number of Countries	43	44	46	46
Number of Observation	345	438	753	754

Standard errors in parenthesis, ***, **, * shows significance at 1%, 5% and 10%

positively related to public health expenditure to GDP. The study showed that a 10% increase in the number of ATMS per 100 000 people, amount of broad money and bank credit to the private sector to GDP leads to a 0.6%, 4.1%, and 2.3% respective increases in the percentage of public health expenditure to GDP. Table 4 shows the results.

In the 2SLS, number of ATMS and commercial bank branches per 100 000 people were not statistically significant despite having the expected signs. On the other hand, financial development as measured by the proportion of broad money and bank credit to the private sector to GDP is positively and significantly correlated to public health care expenditure. A 10% increase in the proportion of broad money and bank credit to the private sector to GDP leads to an increase of 2.6 and 3.3% in the proportion of public health care expenditure to GDP. See Table 5 below for detailed results.

16. Financial development and private health care expenditure

Exploration of the effect of financial development on private health care expenditure showed that financial development is positively correlated with private health care expenditure. The analysis showed that a 10% increase in bank branches per 100 000 people, proportion of broad money and bank credit to the private sector to GDP leads to 1.1%, 1.7% and 1% increase in the proportion of private health care expenditure to GDP. Table 6 shows the results of the fixed and random effects estimation approaches.

Table 3. Financial development and total health care expenditure per capita: A 2SLS approach

Independent Variables	Two Stage Least Squares Estimation			
	Model 5	**Model 6**	**Model 7**	**Model 8**
logATMS	0.19*** (0.06)	-	-	-
logBankBranches	-	0.25** (0.12)	-	-
logBroadMoney	-	-	0.57*** (0.18)	-
logBankPvt_credit	-	-	-	0.72** (0.32)
logGDP_capita	−0.12 (0.15)	0.10 (0.13)	0.31*** (0.06)	0.15 (0.17)
logtax_revenue	0.30*** (0.05)	0.07 (0.07)	0.12 (0.13)	−0.24 (0.33)
logU14	−2.43*** (0.84)	−2.25** (1.0)	−1.33** (0.57)	−0.70 (0.8)
logover65	0.74 (0.76)	0.23 (0.83)	−0.06 (0.34)	0.08 (0.49)
Govt financed HS	−0.01 (0.07)	−0.002 (0.06)	0.003 (0.03)	0.05 (0.03)
OOP financed HS	−0.13** (0.05)	−0.10 (0.04)	−0.01 (0.04)	−0.01 (0.06)
Number of Countries	43	43	45	45
Number of Observation	333	416	551	551
Hansen J test (p-value)	0.66	0.17	0.099	0.29
Craig-Donald Wald F Statistic	119.4	73.8	49.4	11.0
Instrumental Variables	Perceived rule of law, Populations with mobile phones			

Standard errors in parenthesis, ***, **, * shows significance at 1%, 5% and 10%

In addition to the random and fixed effects regressions, the study also used the 2SLS to determine the effect of the financial development on private health care expenditure. A 10% increase in financial development causes an increase in private health care expenditure ranging from 2.8 to 3.2%. Table 7 shows the results obtained from the 2SLS estimation approach.

The study acknowledges that the use of single dimension variables to measure financial development is without limitations as financial development is multidimensional (Svirydzenka, 2016). The financial access and depth indicators used in the above regressions only focus on the banking sector ignoring capital markets and the insurance sector and the efficiency aspect of the banking sector. The study examined the effect of financial development on health care expenditure using a multidimensional financial development index capturing depth, access and efficiency of the entire financial sector (banking, capital markets and insurance sector) as proposed by Svirydzenka (2016). However, the results were not robust to different specifications and are shown in Table A3 in the Annex.

Although our study focused on the macrolevel relationship between finance and health care expenditure, the findings corroborate with results from microlevel studies by Doan et al. (2011), Dupas and Robinson (2011) as well as Prina (2012) which showed that access to informal financial services like microfinance leads to increased household expenditure on health care.

Table 4. Financial development and public health care expenditure to GDP

Independent Variables	Random and Fixed Effects Estimation			
	RE Model 9	RE Model 10	FE Model 11	FE Model 12
logATMS	0.06* (0.03)	-	-	-
logBankBranches	-	0.06 (0.04)	-	-
logBroadMoney	-	-	0.41*** (0.07)	-
logBankPvt_credit	-	-	-	0.23*** (0.06)
log GDP per capita	−0.14*** (0.05)	−0.07 (0.05)	−0.05 (0.05)	−0.06 (0.05)
logtax_revenue	0.4*** (0.1)	0.33*** (0.11)	0.25 (0.17)	0.28* (0.15)
logU14	−1.0 (0.67)	−1.0 (0.71)	0.25 (0.56)	−0.3 (0.73)
logover65	−0.65* (0.39)	−0.8* (0.43)	0.41 (0.38)	0.43 (0.38)
Govt financed HS	0.32*** (0.8)	0.32*** (0.07)	0.31*** (0.04)	0.32 (0.04)
OOP financed HS	−0.28*** (0.06)	−0.25*** (0.05)	−0.28*** (0.04)	0.3 (0.04)
Constant	5.18*** (3.0)	5.3*** (3.1)	0.45 (2.5)	0.47 (0.04)
R-squared	0.41	0.36	0.43	0.43
Number of Countries	43	44	46	46
Number of Observation	345	438	753	754
Breusch Pagan LM test (p-value)	0.00	0.00	-	-

Standard errors in parenthesis, ***, **, * shows significance at 1%, 5% and 10%

17. Control variables

The analysis showed that the relationship between real GDP per capita and health care expenditure is conflicted. In four of the 24 regression estimations, real GDP per capita is positively and significantly correlated to health care expenditure. This is in line with the priori expectation and other findings in the literature. However, in other six regression estimations, GDP per capita is negatively and significantly correlated with health care expenditure. The negative relationship was prevalent in the regressions involving private health care expenditure as a dependent variable. Private health care expenditure in low-income settings like SSA is largely made up of out-of-pocket (OOP) health care expenditure as a result of low penetration of health insurance and low government expenditure in health care (Okello & Njeru, 2015). Increase in income levels reduces OOP hence the negative relationship (Musgrove et al., 2002).

The results also showed that the demographic structure variables have a significant effect on health care expenditure. The results showed a negative and statistically significant correlation between the proportion of the population under 15 years and health care expenditure. It also showed a statistically significant and positive relationship between the proportion of the population over 65 years and health care expenditure. The results of the health financing system were as expected, with OOP financed health systems having a negative effect on total and public health care expenditure. Government financed health systems dummy variable

Table 5. Financial development and public health care expenditure to GDP-2SLS

Independent Variables	Two Stage Least Squares Estimation			
	Model 13	**Model 14**	**Model 15**	**Model 16**
logATMS	0.07 (0.04)	-	-	-
logBankBranches	-	0.14 (0.11)	-	-
logBroadMoney	-	-	0.26* (0.15)	-
logBankPvt_credit	-	-	-	0.33* (0.19)
log GDP per capita	−0.18*** (0.07)	−0.12* (0.06)	−0.06 (0.05)	−0.13 (0.09)
logtax_revenue	0.42*** (0.1)	0.29*** (0.13)	0.4 (0.24)	0.23 (0.27)
logU14	−1.0** (0.67)	−0.87 (0.73)	−0.69 (0.64)	−0.4 (0.78)
logover65	0.62 (0.39)	−0.7 (0.43)	0.22 (0.42)	0.23 (0.49)
Govt financed HS	0.32*** (0.08)	0.35*** (0.07)	0.36 (0.04)	0.39 (0.49)
OOP financed HS	−0.29*** (0.05)	−0.24*** (0.05)	−0.27 (0.05)	−0.29 (0.05)
R-squared	0.41	0.41	0.45	0.43
Number of Countries	43	43	45	45
Number of Observations	333	333	551	551
Hansen J test (p-value)	0.57	0.31	0.9	0.88
Craig-Donald Wald F Statistic	19.93	19.93	49.4	11.0
Instrumental Variables	Perceived rule of law, Populations with mobile phones			

Standard errors in parenthesis, ***, **, * shows significance at 1%, 5% and 10%

although insignificant in most of the regressions, was negatively and significantly correlated to private health care expenditure. This shows that in SSA public and private health care expenditure are substitutes rather than complementarities. Tax revenue was positively and significantly related to total health expenditure per capita and public health expenditure to GDP. This is in line with the priori expectation. However, the same variable is negative for private health care expenditure to GDP.

18. Conclusion

The paper aimed to determine the effect of financial development of on health care expenditure in SSA region from 1995 to 2014. Financial development was measured using four indicators, namely, number of ATMS and commercial bank branches per 100 000 people as well as the ratios of broad money and bank credit to the private sector to GDP, respectively. Health care expenditure was measured using total health care expenditure per capita, public and private health care expenditure to GDP. In addition to financial development variables, control variables were also added to the regression analysis. These variables include real GDP per capita, government tax revenue, demographic characteristics, sources of health financing and level of education. The results showed that financial development is positively and significantly correlated to health expenditure although some of the financial development measures were not statistically significant. The results are consistent with the study hypothesis

Table 6. Financial development and private health care expenditure to GDP

Independent Variables	Random and Fixed Effects Estimation			
	Model 17	**Model 18**	**Model 19**	**Model 20**
logATMS	0.05 (0.04)	-	-	-
logBankBranches	-	0.11** (0.05)	-	-
logBroadMoney	-	-	0.17*** (0.05)	-
logBankPvt_credit	-	-	-	0.1* (0.05)
log GDP per capita	−0.19 (0.11)	−0.17* (0.09)	−0.06 (0.05)	−0.06 (0.06)
Loged	0.01 (0.09)	0.002 (0.08)	0.01 (0.07)	0.02 (0.07)
logU14	−1.1** (0.52)	−1.0* (0.5)	0.58 (0.73)	0.46 (0.7)
logover65	1.6** (0.81)	1.27 (0.82)	0.19 (0.3)	0.55 (0.41)
Govt financed HS	−0.24** (0.1)	−0.2** (0.04)	−0.16*** (0.03)	−0.11*** (0.03)
OOP financed HS	0.05 (0.06)	0.06 (0.05)	0.08** (0.04)	0.07* (0.04)
Constant	4.6* (2.3)	4.5** (2.1)	−1.0 (3.3)	−1.37 (3.3)
R-squared	0.22	0.19	0.11	0.12
Number of Countries	45	46	46	46
Number of Observation	245	306	753	754

Standard errors in parenthesis, ***, **, * shows significance at 1%, 5% and 10%

which stated that health care expenditure is a key transmission mechanism through which financial development leads to improved health outcomes.

The results of the effects of control variables on health expenditure were largely in line with prior expectations, although some of the findings were contrary to expectation as well as being statistically insignificant. Real GDP per capita was largely positively and significantly correlated to health care expenditure although in other estimations it was negatively and significantly correlated to health care expenditure. The results also showed that a high proportion of a young population reduces health expenditure whilst a higher proportion of an old population increases health expenditure. Tax revenue was positively and significantly related to total health care expenditure per capita and public health care expenditure to GDP.

In terms of policy recommendations, SSA policymakers must continue to deregulate the financial sector, reduce government ownership of banks and strengthen the regulatory environment to foster financial development. The policymakers also need to put in place prepaid health care financing schemes like social health insurance and tax-financed health care systems to minimise upfront payments. There is a need for governments in SSA to grow their economies to increase income per capita and implement prudent policies that promote macroeconomic stability. The policymakers also need to enhance domestic resource mobilisation in the form of improving tax systems, including increasing the capacity of tax bodies to collect tax and reforming tax laws to generate more resources that can be channelled towards expenditure in the health sector.

Table 7. Financial development and private health expenditure to GDP-2SLS

Independent Variables	Two Stage Least Squares Estimation			
	Model 21	**Model 22**	**Model 23**	**Model 24**
logATMS	0.28*** (0.07)	-	-	-
logBankBranches	-	0.37** (0.14)	-	-
logBroadMoney	-	-	0.32** (0.15)	-
logBankPvt_credit	-	-	-	0.34** (0.16)
logGDP_capita	−0.5*** (0.13)	−0.33* (0.13)	−0.06 (0.06)	−0.13* (0.07)
Loged	0.45*** (0.22)	−0.09 (0.1)	0.07 (0.09)	−0.09 (0.11)
logU14	−1.0** (0.54)	−0.89 (0.51)	0.22 (0.64)	0.5 (0.77)
logover65	2.0*** (0.76)	1.4* (0.81)	0.81** (0.41)	0.85 (0.41)
Govt financed HS	−0.2.4*** (0.08)	−0.17** (0.07)	−0.14*** (0.04)	−0.12*** (0.03)
OOP financed HS	0.001*** (0.06)	−0.07 (0.05)	0.05 (0.04)	0.06 (0.06)
Number of Countries	44	45	45	45
Number of Observation	243	299	398	398
Hansen J test (p-value)	0.70	0.87	0.20	0.42
Cragg-Donald Wald F Statistic	31.5	73.8	49.4	11.0
Instrumental Variables	Perceived rule of law, Populations with mobile phones			

Standard errors in parenthesis, ***, **, * shows significance at 1%, 5% and 10%

Acknowledgements
The author acknowledges the feedback and suggestions from the participants of the African Finance Journal Conference, 18–19 April 2018, Nairobi, Kenya.

Funding
The authors received no direct funding for this research.

Author details
Jaison Chireshe[1]
E-mail: jaisonchireshe@yahoo.com
Matthew K. Ocran[2]
E-mail: mocran@uwc.ac.za
[1] Department of Economics, University of the Western Cape, Private Bag X1, Bellville, 7535, Republic of South Africa.
[2] Department of Economics, University of the Western Cape, Private Bag X17, Bellville, 7535, Republic of South Africa.

Citation information
Cite this article as: Financial development and health care expenditure in Sub Saharan Africa Countries, Jaison Chireshe & Matthew K. Ocran, *Cogent Economics & Finance* (2020), 8: 1771878.

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Appendix

Table A1. Panel unit root test

Variable	Fisher Type ADF Test	Result
	Model with trend	
log*ATMS*	231.9***	I(0)
log*BankBranches*	150.6***	I(0)
logBankPvt_credit	118.5**	I(0)
log*BroadMoney*	110.4**	I(0)
log*GDP_capita*	123.8***	I(0)
logTHE_capita	172.5***	I(0)
logPubHE2GDP	129.5***	I(0)
logPvtHE2GDP	143.7***	I(0)
Logtax	158.3****	I(0)
logover65	157.2***	I(0)
logU15	186.2***	I(0)

***, **, * shows significance at 1%, 5% and 10%

Table A2. Cross-sectional dependency test

Dependent Variable	Independent explanatory variables	CD Test p-value
LogTHE_capita	logFINDEV logGDP_capita, logu14 logover65 oop_financed pub_financed	22.69 (0.00)
LogTHE_capita	logATMs logGDP_capita, logtax logu14 logover65 oop_financed pub_financed	-
LogTHE_capita	logBankBranches logGDP_capita, logtax logu14 logover65 oop_financed pub_financed	−0.243 (0.808)
LogTHE_capita	logBroadMoney logGDP_capita, logtax logu14 logover65 oop_financed pub_financed	3.752 (0.00)
LogTHE_capita	logBankPvt_credit logGDP_capita, logtax logu14 logover65 oop_financed pub_financed	4.11 (0.000)
LogTHE2GDP	logFINDEV logGDP_capita, logu14 logover65 oop_financed pub_financed	16.22 (0.105)
LogTHE2GDP	logATMs logGDP_capita, logtax logu14 logover65 oop_financed pub_financed	-
LogTHE2GDP	logBankBranches logGDP_capita, logtax logu14 logover65 oop_financed pub_financed	−0.656 (0.512)
LogTHE2GDP	logBroadMoney logGDP_capita, logtax logu14 logover65 oop_financed pub_financed	−0.661 (0.509)
LogTHE2GDP	logBankPvt_credit logGDP_capita, logtax logu14 logover65 oop_financed pub_financed	0.185 (0.853)
LogPVT2GDP	logFINDEV logGDP_capita, logu14 logover65 oop_financed pub_financed	1.219 (0.223)
LogPVT2GDP	logATMs logGDP_capita, logtax logu14 logover65 oop_financed pub_financed	-
LogPVT2GDP	logBankBranches logGDP_capita, logtax logu14 logover65 oop_financed pub_financed	−0.207 (0.836)
LogPVT2GDP	logBroadMoney logGDP_capita, logtax logu14 logover65 oop_financed pub_financed	−1.188 (0.235)
LogPVT2GDP	logBankPvt_credit logGDP_capita, logtax logu14 logover65 oop_financed pub_financed	−0.653 (0.514)

Table A3. Financial development index and health care expenditure

	Fixed Effects Estimation			2SLS Estimation		
Independent Variables	**Total Health Expenditure per capita**	**Public Health Expenditure to GDP**	**Private Health Expenditure to GDP**	**Total Health Expenditure per capita**	**Public Health Expenditure to GDP**	**Private Health Expenditure to GDP**
logFindex	0.18*** (0.02)	−0.278*** (0.0920)	0.003 (0.07)	2.0*** (0.339)	2.17** (0.88)	−0.847 (0.728)
log GDP per capita	2.0*** (0.07)	−0.463 (0.474)	−0.21 (0.20)	1.315*** (0.211)	−1.21*** (0.43)	−0.04 (0.23)
logtax_revenue	-	-	−0.08 (0.09)	-	−0.49 (0.94)	0.07 (0.15)
logU14	−1.93*** (0.26)	−2.389 (1.998)	1.20 (1.13)	0.547 (0.733)	−0.49 (0.79)	0.54 (0.76)
logover65	−0.17 (0.18)	0.885 (1.368)	0.72 (0.51)	−0.008 (0.087)	0.74* (0.42)	0.834*** (0.277)
Govt financed HS	0.04 (0.04)	0.195 (0.164)	−0.06 (0.04)	0.532 (0.481)	0.21 (0.18)	−0.07 (0.04)
OOP financed HS	−0.09 (0.06)	−0.083 (0.139)	0.05 (0.05)	−0.0101 (0.0902)	−0.138 (0.126)	0.06 (0.05)
Constant	−2.46** (0.99)	12.28 (9.305)	0.23 (5.4)			
R-squared	0.42	0.05	0.20			
Number of Countries	43	43	43	43	43	42
Number of Observation	635	635	463	333	266	429
Hansen J test (p-value)				0.57	0.44	0.26
Craig-Donald Wald F Statistic				19.93	19.93	19.93
Instrumental Variables				Perceived rule of law, Populations with mobile phones		

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***Cogent Economics & Finance* (ISSN:) is published by Cogent OA, part of Taylor & Francis Group.**