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Is the Demand for Health Care Income Elastic? The Case of 40 Sub-Saharan African Countries

Meron Masresha Nadew

Eastern Illinois University

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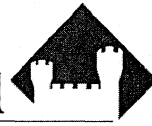
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Is the Demand for Health Care Income Elastic?

The Case of 40 Sub-Saharan African Countries

(TITLE)

BY

Meron Masresha Nadew

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

Master of Arts in Economics

IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY
CHARLESTON, ILLINOIS

2016

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Is the Demand for Health Care Income Elastic? The Case of 40 Sub-Saharan African Countries

Meron Nadew
12/15/2016

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Abstract

This paper uses panel data (1995 to 2011) from 40 Sub-Sahara African countries to analyze the income elasticity of health care expenditure along with some of the other theoretical determinants. The empirical results of the instrumental variable approach indicate that per capita income is a core and statistically significant determining factor of health expenditure. The value of the elasticity is about 0.48, suggesting that health expenditure as a commodity is a necessity for this region. In simple words, the goal of the system in this region is curative rather than caring. The percentage of population age 65 or older and official development assistance are found to have a significant role in increasing health expenditure. This research recommends that healthcare expenditure in sub Saharan Africa be a priority as it is a necessity. Public investment on healthcare should also be seen as an opportunity towards promoting health and increasing production, as opposed to a burden.

1. Introduction

1.1 Background

According to the World Bank (2011), "Improving health is central to the Millennium Development Goals, and the public sector is the main provider of health care in developing countries. To reduce inequities, many countries have emphasized primary health care, including immunization, sanitation, access to safe drinking water, and safe motherhood initiatives", Thus, in many developing countries, governments are faced with increasing pressure to improve the efficiency and financial viability of the health care delivery system.

The question of what determines the level of resources a country devotes to health care spending is getting increasing attention from researchers, government policy makers and non-governmental organizations. Culyer (1988) pointed out that health care is shaped by too many determinants: income, age structure, and the structure of the health budgeting system (more centralized systems generally have a lower share of health care spending). Each of these determinants vary in importance in different parts of the world.

Henderson (2002) affirmed the importance of the income elasticity of health expenditures for several reasons. He explained that income is one of the key determinants of health expenditures and argued that understanding the determinants of health expenditures is of huge importance in deciding the optimal amount of health-care spending for a society.

Murthy and Akunade (2009) highlighted that health care is a core component of human capital investment and thus, rising national health care

spending would tend to raise labor productivity, quality of life, and general welfare. Health care has also been credited for prolonging life expectancy, reducing morbidity, and lowering infant mortality rates. The authors stated that greater health spending is also capable of reducing disease epidemics.

However, there is a significant difference in the levels of per capita health expenditures (in current U.S dollars) among countries, especially when comparing countries at different levels of development. Based on data from the World Development Indicators, in 2008, per capita health care spending was $24 in Nepal, $17 in Bangladesh, $37 in Burkina Faso, $40 in Haiti and $7,164 in the United States. As can be seen from these figures, there is a huge gap between the U.S and the other five countries (which are categorized by The World Bank as least developed). The pace of the increase in per capita health spending in the U.S and other developed countries is much higher than that of least developed countries, even though these countries are carrying much of the disease burden. This paper aims to examine some of the factors affecting per capita health care expenditure in a subset of less developed countries in Sub Saharan Africa and to estimate the income elasticity of per capita health expenditure in those nations.

1.2 Statement of the problem

Least developed countries (LDCs) that demonstrate very low growth in their levels of health care expenditures are devastated by their carriage of the highest disease and injury burdens. Sub-Saharan Africa has 11 percent of the world population, but carries 24 percent of the global disease burden, there by facing the greatest challenges. Yet the region has only 3 percent of the global health workforce and accounts for less than 1 percent of health expenditures worldwide (IFC, 2013).

Health care spending has the ability to prolong life expectancy, reduce morbidity, and lower infant mortality rates which are generally characterized as "health outcomes." Because income is one of the major determinants of health care expenditures, estimating the income elasticity of health expenditures in line with some of the other factors explaining health care expenditure is essential for countries. Such estimation will provide some policy implications as to what the optimal amount of health expenditures is for a country, as well as helping policy makers understand its core determinants.

Following the theories in health economics literature, health care is taken as a technical necessity if the income elasticity lies between zero and one, (Culyer and Newhouse, 2000). If this elasticity is greater than unity, then health care is claimed to behave as a luxury commodity, according to Newhouse (1977). If health care is found to be a technical necessity, it would mean that the public sector has not been accorded high enough priority in the country's agenda of social and economic development. Matteo (2003) pointed out that estimated

income elasticities carry great weight for policy making. If the income elasticity is found to be a "necessity" commodity, greater public involvement in health care is warranted. On the contrary, those who view health care as a "luxury" commodity would consider it as any other commodity and best left to market forces.

Unfortunately, there is a huge dearth of recent empirical analysis for this matter in developing countries, specifically in Sub-Saharan Africa. This paper, having established the relationship between income and health care spending, will try to answer the question; is health care a necessity or luxury in Sub-Saharan Africa? This is investigated in line with some of the major theoretical determinants of health care expenditures.

1.3 Significance of the Study

A relatively huge mass of econometric studies of health care spending in developed countries have been explored. There is, however, a paucity of such econometric studies for the case of Sub-Saharan Africa. Most previous research that investigated the relationship of the various determinants of health care expenditure for this region failed to include the prevalence of HIV/AIDS, malaria or other epidemics as one of the driving forces.

Therefore, a discussion about the effect of the prevalence of HIV on health expenditures in Sub-Saharan Africa in addition to the other commonly used variables in examining the determinants of health care expenditure based on a relatively recent data set will be one of the novel contributions of the research paper thereby giving an inference based on the analysis.

2. Literature Review

2.1. Theoretical Framework
2.1.1 Health and Health Expenditures

Health is a component of human capital. According to the definition of the World Health Organization (1948), health is a state of complete physical and mental well-being and not merely the absence of disease or infirmity. It is also an essential component of development, vital to a nation's economic growth and internal stability. It is also positively correlated with other forms of human capital such as knowledge, skills, and motivation which are needed for productive work.

Germano (2007) stated that the most important difference between health and health care is the sense that health care is tradable in markets where as health is not. According to Grossman (1972), human capital theory at the individual level considers health as a commodity which the individual will demand to consume and maximize utility subject to his budget constraint in combination with a number of endogenous and exogenous variables that have an impact on an individual's health. In this model, income and education level play prominent roles as explanatory variables.

Health expenditures are generally considered as an outcome resulting from the combination of supply-side and demand-side factors and their interactions, because health care expenditures are the product of the price of health care expenditure and the quantity of health care consumed. This means that these expenditures will be affected by economic, social, demographic, institutional, and

technological factors. The determinants of health care expenditures are usually explained by either demand-side or supply-side factors.

2.1.3. Henderson's View on the Factors Influencing the Demand for Health

According to Henderson (2009), the relationship between income and health at the national level requires a completely different perspective. In comparisons of modern industrial nations, little correlation emerges between the level of national income and the various measures of health. Henderson however points out that the relationship between income and health can be seen if less developed countries are included due to better public health measures as the level of development increases, including sanitary water and sewage systems and immunization programs that reduce the spread of disease.

Henderson categorizes the major factors that influence the demand for health care as patient factors and physician factors. Patient factors include health status (HS), demographic characteristics (DC), and economic standing (ES). Physicians (PF) on the other hand are considered as agents who create demand for their own services.

2.1.3.1. Health Status

An individual's demand for medical care treatment is for either curative or preventive purposes. Epidemiological need is included as a covariate of health care expenditure through different proxies. The prevalence of HIV and mortality rates are some of the proxies used in different research analyses as driving factors of health care expenditures.

2.1.3.2. Demographic Characteristics

Individual and population demographics are also considered to be important determinants of health care demand. A growing population that changes the family structure will likely increase the demand for health care. An aging population also contributes to an increase in the demand for health care, because the demand for health care rises as individuals age. Hence, health care spending escalates in populations comprised of an aging population. According to Gerdtham et al. (1992) and Schultz (2005), female labor force participation can be considered as an indicator of the substitution of formal medical care for informal care and also leads to higher health care expenditures.

2.1.3.3. Economic Standing

The demand for health care is highly associated with income. The higher the income an individual earns, the higher the demand he will have for health care. However, this relationship has weakened in developed countries like the United States, where there is increased third-party insurance coverage, according to Henderson (2009). Furthermore, income and education levels are highly correlated. With a higher level of education, consumption of health care services is also high. Greater education also improves one's ability to recognize symptoms of certain diseases as well as increases a person's consciousness about his health status which raises the demand for health care consumption.

2.1.3.4. Physician Factors

Physicians have also a considerable role in increasing the demand for health care, by creating supplier-induced demand. Patients are willing to trust physicians to make choices for them because of the difficulty in gathering and

understanding medical information. This, however, creates a conflict of interest on the physicians as a supplier. In some cases, physicians get payments for each service they provide which creates incentives to render more expensive services. This means that patients or society pay for such uneconomical services.

2.1.4. Income Elasticity of the Demand for Health Care

This study considers how a consumer's demand for health care changes as income changes. The main objective is to examine how health care expenditure changes with income holding price fixed. In economic theory, an increase in income affects the budget line when price is fixed, by shifting it outward in a parallel fashion. For normal goods, the consumer purchases more. The opposite is true in the case of inferior goods.

The income elasticity of demand measures the relationship between a change in quantity demanded for a certain good and a change in real income. It can be used as an indicator for the health industry, consumption patterns, and as a guide to firms' investment decisions. The income elasticity of health expenditure is thus defined as the percentage change in health expenditure in response to a percentage change in income. Mathematically;

$$E_I = \frac{\% \text{ change in HE}}{\% \text{ change in I}} = \frac{\partial HE}{\partial I} \times \frac{I}{HE}$$

A positive income elasticity of demand is associated with normal goods. An increase in income leads to a rise in demand (health care expenditure in this

case). So, a value of elasticity greater than zero will mean that health care is a normal good. If $E_I < 1$, an increase in income is accompanied by a less than proportionate increase in health care expenditure. (e.g., a 10 percent increase in heath expenditure due to a 20 percent increase in income). $E_I > 1$, an increase in income is accompanied by a larger increase in health care expenditure. (e.g., a 20 percent increase in health expenditure due to a 10 percent change in income).

If the income elasticity is negative, an increase in income is accompanied by a decrease in health care expenditure. For example, if a 10 percent decrease in health care expenditure occurred due to a 20 percent increase in income, we would conclude that health expenditure is an inferior good.

My research will analyze health care expenditures mostly from the demand side; from the supply side only the number of physicians per 1,000 people will be included in the model because of the limited availability of data for the other supply side variables. The income elasticity of health care expenditure will then be derived from the parameter estimate of the coefficient on income. This will be discussed thoroughly in the data and empirical model section.

2.2 Brief Overview of Health Expenditures & Health Outcomes in Sub Saharan Africa

2.2.1. Health Expenditure Per Capita

The developing regions of the world have been recording low health care expenditures over the years regardless of the existing health care burden. Health care expenditure in these regions is mostly covered by external resources which are not the means for sustainable health care expenditure and health outcomes. The table below shows the total health expenditure and some of the components of health expenditures by region of the world for the year 2001 and 2011. This allows us to see the change in health expenditure over time and also to make a comparison of health care expenditure in Sub-Saharan Africa with other regions of the world.

Table 1: Healthcare Expenditures by Region

Regions	HE per capita, PPP (constant 2005 international $)		HE, private (% of GDP)		HE, public (% of GDP)	
	2001	2011	2001	2011	2001	2011
East Asia & Pacific	277.1	623.0	1.9	2.2	4.7	4.9
Middle East & North Africa	326.9	619.0	2.1	1.9	2.9	2.7
Sub-Saharan Africa	89.0	150.8	3.8	3.6	2.5	2.8
World	615.7	1063.4	4.1	4.0	5.6	6.1

Source: The World Bank Database

As can be seen from the above table, Sub Saharan Africa has the lowest health care expenditure per capita when compared with the other regions. Regardless of the existing huge disease burden, health care spending in this region has remained low. Total health expenditure is largely financed by out-of-pocket payments from its largely disadvantaged population. According to Huber (2015), Sub-Saharan Africa's health and health-care systems are among the lowest in the

world. To make it even worse, health care is not given the appropriate policy attention to improve health and healthcare delivery.

2.2.2. Prevalence of HIV in Sub Saharan Africa

HIV still has a great impact on Sub Saharan Africa in many ways. Since the outbreak of this pandemic, it has extensive social and economic impacts. According to UNAIDS (2012), 34 million people were estimated to be living with HIV and 69 percent (23.5 Million) of the people living with it are in Sub-Saharan Africa. The table below shows the prevalence of HIV for the regions for which data were available.

Table 2: Prevalence of HIV, Total (% of Population Ages 15-49)

Regions	Prevalence of HIV, total (% of population ages 15-49)	
	2001	2011
South Asia	0.3	0.3
Sub-Saharan Africa	5.8	4.7

Source: The World Bank Data Base

As can be seen from the table the prevalence of HIV in Sub Saharan Africa appears to be higher than in South Asia. A huge improvement in creating awareness, promoting preventive measures, and in ensuring access to life prolonging medications have been made. UNAIDS (2012) also revealed a 32 percent reduction in the number of AIDS-related deaths in sub-Saharan Africa from 2005 to 2011.

2.2.3. Infant Mortality

There has been a remarkable achievement in decreasing the infant mortality rate. According to Demombynes (2012), 12 Sub Saharan countries reported a decline in the under-age-five mortality rate above 4.4, which is the

annual rate required to achieve one of the Millennium Development Goals, a two-thirds decline of the under-age-five mortality rate between 1990 and 2015. Senegal, Rwanda, Kenya, Uganda, and Ghana had large drops with more than 6 percent per year. Figure 1 below shows the decline in infant mortality rate over the years.

Figure 1-Infant Mortality Rate (per 1; 000 live births) in Sub Saharan Africa
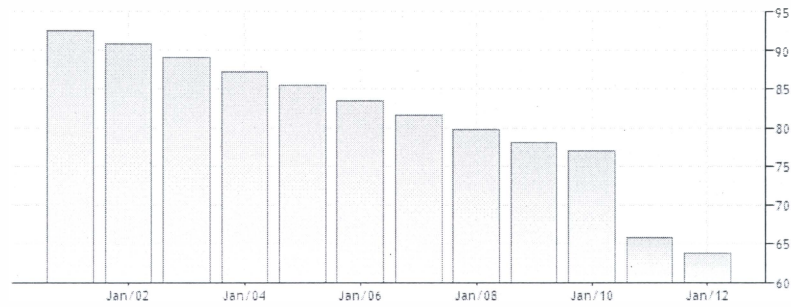
Source: Trading Economics 2015

Figure 2-Under-Age- Five mortality Rate by Millennium Development Goal Region
1990-2012 (deaths per 1,000 live births)
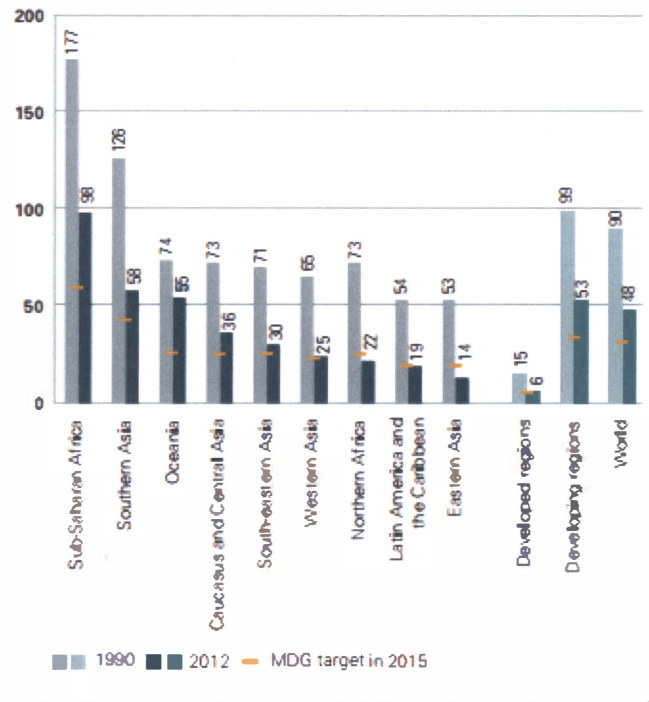
Source: UNICEF 2013

As can be seen from figure 2, all regions have shown a significant
progress in reducing under-age-five mortality rate. According to UNICEF (2013),
with the exception of Sub Saharan Africa and Oceania, all regions were able to
show a decline in under-age-five mortality rate by more than half. This being a
tremendous achievement, Sub Saharan Africa still has the highest infant mortality
rate when compared with the other regions as shown in the table below.

Table 3: Infant Mortality Rate, (Per 100 Live Births)

Regions	Infant Mortality rate, (per 1,000 live births)	
	2001	2011
East Asia & Pacific	30	17
Latin America & Caribbean	25	16
Middle East & North Africa	33	21
OECD members	10	7
South Asia	67	48
Sub-Saharan Africa	92	65

Source: The World Bank: World Development Indicators

A higher infant mortality rate has an impact on policy decisions related to healthcare expenditure. Presumably, a higher healthcare expenditure leads to improved or better access to healthcare which can in turn reduce the infant rate.

2.2.4. Life Expectancy

The table below shows 2012 life expectancy data from the World Bank. Life expectancy at birth in Sub Saharan Africa is 56, which is extremely lower than the other regions. This might also be related to inadequate access to health care, nutrition, and other variables which are due to economic, institutional and regional factors.

Table 4: Life Expectancy at Birth

Regions	Life expectancy at birth, total (years)
East Asia & Pacific	75
Latin America & Caribbean	75
OECD	80
South Asia	67
Sub-Saharan Africa	56

Source: The World Bank: World Development Indicators

2.3 Empirical Evidence

Unlike the case of developed countries, there is a huge lack of econometric studies for developing countries, specifically sub-Saharan Africa. Some of the few studies that have focused on this region along with others examining other regions will be discussed in this section.

Newhouse (1977), one of the best-known researchers in this field, examined the relationship between medical care expenditure and income across 13 developed countries, regressing per capita medical care expenditures on per capita GNP. He reached two major conclusions. First, GNP accounts for most of the variance in medical care expenditures across countries. Second, the income elasticity of medical care expenditures across countries exceeds one which by definition implies that, at the margin, medical care is a luxury good. He further explained how the level of economic development affects the nature and composition of health expenditures. Newhouse also stressed that such findings as his are consistent with the view that in developed countries, medical services at the margin have less to do with common measures of health status such as mortality and morbidity and more to do with health services that are not easily measured, such as relief of anxiety, more accurate diagnoses, and heroic measures near the end of life.

Hitiris and Posnett (1992) re-analyzed the models of Newhouse and Leu using panel data for 20 OECD countries for the period 1960 to 1987. All models were estimated both in linear and log-linear form. Their results re-confirmed the importance of GDP as a major determinant of health expenditure, with an

elasticity of about one. The importance of some non-income variables was also confirmed, although the direct effect of such factors appeared to be small.

Gebesemete and Gerdtham (1992) used data for 22 OECD countries for the period of 1972 to 1987. They found that country fixed effects and time fixed effects impacted health expenditure and had an important effect on the income elasticity of demand. The estimated elasticity of health expenditure with respect to GDP was 0.74 in the static equilibrium models. But, the remaining variables were insignificant. This study also found out that the age structure of the population of a country may also be of prime importance in determining the level of health care expenditures.

Gebesemete and Gerdtham (1992) investigated the determinants of health care expenditure for countries in Africa and found that GNP per capita, the percentage of births attended by health staff, and foreign aid received per capita explained 78.3 percent of the variation in health care expenditure. GNP per capita was found to be the most significant factor explaining differences in health care expenditure and the income elasticity was close to unity unlike to the results of previous studies focusing on OECD countries in which it was greater than one. In their research of health care expenditure in Africa, they discovered that the demand for medical services fluctuates with age; those under 15 years of age utilize medical services on a higher than average basis.

Murthy and Akunade (2009) used a cross-sectional data set for 2001 from 44 African countries. They empirically confirmed that the major determinants of real per-capita health care are real GDP per-capita and real per- capita foreign aid.

Their results derived from ordinary least squares, least absolute error, and two-stage least squares were robust with a statistically significant and positive effect of income on health care expenditure revealing that health care is a necessity rather than a luxury good in the countries studied. While explaining the significantly positive impact of foreign aid, the authors pointed out that official development assistance benefiting the health sector in the long run is capable of fueling economic growth through improvements in the population's health stock.

Previous studies have not considered prevalence of disease epidemics such as HIV/AIDS or malaria and in their models. Combating HIV/AIDS, malaria and other diseases is one of the Millennium Development Goals. According to the UN/AIDS report of 2010, in 22 countries of sub-Saharan Africa, the HIV incidence declined by more than 25 percent between 2001 and 2009. Still, Eastern and Southern Africa remain the areas most heavily affected by the HIV epidemic worldwide. Out of the total number of people living with HIV worldwide in 2009, 34 percent resided in ten countries in Southern Africa. The variation in the trend of HIV/AIDS may also have an impact on the trend of per capita health expenditure. This issue will be examined further in this research study.

According to the World Health Organization (2003), Least Developed Countries exhibited the worst health outcomes and the health Millennium Development Goals (MDGs) are least likely to be met in spite of the fact these nations receive huge amounts of health resources or official development assistance (ODA).

Lv and Zhu (2014) performed a panel data analysis to study the relationship between per capita health care expenditures and per capita GDP for 42 African countries over the period 1995 to 2009. In this study, income elasticity was found to vary with income level as opposed to being constant, and indicated that health care is a necessity rather than a luxury for African countries. The proportion of the population aged 65 or older was statistically insignificant, while the infant mortality rate per 1,000 live births had a negative effect on per capita healthcare expenditure.

Jaunky and Khadaroo (2008) examined the income elasticity of health care expenditure for 28 African countries for the period 1991 through 2000. Their study also found public health expenditure to be a luxury while private health expenditure a necessity. The income elasticity of public health expenditure was found to be pro-cyclical and private health expenditure was counter-cyclical.

3. Data and Empirical Model

Panel (1995-2011) data from 40 sub-Saharan African countries are employed in this study to examine the determinants and income elasticity of health care expenditure in the region. The empirical model is presented as follows:

$$HE = \beta_0 GDP^{\beta_1}.ODA^{\beta_2}.AGE65^{\beta_3}.IMR^{\beta_4}.HIV^{\beta_5} \qquad (1)$$

$$\log(HE) = \beta_0 + \beta_1 \log(GDP) + \beta_2 \log(ODA) + \beta_3 \log(Age65) + \beta_4 \log(IMR) + \beta_5 \log(HIV) \qquad (2)$$

The dependent variable is real per capita health expenditure (HE), which is the total sum of public and private health expenditures as a ratio of total population. Explanatory variables include real per capita gross domestic product (GDP), net official development assistance (ODA), the percentage of the population of ages 65 and above (AGE65), and the prevalence of HIV/AIDS (HIV). The key variable of interest here is real per capita income, which will allow us to estimate the income elasticity of health expenditure. All the data are extracted from the World Development Indicators (WDI). The description of each variable as defined by the data source will be discussed in the next section.

Looking at the variables, obviously a less healthy population will on average require more resources and thus result in greater demand for health care and an increase in per capita health expenditures (Sen 2005). Infant mortality (a commonly used measure of health outcomes) and the prevalence rate of HIV/AIDS both demonstrate the health status of the population, and an increase in either is thus expected to raise per capita health expenditure.

The demand for health care also varies with age where the rate of health care consumption shoots up during the last years of life. Hence, health care spending is expected to escalate with percentage of population of age 65 and above. Due to limited availability of data, the proportion of the population under 15 years of age is not included in the model.

The expected sign for the coefficient of official development assistance is undetermined; it may either be positive or negative. The coefficient is expected to be positive in the scenario where the sub-Saharan countries are somewhat

dependent on foreign aid in financing their health sectors. If the coefficient is negative, this will imply that government policy makers and non-governmental organizations may wish to direct foreign aid to the other sectors of the economy.

4. Variable Description

4.1 Per Capita Health expenditure (HE)

Total health expenditure is the sum of public and private health expenditures as a ratio of total population. It covers the provision of health services (preventive and curative), family planning activities, nutrition activities, and emergency aid designated for health, but does not include provision of water and sanitation. Data are in international dollars converted using 2005 purchasing power parity (PPP) rates.

4.2 Per Capita Income (GDP)

Per Capita income (GDP per capita based on purchasing power parity), is gross domestic product converted to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as the U.S. dollar has in the United States. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion

and degradation of natural resources. The data are in constant 2011 international dollars.

4.3 Net Official Development Assistance (ODA)

Net official development assistance (ODA) per capita consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC) by multilateral institutions and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients. It is calculated by dividing net ODA received by the midyear population estimate. It includes loans with a grant element of at least 25 percent (calculated at a rate of discount of 10 percent).

4.4 Population of Ages 65 and Above (AGE65)

Population ages 65 and above is the proportion of population of ages 65 and above as a percentage of the total population. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship except for refugees not permanently settled in the country of asylum, who are generally considered part of the population of the country of origin.

4.5 Prevalence of HIV/AIDS (HIV)

The Prevalence of HIV refers to the percentage of people ages 15 to 49 who are infected with HIV.

5. Estimations Methods

The concern with endogeniety due to the fact that some unobservable variable might be affecting both health expenditures and income in addition to the existence of reverse causality warrants an estimation of the models using an instrumental variables approach. An increase in health care expenditure may lead to an increase in income through enhanced health outcomes and increased productivity. As estimates from OLS regression will be biased, instrumental variable regression will be the econometric approach that will be used. One of the contributions of my research will be the use of arable land as (percent of total land area) as an instrumental variable for the endogenous variable GDP. According to the World Bank (2011), in many SSA countries, the agricultural sector is the largest employer. According to Deutsche Bank (2014), agriculture accounts of 25 percent of Sub Saharan Africa's GDP which makes it the predominant sector of the economy. The rule of thumb for an instrument variable to be valid is that it must be exogenous to the error term and should be correlated with the endogenous variable it is treating, GDP in this case. The assumption is that arable land is correlated with GDP per capita, but not with the unobserved determinants of per capita healthcare expenditure.

The first stage, reduced form is shown below:

$$\log (GDP_{pt}) = \alpha_0 + \alpha_1 \log (ARL_{pt}) + \alpha_2 X + u_{pt}$$

where GDP represents per capita income and ARL (arable land, % of total land area) is the instrument. X is a vector of control variables and u denotes the error term. The second-stage regression is shown as follows:

$$\log (HE_{pt}) = \beta_0 + \beta_1 \log (\widehat{GDP}_{pt}) + \beta_2 X_{pt} + \varepsilon_{pt}$$

This is the structural equation of interest and the coefficient of β_1 can be interpreted as the income elasticity of health care expenditure. The assumption is that the instrument variable will have an indirect impact on health expenditures through its effect on GDP per capita. The instrumental variable regression approach is hence expected to produce unbiased estimates.

6. Results and Discussion

As it was mentioned in the data and empirical model section, a panel from 1995 to 2011 was used in analyzing the income elasticity of health expenditures in line with the other determinants of health expenditure. The results of the instrumental variable regression are presented in Table 6.

Table 5: Panel Data Results

logHE	M1 b/(SE)
logGDP	0.477^{***} (0.08)
logODA	0.148^{***} (0.03)
logAge65	0.895^{***} (0.19)
logHIV	0.166^{***} (0.02)
constant	-1.027 (0.42)
R-sqr Dfres BIC	0.726

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

The panel data were analyzed through instrumental variable regression, where arable land as a percent of total land area was used as the instrument for the endogenous variable GDP (per capita income). The tests of endogeniety and the first stage summary statistics are shown in Appendices 2 and 3. Both Durbin and Wu-Hausman tests registered significant p-values and the null hypothesis was rejected which suggests that GDP is indeed endogenous.

Consistent with previous studies, per capita income was found to have a significant effect on per capita health expenditure. Holding other things constant,

for each percentage increase in GDP per capita, health expenditure is found to increase by 0.48 percent suggesting per capita health expenditure is a necessity. The results are consistent with the region's health financing where majority of health expenditure in sub-Sahara Africa is absorbed by private healthcare providers, with out-of-pocket financing being the mainstream of the private health expenditure. In the majority of Sub-Saharan African countries, private health insurance appears to have a very low membership, contributions, and coverage scale (Denis Drechsler and Johannes Jütting, 2005). This is mainly attributed to the low per-capita income of the region which constrains individuals from enrolling in private health insurance. The majority of the population is engaged in agriculture in the region. So, the minority is involved in urban works, where only a few exceptional companies cover health insurance. There is no doubt that households in such an environment are going to face income constraints in financing health expenditure.

Official development assistance also has a significant positive impact on healthcare expenditure. Healthcare expenditure increases by about 0.15 percent for each percentage increase in ODA.

Theoretically and presumably, infant mortality is considered as one of the factors fueling up health expenditure. The causality also goes from health expenditure to infant mortality which is supposedly negative. This variable was dropped due to its high correlation with HIV.

The population of age 65 and above has a significant, positive impact on healthcare expenditure which is consistent with the theory and previous studies. A

percentage increase in the population of age 65 and above is associated with an increase on healthcare expenditure by 0.89 percent.

The coefficient of HIV indicates that the prevalence of HIV has a significant, positive impact on healthcare expenditure. Each percentage increase in the prevalence rate of HIV is found to cause an increase in healthcare expenditure by 0.17 percent.

These results together confirm that healthcare in this region is a necessity and also that all of the demand-side variables included in the model have a significant impact on health expenditures. The next two sections will discuss what we can conclude based on my research as well as the policy implications.

The model was further estimated by the income level of the countries in the panel as there is a variation in income between countries. World Bank's 2016 list of economies (based on 2015 gross national income (GNI) per capita) is used to group countries by income level. The groups are: low income, $1,025 or less; lower middle income, $1,026–4,035; upper middle income, $4,036–12,475; and high income, $12,476 or more. Seychelles, which is not included in the panel data was the only country in the high income category. The sample size for low, lower middle and upper middle income groups are 22, 11 and 7 respectively. The tables in Appendix 4 show the different results for the different income groups. The results for the lower and lower middle income groups are insignificant and are not consistent with the overall model. The model for the upper middle income groups has coefficients that are significant at the 1 percent level. The coefficient of GDP

for this group was also found to be less than one which is consistent with the result for all countries combined.

7. Conclusion

The main objective of my research was to answer the question whether health care in Sub-Saharan African countries is a necessity or luxury in addition to exploring some of the other demand-side determinants of health care expenditures. Eight countries were also dropped from the study due to paucity of data. Supply side variables like the number of physicians per 1000 population that would have an impact on health expenditures were also not included in the model due to limited availability of data for this region for the study time period.

Instrumental variables were used in estimating the model due to one of the explanatory variables (GDP) being endogenous to the model. This will ensure the estimates obtained will not be biased. The coefficient for per-capita income is less than one, suggesting health care as a commodity is a necessity in Sub Saharan Africa. Official development assistance is also found to have a significant positive impact on health expenditure. A positive relationship was found between per capita healthcare expenditure and the proportion of the population of age 65 and above. Not surprisingly, the prevalence of HIV has a significant positive effect on health expenditure. This epidemic dominantly prevails in this region with enormous social and economic impacts there by increasing healthcare expenditure.

To sum up, income is found to positively effect health care expenditure in Sub-Saharan Africa, but the estimated income elasticity is less than one. Therefore, the results of this research suggest that health care is indeed a necessity.

Considering the fact that other variables that could influence health expenditures are excluded from the model due to data limitations, there is much room for future studies to explore more on this subject with all the relevant variables employed.

8. Policy Implications

The findings in this research suggest that income is the most significant factor affecting health expenditure. Health care as a commodity in this region is found to be a necessity. A Large amount of the total health expenditure is financed by the private sector where the majority of it is made out of pocket. By taking this into account, governments of the countries in Sub Saharan Africa should give the appropriate attention and increase their health expenditure to make health care affordable and accessible regardless of per capita income level. An aging population and the prevalence of HIV are found to drive up health expenditures. Promoting preventive care to maintain the health of the population would help lower health expenditures as chronic conditions and epidemics would be controlled at the early stage. A healthy population is one of the recipes for economic growth as it will boost productivity in the economy. Public investment

on healthcare should be seen as an opportunity towards increasing production as opposed to a cost as it has a massive impact on economic growth.

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10. Appendices

Appendix 1- Tests of Endogeniety

```
Tests of endogeneity
Ho: variables are exogenous

Durbin (score) chi2(1)          =     38.498  (p = 0.0000)
Wu-Hausman F(1,554)             =     40.897  (p = 0.0000)
```

Appendix 2- First Stage Regression Summary Statistics

```
                        Adjusted      Partial
        Variable   R-sq.    R-sq.      R-sq.     F(1,555)   Prob > F

          logGDP   0.4153   0.4110     0.1268    80.5726    0.0000


Minimum eigenvalue statistik = 80.5726

Critical values                    # of endogenous regressors:    1
Ho: Instruments are weak           # of excluded instruments:     1

                                    5%     10%    20%    30%
2SLS relative bias                        (not available)

                                    10%    15%    20%    25%
2SLS Size of nominal 5% wald test  16.38  8.96   6.66   5.53
LIML Size of nominal 5% wald test  16.38  8.96   6.66   5.53
```

Appendix 3 Regression Results Grouped by Income Level

Variables	Low	Lower Middle	Upper Middle
logGDP	-0.74	0.44	0.31***
	(7.78)	(0.80)	(0.11)
logODA	0.49	0.05	-0.28***
	(0.86)	(0.06)	(0.06)
logAge65	0.12	0.15	1.27***
	(2.10)	(0.50)	(0.28)
logHIV	-0.31	0.03	0.35***
	(1.34)	(0.06)	(0.06)
_cons	6.74	0.31	1.66*
	(53.30)	(6.54)	(0.74)

*P<0.05, **P<0.01, ***P<0.01

Appendix 4 -List of Sub Saharan Countries Included in the Study

List of Sub Saharan African Countries Included in the Study	
Angola	Kenya
Benin	Lesotho
Botswana	Madagascar
Burkina Faso	Malawi
Burundi	Mali
Cabo Verde	Mauritania
Cameroon	Mauritius
Chad	Mozambique
Comoros	Namibia
Congo, Dem. Rep.	Niger
Congo, Rep.	Nigeria
Cote d'Ivoire	Rwanda
Equatorial Guinea	Senegal
Eritrea	Sierra Leone
Ethiopia	South Africa
Gabon	Swaziland
Gambia, The	Tanzania
Ghana	Togo
Guinea	Uganda
Guinea-Bissau	Zambia