HEALTH EXPENDITURE, HEALTH OUTCOMES AND ECONOMIC GROWTH IN SUB-SAHARAN AFRICA

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BENIN CITY

NIGERIA.

JULY 2015

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Thesis submitted to the Department of Economics and Statistics, Faculty of Social Sciences, University of Benin, Benin City, Nigeria, in partial fulfilment of the requirements for the award of Doctor of Philosophy (Ph.D.) degree in Economics.

JULY 2015

DECLARATION

This is to certify that this thesis is the result of my research work in the Department of Economics and Statistics, University of Benin, Benin City, Nigeria, in partial fulfilment of the requirements for the award of the degree of Doctor of Philosophy (Ph.D.) in Economics. I declare that no portion of this thesis has been previously submitted for another degree in this University or other institution of higher learning.

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CERTIFICATION

We certify that Eric Arthur carried out this research work in the Department of Economics and Statistics, University of Benin, Benin City, Nigeria in partial fulfilment of the requirements for the award of Doctor of Philosophy degree (Ph.D.) in Economics.

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DEDICATION

I dedicate this work to my parents, Mr. and Mrs. Arthur, and my aunties, Ms. Grace Kwakwa and Ms. Hannah Sarkodie for their support and encouragement throughout my education.

ACKNOWLEDGEMENTS

To the Almighty God, I give my gratitude for His gift of knowledge, guidance, and health without which this research would not have been completed. I wish to express my sincere appreciation to my supervisors, Professors M.A Anyiwe, and H.E Oaikhenan, for their time and effort in guiding me with valuable comments throughout the course of writing this thesis. I will forever be grateful for your guidance. I also want to thank Professors Oriakhi and Monye-Emina, Dr Oyefusi and the entire staff of the Department of Economics and Statistics, University of Benin, for their valuable inputs. To Dr Nketiah-Amponsah and Mrs. Sarah Akuoni of the University of Ghana, Legon, I want to say Thank you!!

I also want to acknowledge the support of the African Economic Research Consortium (AERC) who provided me with sponsorship for the PhD program. I am grateful for the valuable inputs into my career and future. Indeed, you made my dream come true. Thank you AERC!! I want to especially thank Prof Festus Egwaikhide of the University of Ibadan for his tutorship, Sir, God bless you. To the entire staff at the University of Ibadan, and all my colleagues in the AERC CPP program, I appreciate the interactions we had and the support for each other. It was a blessing meeting each one of you and I wish you all well in your endeavours.

Finally, my heartfelt appreciation to Dr Ofori Boateng and Dr Tuffour for their encouragement. To Blessing Oligbi and family, Jacob Novignon, Frank Ogbeide, Vera Fuein, Yemisi Akinkuotu, and Saidi Atanda, thank you for being part of my success. A special thank you to Paul Adjei Kwakwa, Ataa Boakyewaa, Mercy Akosua Cobbah, Michelle Clottey and Edna Quansah for their support and prayers. And to all my friends, I say a big thank you. I pray God favours you as He has favoured me. Thank you for being there for me.

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ABBREVIATIONS

AfDB – African Development Bank

GDP – Gross Domestic Product

GMM – Generalised Method of Moments

IMF – International Monetary Fund

IMR – Infant Mortality rate

LEB – Life Expectancy at Birth

MDG – Millennium Development Goals

MENA – Middle East and North Africa

MMR – Maternal Mortality Rate

OLS – Ordinary Least Squares

OECD - Organisation for Economic Cooperation and Development

SSA – Sub-Saharan Africa

UMR – Under-five mortality rate

UNICEF – United Nations International Children's Emergency Fund

UN – United Nations

UHC – Universal Health Coverage

WB – World Bank

WHO – World Health Organisation

2SLS/TSLS – Two Stage Least Squares

PVAR – Panel Vector Autoregressive

GLOSSARY

- **Economic growth**: refers to growth in Gross Domestic Product (GDP) or Gross Domestic Product per capita of an economy over time. This is measured as the change in the current year's GDP relative to that of the previous year.
- **Health outcomes/status**: refers to the state of health of an individual, group or population. Common measures include Life expectancy at birth, and infant and under-five mortality rates.
- **Life Expectancy at birth**: refers to the number of years a new-born infant is expected to live given that prevailing patterns of mortality at the time of birth were to stay the same throughout the individual's lifetime.
- **Infant Mortality rates**: refers to the probability of dying before age one per 1000 live births. It is measured as the number of infant deaths per 1000 live births per year.
- **Under-five mortality rates**: measures the probability of dying between age one and age five per annum. It is a measure of the effectiveness of health care systems.
- **Total Health expenditure**: The sum of public and private health expenditure incurred in the provision of health services (preventive and curative), family planning services, nutrition activities, and emergency aid designated for improvement in health.
- **Public health expenditure**: Spending incurred by government on healthcare provision, plus money from grants, social insurance schemes and non-governmental organisations.
- **Private health expenditure**: This includes direct household (out-of-pocket) expenditure on health, private insurance schemes, charitable donations to health care and direct service payments by private corporations.

ABSTRACT

The study examines the interrelationship among health expenditure, health outcomes and economic growth in some selected Sub-Saharan African (SSA) countries. These countries have made significant efforts in increasing health expenditure over the years, with the aim of improving health outcomes and accelerating economic growth. Despite this, health outcomes have only responded marginally in SSA, raising concerns on the significance of health expenditure in improving health outcomes. Besides, empirical evidence of the effect of health outcomes on economic growth is mixed. This study thus investigates the effect of health expenditure on health outcomes, applying the fixed effects model. Further, the study examines the effect of health outcomes on economic growth using the Generalised Method of Moments (GMM) estimator. Lastly, the study tests the causal relationship among health expenditure, health outcomes, and economic growth using Panel Vector Autoregressive (PVAR) model. The data for the study were sourced from the 2012 World Bank's World Development Indicators (WDI) for a sample of 40 SSA countries from 1995 to 2011.

The findings from the study indicate that health expenditure has a significant, but inelastic effect on health outcomes in SSA, reducing mortality rates and improving life expectancy at birth. Reductions in mortality rates were significantly influenced by public health expenditure, whereas improvements in life expectancy at birth were significantly influenced by private health expenditure. There is, however, a strong complementary relationship between private and public health expenditures in SSA, despite the dominance of the former over the latter. In addition, clean water, proper sanitation and immunisation rates were found to enhance health outcomes, whereas the prevalence of diseases and urban population growth rates had deleterious effects on health outcomes. Health outcomes were also found to contribute significantly to economic growth in SSA. The empirical evidence indicates that this was driven more by reductions in mortality rates than by improvements in life expectancy at birth in the region. Physical capital, education and openness to trade contribute positively to economic growth, whereas the age dependency ratio serves as a drag on growth rate. Lastly, the findings indicate bidirectional causality between health expenditure and health outcomes, between health outcomes and economic growth and unidirectional causality from health expenditure to economic growth.

Given the significant, but inelastic effect of health expenditure on health outcomes and the significant contribution of health outcomes to economic growth, the study recommends that SSA countries should make efforts to increase health expenditure to improve health outcomes in order to speed up growth. In particular, there should be deliberate efforts to increase public health expenditure with a view to reducing the burden of private health spending on individuals. This perhaps can be achieved through effective health insurance schemes, which will enable people to save against financial crisis that may arise due to ill health, thereby reducing out-of-pocket health expenditure. In addition, there is the need for public enlightenment on the importance of constant health check-ups given the significance of the use of preventive health care in enhancing health outcomes. Furthermore, it is necessary to improve environmental conditions due to the negative effects of such conditions on health outcomes. Finally, there is the need to manage the population growth rates in SSA countries to reduce the age dependency ratio in order to enhance the growth rate of per capita GDP in the region.

CHAPTER ONE

INTRODUCTION

1.1 Introduction to the Study

Poor health has a dire consequence on the individual. It does not only incapacitate him/her; it also prevents him/her from participating effectively in the productive and social sectors of the economy. This affects the quality of life and productivity of the individual. Indeed, the saying "health is wealth" summarises the importance of health to the individual. For instance, a person's health status is an important factor in the pursuit of education. In addition, participation in the labour force is dependent on good health, which determines an individual's ability to work efficiently in a demanding work environment. All these have implications for the individual's income and thus likely to determine poverty level. Undeniably, as noted by the Nobel Laureate Amartya Sen (1980), health, like education, is among the basic capabilities that gives value to human life.

Besides its adverse impact on the individual, poor health also has a negative impact on the productivity and economic growth of a nation. Health is a key component of human capital because it enhances the worker's productivity by increasing his/her mental and physical capacities. According to Barro (1996), health is a capital productive asset and an engine of economic growth. Health status can affect economic growth through its effect on people's ability to save out of their income, which is a key determinant of physical capital accumulation (Bloom and Canning, 2003; Solow, 1956; Romer and Chow, 1996). Also, individuals with better health status are likely to invest more in education because they expect to enjoy the benefit over a longer period (Bloom and Canning, 2003). This improves the quality of the labour force and

enhances economic growth. Moreover, Galor (2005) argues that in an environment marked by low child mortality, parents are likely to choose a low level of fertility. This limits the growth of total population, thereby improving the demographic dividend and supports per capita GDP growth. It has been argued that poor health appears to be a key factor in explaining the existence of underdevelopment in many regions (Cole and Neumayer, 2006; World Health Organisation, 2006).

One of the major goals of economic development is a healthy population. The importance of health outcomes is highly recognised in the Millennium Development Goals (MDGs), with three of the eight goals being directed to the improvement in health status. The 2001 World Health Organisation's Commission on Macroeconomics and Health alludes to the fact that ill health is an impediment to economic growth, and thus recommends that in our growth efforts, attention must be paid to health improvement. However, the question that comes up is how to improve health outcomes. Several development policies have suggested that health expenditure is an effective means of influencing health outcomes. This is based on the premise that health expenditure serves as a policy tool for the government in influencing the health sector to achieve desired outcomes. This view has, however, not been totally supported by empirical evidence as studies have produced mixed results. While some studies have reported a significant effect of health expenditure on health outcomes,[1] others have suggested that health expenditure has no significant effect[2].

[1] Nixon and Ulmann (2006), Anyanwu and Ehijakpor (2007), Oluyele and Afeikhena (2008), Kamiya (2010), Issa and Ouattara (2005), Novignon, Olakojo and Nonvignon (2012), and Berger and Messer (2002), Akanni (2012).

[2] Musgrove (1996), Filmer and Pritchett (1997, 1999), Fayissa and Gutema (2008), Gupta, Verhoeven and Tiongson (2002)

Sub-Saharan Africa is argued to be the least-developed region in the world, with its attendant health problems (WHO, 2010). It is suspected that the poor health status in the region might be contributory to the slow pace of economic growth. Communicable diseases and child mortality are more prevalent in SSA than other regions in the world (WHO, 2010). In an effort to improve health outcomes, the Abuja Declaration by Heads of States of African Union in 2001 sought to mobilise resources by allocating at least fifteen percent of annual budgets to the health sector. Akanni (2012) reports that many countries have not achieved this target. The possible explanation for government's failure to meet the required target may be found in the paucity of funds[3] or a sheer reluctance to increase the allocation to the health sector. Besides, health status is argued to affect economic growth in SSA. The WHO (2011) postulates that millions of lives could be saved if health is improved with the resulting effect of reducing poverty and improving growth rate. It is thus pertinent to know whether or not poor health outcomes can be attributed to inadequate spending, and whether the dismal economic performance can be explained by the former or not.

1.2 Statement of Problem

Sub-Saharan Africa (SSA) has made significant efforts in increasing health expenditure over the years, with the aim of improving health outcomes and accelerating economic growth. Despite this, health outcomes have only responded marginally, and growth in GDP per capita in the region has experienced some fluctuations suspected to be due to mortality reductions with the high fertility rate. This raises concerns on the significance of health expenditure to improving health outcomes in the region, and the effect of health outcomes on economic growth.

[3] The declaration also calls on development partners to honour the 0.5 percent development assistance to Africa.

Nevertheless, there exists no consistent empirical evidence on the effect of health expenditure on health outcomes and the ripple impact on economic growth in SSA.

Health expenditure in SSA increased from $42.82 to $97.07 per capita from 2003 to 2011. Unfortunately, this has not translated into significant improvements in health outcomes. Infant and under-five mortality rates declined from 86.52 to 64.88 and 140.82 to 99.56 per 1000 live births, respectively, while life expectancy at birth increased slightly from approximately 51 years to 56 years within the same period (World Bank, 2012). The percentage improvement in health status is abysmal compared to the percentage increase in health expenditure per capita for the period. Within the same period, economic growth in SSA has been unstable for most countries, despite the positive growth rates recorded from the year 2000. On the average, the growth rate of GDP per capita in SSA increased from 0.97 in 2000 to 1.77 in 2011 (World Bank, 2012). The fluctuation in growth rates may partly be due to the declining mortality rates coupled with the high fertility rates in the region (IMF, 2014). The low mortality rate with the high fertility rate leads to a high dependency ratio, which can drag the growth rate of GDP per capita.

Some studies have suggested that the marginal improvement in health outcomes and economic growth may be due to inadequate health spending[4]. For instance, the World Bank (2012) reports that the average health expenditure in SSA of $85 is far below the world average of $950 per capita recorded in 2010, and further argues that SSA spends only 6 percent of GDP on health care compared to 13 and 17 percent

4 Akanni, 2012; Oaikhenan and Umoru, 2012; Fayissa and Gutema, 2008; Kaseje, 2006; Jaunky and Khadaroo, 2006, World Bank, 2012.

respectively in the OECD[5] countries and North America. This level of spending is also below the target set by the Abuja Declaration of a minimum of 15 percent of government budgets to the health sector. This is suspected to be a reason for the marginal effect of health expenditure on health outcomes. Some studies have however suggested that health expenditure has no effect on health outcomes[6]. The question that comes up is whether the marginal improvement in health outcomes recorded over the period is a result of the low level of health spending as argued, or it is because health expenditure has no significant effect on health outcomes.

Moreover, the argument on the importance of health outcomes to economic growth has been inconclusive, especially for SSA. While Gyimah-Brempong and Wilson (2003) report that health outcomes contribute significantly to economic growth in SSA, Ogunleye (2011), and Frimpong and Adu (2014) do not find any significant effect. It has been argued that the reason most governments spend less on health care in SSA is due to the less importance placed on the contribution of health outcomes to economic growth. It is, therefore, necessary to understand the contribution of health status to economic growth as the region seeks to improve health outcomes, through increasing health expenditure. Besides, Muskin (1962) has suggested that health spending contributes to economic growth since it is an investment into health capital which is a component of human capital. Given the importance that has been placed on health expenditure in improving health outcomes and economic growth, and the postulated significance of health status to economic growth, it becomes necessary to understand these relationships, particularly in the context of SSA.

[5] Organisation for Economic cooperation and Development
[6] Musgrove, 1996; Filmer and Pritchett, 1997, 1999.

Most studies on the relationship among these variables have been conducted elsewhere in the world with just a few studies on SSA[7]. The few studies on SSA have also produced inconclusive evidence on the effect of health expenditure on health outcomes. For instance, Fayissa and Gutema (2008) report that increases in health expenditure are associated with a fall in life expectancy at birth in SSA, blaming it on tax-financed health care and user fees. Akinkugbe and Afeikhena (2006) conclude that health expenditure is significant in influencing health outcomes. The study, however, uses only public health expenditure in the analysis. This is likely to be problematic given that private health expenditure is higher than public health expenditure in SSA. Novignon, Olakojo and Nonvignon (2012) and Akanni (2012) agree in their reports that health expenditure leads to a significant improvement in health outcomes but differ on the channels of influence. Furthermore, there is no known study on the causal relationship among health expenditure, health outcomes and economic growth in SSA, to the best of our knowledge.

In addition, despite the conflicting results produced by such studies, important variables that do influence health outcomes were mostly unaccounted for in the previous studies. This can affect the results and lead to biased outcomes. Socioeconomic determinants of health outcomes such as disease prevalence, environmental factors, and preventive health care use are important factors that influence a person's health status. Again, in modelling economic growth, it is important to account for the age dependency ratio and the degree of openness to trade, as these can also effect growth. Thus, to understand the interrelationship among these variables, it is important that all related factors are accounted for.

[7] Mugrove, 1996; Filmer and Pritchett, 1997, 1999; Gupta et al., 2002; Kamiya, 2010; Acemoglu and Johnson, 2007; He, 2009; Aghion et al., 2010.

1.3 Research Questions

This study seeks to provide answers to the following research questions:

i. Does health expenditure lead to improvement in health outcomes in SSA?

ii. Is there any significant effect of health outcomes on economic growth?

iii. What is the nature and direction of the causal relationship among health expenditure, health outcomes and economic growth in the region?

1.4 Research Objectives

The main objective of this study is to investigate the interrelationship among health expenditure, health outcomes, and economic growth in Sub-Saharan Africa (SSA). Specifically, the study seeks to:

i. Examine the effect of health expenditure on health outcomes in SSA.

ii. Investigate the effects of health outcomes on economic growth in SSA.

iii. Test the causal relationship among health expenditure, health outcomes and economic growth in the region.

1.5 Research Hypotheses

The present study hypothesizes that:

i. Health expenditure has no significant effect on health outcomes in SSA.

ii. Health outcomes do not contribute significantly to economic growth in SSA.

iii. There is no causal relationship among health expenditure, health outcomes and economic growth in SSA.

1.6 Significance of the Study

Despite the importance of the interrelationship among health expenditure, health outcomes and economic growth, much research has not been done on this in SSA. The few studies that have been conducted also do not provide clear-cut empirical evidence. This is evident in the mixed results found in the literature. Also, studies on the effects of health expenditure on health outcomes have failed to incorporate the effect of such social determinants of health outcomes as disease prevalence, environmental conditions, the use of preventive health care/immunisation, and population dynamics in the analysis. This has the potential to lead to a bias in the results obtained in such studies. Likewise, known studies on the contribution of health outcomes to economic growth in the region have left out the impact of the demographic dividend and openness to trade. This again has the potential of causing bias in the results obtained in their reports. In addition to the foregoing, the causal relationship among health expenditure, health outcomes, and economic growth have largely remained un-investigated. There is currently no substantive study, to the best of our knowledge, on these very important issues for SSA. Thus, this study seeks to provide an insight into the interrelationship among these variables in the context of SSA.

Understanding the relationship among health expenditure, health outcomes and economic growth is important for several reasons. Health is the core of the individual's existence, thus improving health first and foremost implies improving the wellbeing of citizens. An understanding of the channels through which health can be influenced is therefore extremely important. Meanwhile, previous studies have argued that there is an important effect of health outcomes on economic growth. It is,

therefore, important to understand whether or not there is an effect of health status on economic growth in SSA and the magnitude of this effect. This will contribute to poverty reduction through increased earnings and to economic growth through increased productivity of individuals, due to health improvement.

This study, therefore, proposes that to encourage governments to invest in health outcomes in SSA, there is the need to first understand the effect of such investment, and to know the other determinants of health outcomes. Then, even though understanding the significance of health investment in improving health outcomes is necessary, it would be worthwhile to understand the contribution of health outcomes to economic growth. Previous studies have often been focused on the developed regions leaving little evidence on SSA. It, therefore, calls for detailed research like this one to understand the nature of the relationship in the SSA context to inform policy. More so, by broadening the knowledge and understanding of the relationship, this study will contribute to the understanding of the role of health investments in meeting the health-related Millennium Development Goals (MDGs) in the region with the ultimate aim of achieving sustained economic growth and contribute to the policy on Universal Health Coverage (UHC) in SSA.

1.7 Limitations of the Study and Suggestions for Further Studies

The study has two limitations, and thus suggests these for further studies:

i. The short time span of the data restricts the study in assessing the short and long run nature of the causal relationship among the variables. Thus, it will be necessary if further studies could be conducted using a longer time span, given the availability of data.

ii. The study could not access the differential impact of capital and recurrent expenditure on health outcomes due to data unavailability. It will also be important if further studies could be conducted in this regard, particularly for SSA. Capital expenditure is the expenditure in acquiring capital goods, like hospital equipment, infrastructure, and the training of hospital staff, which are long-term investments. Recurrent expenditure, on the other hand, refers to expenditure for the day-to-day running of the health sector. This will be important to guide policy in setting long term and short term goals for health improvement.

1.8 Scope of the Study

The geographical focus of this study is Sub-Saharan Africa (SSA) for the period 1995-2011 using data from the World Banks's World Development Indicators (World Bank, 2012). The study seeks to understand the effect of the increases in health expenditure during this period on health outcomes and the contribution of health outcomes to economic growth, with the introduction of the Millennium Development Goals (MDGs). The benchmark of the MDGs was the year 1990; unfortunately, there is no data on health expenditure between the years 1990 and 1994 and after 2011, thus limiting the study to the use of the period 1995 to 2011. The study uses a sample of 40 SSA countries with complete data within the specified period[8]. The study focuses on SSA due to the peculiar situation of the region; poor health outcomes, low levels of health spending and slow pace of economic growth. There are three principal

[8] Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central Africa Republic, Chad, Comoros, DR. Congo, Cote d'Ivoire, Equatorial Guinea, Eritrea, Ethiopia, Gabon, The Gambia, Ghana, Guinea, Guinea Bissau, Kenya, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, South Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia.

variables of interest in the study: health expenditure (made up of public and private spending on health care), health outcomes (Infant and Under-five mortality rates and Life Expectancy at Birth), and economic growth (growth in GDP per capita).

1.9 Structure of the Study

The study is organised into six chapters. Chapter 1 has presented the introduction to the study, a statement of the problem, and research questions. In chapter 2, a background to the study is presented. Chapter 3 reviews the previous literature on the subject matter, dealing with the theoretical, empirical and methodological reviews. In chapter four, we present the theoretical framework, model specification and empirical methodology for the study. Chapter 5 presents the empirical results from the study in accordance with the objectives outlined in chapter 1. The study concludes with chapter 6 presenting a summary of the findings from the study, recommendations and conclusion.

CHAPTER TWO

BACKGROUND TO THE STUDY

2.1 Introduction

The main objective of this study is to investigate the interrelationship among health expenditure, health outcomes and economic growth in the context of Sub Saharan Africa. In this chapter, we present a background review of the study. The chapter is structured into five sections. Section 2.2 discusses the history of health systems in SSA, from the traditional medical practitioners to the modern health care system in Africa and in SSA in particular. Sections 2.3 and 2.4 present a review of health expenditure and health outcomes in SSA respectively. Finally, in section 2.5, a review of economic growth is carried out to identify the pattern and trends of economic growth in the region.

2.2 History of Health Care Provision in Sub-Saharan Africa

The provision of health care is affected by the environment, particularly, through the workings of the health system. Hence, a malfunctioning health system will fail to provide the necessary improvement in health care delivery and health improvement that is required, irrespective of the level of investment. In the 2000 World Health Report, a health system was defined to include all the organizations, institutions and resources that are devoted to producing health actions with the primary purpose of improving the health of individuals in the society (WHO, 2000). The workings of the health systems mostly focus on the provision and equity of health services. The health system aims to achieve two basic goals: goodness and fairness. Goodness implies responding to people's expectations; while fairness connotes the ability of the system

to respond to everyone without discrimination. Hence, a good health system achieves a balance between these two primary goals of goodness and fairness.

The health system in SSA has evolved mostly from the heavy presence of traditional medicine through the period of orthodox medicine and now the quest to integrate the two systems. Traditional healers/herbalist using a hybrid of "herbalism and spiritualism" mostly addressed health issues and concerns in SSA. People who were sick or had one health issue or the other visited a traditional practitioner in the town or travel to other towns to find one. The traditional healer combined the use of herbs and spiritual incantation in treating a patient with either a sickness or spiritual issue. Mostly the question that was left unanswered was whether the sick person was healed because of the herbal medicine or because of the spiritual incantation. Most of the practitioners derived their skills from traditions or informal training and mostly do their work either in the comfort of their homes, or in some cases in the homes of their clients depending on the nature of the sickness (Boom, Nsowah-Nuamah and Overbosch, 2008).

Traditional practitioners were mostly paid in kind, usually with foodstuff and animals (like fowls, goats, and sheep). Nevertheless, the quantity of the payment depended mostly on the severity of the illness. One peculiar feature of this practice was the easy access due to their proximity to the people since the healers mostly lived in the communities. Thus, people did not have to travel far from their homes to access medical care except in situations where the practitioner had no cure for a particular disease/ailment and the patient had to visit another practitioner from a different town.

This system of traditional medicine was somehow phased out mostly in the urban centres during the colonial era. This was due to the introduction of western medicine by the colonial government. The services of these health centres were mostly limited to the urban areas and city centres. The introduction of western medicine was, however, solely the preserve of the colonial masters, established to protect them against the possible contraction of infectious diseases from the "unhygienic" conditions of the environment and the people they interacted with on a daily basis. The rural centres were mostly left out due to the difficulty in accessing these areas by the colonial government and the difficulty in living in such areas due to the unavailability of most of the social amenities (electricity, clean water, proper sanitation). Thus, traditional medicine in this era was mostly left for the rural dwellers that still had confidence in this system and probably could easily afford it compared to the high cost of orthodox medicine and the restricted access.

In the era of missionary services in the African societies, the missionaries made efforts to establish health centres. These missionaries were mostly private and/or Not-For-Profit health service providers. They extended health service to the rural folks as they established churches and schools within the communities. Most of these health centres provided service for free or at a reduced cost to most of the people as part of their religious duties. Their services were mostly financed by donor organisations or from charity. This brought western/orthodox medicine closer to some of the people in the rural areas. In the post-independence era, most governments made efforts to extend services to the larger population, even though these tended to be biased towards services for the urban folks. Most countries resorted to the "cash and carry" system where people had to deposit cash before treatment was given and this is

suspected to be have contributed to the poor health status in that era. This period was characterised by high mortality rates, high fertility rates, low life expectancies and higher incidence of communicable and childhood diseases.

Two country examples about the introduction of western medicine in SSA worth mentioning is the introduction of modern medicine in Ghana and Nigeria. Christian missionaries and missionary societies first introduced western medicine into the then Gold Coast (currently Ghana) in the nineteenth century. Missionaries were almost the sole providers of modern medicine until the end of World War I. Important missionary medical facilities in Ghana today include Catholic-affiliated hospitals in Sunyani and Tamale, the Muslim Ahmadiyah facilities at Efiduasi Asokori, The Methodist hospital at Wenchi and a Presbyterian hospital at Agogo in the Eastern Region. Attempts by the government to expand Western medical care in the country were given serious consideration during the tenure of Frederick Gordon Guggisberg (1919-27) as governor of the Gold Coast. As part of his ten-year development program, Guggisberg proposed town improvements, improved water supply and the construction of hospitals. It was during his era that Korle Bu, the first teaching hospital in the Gold Coast, was completed in 1925.

In Nigeria, western medicine was introduced in the 1860s when Roman Catholic missionaries in Abeokuta established the Sacred Heart Hospital. The Roman Catholic missions predominated, accounting for about 40 percent of the total number of mission-based hospital beds by 1960. By that time, mission hospitals somewhat exceeded government hospitals in number: 118 mission hospitals, compared with 101 government hospitals. Mission-based facilities were concentrated in certain areas,

depending on the religious and other activities of the missions. Roman Catholic hospitals, in particular, were concentrated in the South-Eastern and Mid-western areas. By 1954 almost all Roman Catholic missions operated the hospitals in the Mid-western part of the country. The next largest sponsors of mission hospitals were, respectively, the Sudan United Mission, which concentrated on middle belt areas and the Sudan Interior Mission, which worked in the Islamic north.

The missions in Nigeria also played an important role in medical training and education, providing training for nurses and paramedical personnel and sponsoring basic education as well as advanced medical training, often in Europe, for many of the first generation of Western-educated Nigerian doctors. In addition, the general education provided by the missions for many Nigerians helped to lay the groundwork for a wider distribution and acceptance of modern medical care. The British colonial government began providing formal medical services with the construction of several clinics and hospitals in Lagos, Calabar and other coastal trading centres in the 1870s. Unlike the missionary facilities, these were, at least initially, solely for the use of Europeans. Services were later extended to African employees of European concerns. Government hospitals and clinics expanded to other areas of the country as European activity increased in those regions. The Europeans, for example, founded the hospital in Jos, in 1912 after the initiation of tin mining.

In 1978, the Alma Atta Declaration (WHO, 1978) sought to make primary health care accessible to the larger population, with a focus on improving health for all and recommended the integration of herbal medicine into the health care system, defining where these practitioners can fit into the system. This has already led to the

introduction of herbal hospitals and the introduction of herbal medicine courses into the curricula of some universities. Even though this concept was much appreciated, this did not achieve much as most governments failed to provide primary health care due to the heavy cost involved and the unwillingness to increase expenditure to provide health care.

Hence, this integration was very necessary at least to respond to the health needs of the populace due to the limited availability of western medicine in most communities. For example, Renckens and Dorlo (2013) report from the 2006 WHO data that access to regular medicine in Sub-Saharan Africa was far from adequate; while there was one traditional medical practitioner per 500 people, there was only one regular medical practitioner per 40,000 people. This implied that eighty percentage of the population in sub-Saharan Africa still depended on traditional care in 2006. The replacement of traditional medicine by effective and regular medical care for all Africans demands not only economic growth on the continent but also unrestricted political will. Thus, health improvement still lags behind for most African countries and especially SSA due to the high poverty levels. Several other policies were introduced after the Alma-Ata Declaration, with the most recent being the Millennium Development goals in the year 2000.

The Millennium Development Goals (MDGs), which were introduced in the year 2000, seek to improve the welfare of economies with the focus of achieving some set objectives by the end of the year 2015. These objectives cut across several sectors of the economy including health. In the era of the MDGs, governments have been encouraged to invest in the health sector as a means to achieving the health-related

goals. Furthermore, the Abuja Declaration of Heads of States, in a bid to improve the health sector pledged to spend 15 percent of national budgets on the health sector, all in the bid to improve health status in SSA and in Africa as a whole. In recent times, the argument for improving health outcomes in the region and indeed in the developing world focuses on Universal Health Coverage (UHC). The WHO first introduced this concept in 2005, arguing that universal health coverage may be the way out of the poor health trap. Thus, as the MDGs draw to an end, the world is hopeful that UHC would be the alternative to health improvement.

The recommendations of the 2001 Sachs report on Macroeconomics and Health re-instated health as a key ingredient of growth and development. This, together with the momentum generated by the Millennium Development Goals (MDGs) led to the adoption of Universal Health Coverage (UHC), which is about the provision of affordable, accessible and good quality care for all. Universal Health Coverage (UHC) is an aspiration that underpins "the enjoyment of the highest attainable standard of health" which, as stated in WHO's constitution, is "one of the fundamental rights of every human being without distinction of race, religion, political belief, economic or social condition" (WHO, 2010). WHO (2010) has emphasized in the UHC the need to go beyond national health outcomes to look at the building blocks of health systems, which determine fairness in access and delivery, and shape the financial risks associated with ill-health. A key implied policy direction in working towards UHC is a priority of health equity, because of its implications for social justice, poverty reduction, and satisfying unmet needs.

The twin goals of ensuring access to health services, plus financial risk protection, were reaffirmed in 2012 by a resolution of the United Nations General Assembly, which promotes UHC including social protection and sustainable financing. The 2012 resolution goes further to highlight the importance of universal health coverage in reaching the MDGs, in alleviating poverty and in achieving sustainable development. It recognizes that health depends not only on having access to medical services and a means of paying for these services, but also on understanding the links between social factors, the environment, natural disasters and health outcomes. This was an important recognition of health improvement that addresses appropriate environmental and social issues alongside increases in health financing. Thus, a suggested means of improving health status is to invest in health care, hence calling on various governments to take the initiative. This is believed will aid economic growth due to the expected contribution of health capital to growth. Given this, it becomes important to understand the relationship among health expenditure, health outcomes and economic growth, especially in SSA.

2.3 Health Expenditure in Sub-Saharan Africa

The theory of the Demand for Health by Grossman (1972) postulates that investment in health care leads to a significant improvement in health outcomes. One general measure of health investment that has been agreed upon in the literature is health expenditure. It is argued that health expenditure, like many other health inputs, should lead to an improvement in health outcomes. Hence, it can be postulated that the primary objective of increasing health expenditure in a nation is to improve health outcomes. Theoretically, the relationship is postulated as presented in Figure 1:

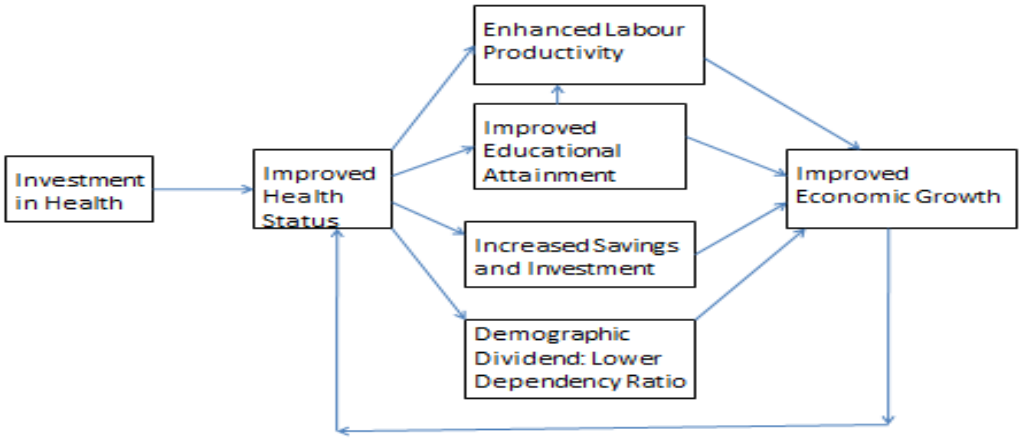

Figure 1: Link between Health Expenditure and Health Outcomes
Source: Akanni (2012) – Health Economics Lecture notes.

Figure 1 illustrates the path through which health investment, by influencing health outcomes, leads to improved economic growth. In Figure 1, health investment, in the form of health expenditure, leads to improved health outcomes. Improved health status enhances labour productivity, improve educational attainment, increase savings and investment in the economy and additionally improve the demographic dividend in the economy. This has the ultimate effect of improved economic growth rates. Indeed, improved economic growth also affects health outcomes because economic growth enhances income, which in turn improves the wellbeing of individuals. Thus, from Figure 1, it is only logical that nations and individuals alike do invest in health care with the primary objective of improving health outcomes.

The World Bank (2012) defines total health expenditure as the sum of public and private health expenditure incurred in the provision of health services (preventive and curative), family planning services, nutrition activities and emergency aid designated for health improvement. It is a measure of the total flow of resources to the health

sector in any economy. Public health spending is defined as all government spending on health care, plus money from grants, social insurance and non-governmental organisations. Public health spending reduces, or even eliminates, the direct cost of healthcare to an individual, especially at the point of service utilisation. Private health expenditure, on the other hand, is defined to include direct household (out-of-pocket) spending, private insurance, charitable donations and direct service payments by private corporations for healthcare. The World Bank (2012) reports that 44.5 percent of private expenditure on health was out-of-pocket in 2012. This is highly unsustainable considering that these payments were made at the point of service utilisation and could result in a worsening of health outcomes.

Most SSA countries, just like other developing countries, fall into low-income group classification (62 percent), with 15 and 21 percent, respectively being in the lower and upper middle-income countries (World Bank, 2010). Improving health is central to the Millennium Development Goals. Thus, many governments have been encouraged to invest in health care, particularly primary health care, including immunization, sanitation, and access to safe drinking water and safe motherhood initiatives (World Bank, 2012) to reduce inequalities. It is also argued that putting appropriate policies, like health insurance will cushion households in the use of health care.

According to the World Health Report (2011), "Investing in Health in Africa," low levels of investment in health in the past have resulted in weak national health systems and have contributed to the poor health outcomes in most developing countries. The report further states that although health expenditure is increasing in Africa, the proportion of national budgets allocated to health care is still low and is

not generally sufficient to provide, maintain and improve quality and access to health services. This, according to the report, has contributed to the poorer health outcomes. Indeed, some researchers have supported the fact that poor health outcomes might partially be due to the low level of health investment. For instance, Oaikhenan and Umoru (2012) alluded to the fact that the poor health outcomes in Nigeria were partly caused by the low level of health investment, which, according to the authors, has a severe consequence mostly for the disadvantaged groups who are women and children. This raises a greater concern for SSA, and probably Africa in general.

Due to the growing concerns on meeting the health-related MDGs, the role of healthcare expenditure has increasingly become crucial across the world. This comes because of the identified relationship between health investment and health outcomes in the literature. In order to improve health outcomes, most nations embark on the provision of health facilities, training of health personnel and the acquisition of essential drugs. All other things being equal, the availability, as well as the quality of these facilities and services ultimately determine the quality of health outcomes in a nation. Health expenditure is therefore very critical in every effort aimed at improving health outcomes of every nation due to its numerous functions. The World Bank (2012) reports that health expenditure has been increasing in several parts, especially in developing countries and this might be due to concerns of achieving the targets for the MDGs. Thus, governments in most developing regions have resulted to increasing the availability of health care services thereby increasing the expenditure on health. Further, in Africa, the increases might also be due to the Abuja Declaration (2001) of committing 15 percent of resources to the health sector.

Over the years, there have been consistent increases in health expenditure in all the regions of the world as evidenced from the World Development Indicators database (World Bank, 2012). For instance, by the year 2010, total health expenditure per capita in the world had increased from $454.94 in 1995 to $682.03 in 2005 to $950.38 in 2010. Similarly, total health expenditure as a percentage of GDP rose from 8.81 percent in 1995 to 10.39 percent in 2010. As reported in Table 1, it is clear that the global total health expenditure per capita has been increasing over the years since 1995. Although the rate of increase was marginal between 1995 and 1999, increases in health expenditure were higher in the year 2000 and beyond.

Table1: Health Expenditure Per capita ($)

Region	**MENA**	**SSA**	**OECD**	**EAP**	**World**
1995	115.73	**38.03**	2097.44	243.29	459.15
1996	118.05	**41.56**	2127.29	231.12	465.75
1997	129.28	**42.78**	2079.87	215.16	457.87
1998	135.99	**42.15**	2122.82	199.24	461.77
1999	150.54	**33.48**	2237.04	229.64	478.32
2000	172.14	**31.95**	2281.94	247.81	487.33
2001	188.24	**30.57**	2357.70	230.80	500.60
2002	145.32	**29.10**	2537.15	232.94	528.93
2003	153.36	**42.03**	2913.05	261.43	604.14
2004	170.39	**52.74**	3200.28	288.61	664.45
2005	189.51	**58.98**	3383.90	305.01	708.47
2006	212.49	**64.84**	3557.06	313.51	750.89
2007	248.06	**72.18**	3866.02	341.52	825.09
2008	295.25	**77.60**	4137.74	397.62	893.80
2009	309.81	**79.14**	4180.29	445.59	904.73
2010	325.71	**85.65**	4310.17	497.64	946.08
2011	370.37	**94.60**	4593.01	335.56	951.58

Source: World Development Indicators (World Bank, 2012)

Sub-Saharan Africa (SSA) also witnessed such consistent increases in health expenditure per capita although these increases began after 2002. Prior to this period, the region observed marginal increases and decreases in health expenditure per capita

as reported on Table 1. From Table 1, total health expenditure per capita in SSA is the lowest in the world. This increased from 1995 to 1999 where it took a downward trend and started rising again in 2003. Although there have been consistent increases in health expenditure over the past decade, the rates of increase have not been the same in all the regions of the world as reported on Table 1, with SSA lagging behind.

Compared to East Asia and the Pacific (EAP), and Middle East and North Africa (MENA) where health expenditure per capita were $335.56 and $370.37 respectively in 2011, health expenditure per capita in SSA was $94.60. It can be seen from Table 1 that Health expenditure per capita in SSA is the lowest in the world followed by MENA. In order to help boost the contribution of government to total health expenditure, African Union member states pledged in 2001 to increase government funding for health to at least 15 percent of their total national budgets in every year. This became generally known as the Abuja Declaration. Even though most of the countries have made progress in scaling up government spending on health after the Abuja Declaration, no country in the SSA region has been able to achieve the Abuja Declaration target as at 2010 (Akanni, 2012).

Table 2 shows the disaggregation of health expenditure into public and private health spending. From Table 2, it can be seen that the proportion of private health expenditure is higher than that of public health expenditure in SSA even though the table shows a consistent increase in the share of the public from 2000 to 2009 when it fell again. This situation is peculiar to SSA and may give an indication of either the resource constraints faced by governments, or the reluctance of governments to commit resources to the health sector. In addition, it shows the importance of the

private sector in health care provision in SSA. Except in SSA, the contribution of public health expenditure to total health expenditure is more than that of the private in all other regions as shown on Table 2. For instance, in 2010, public health expenditure as a percentage of GDP in SSA was about 3 percent whereas that of private health expenditure was about 4 percent of GDP.

Table 2: Public and Private Health Expenditure per capita ($)

	Private health expenditure per capita					**Public health expenditure per capita**				
Region	**MENA**	**World**	**OECD**	**SSA**	**EAP**	**SSA**	**OECD**	**MENA**	**World**	**EAP**
1995	1.87	3.32	3.50	**3.51**	1.42	**2.20**	6.04	2.50	5.45	4.55
1996	1.79	3.42	3.61	**3.79**	1.52	**2.07**	6.08	2.49	5.43	4.47
1997	1.91	3.55	3.76	**3.76**	1.60	**2.26**	5.94	2.54	5.30	4.34
1998	2.08	3.75	3.95	**3.93**	1.72	**2.36**	5.93	2.64	5.33	4.54
1999	2.00	3.80	4.00	**3.91**	1.74	**2.44**	5.96	2.64	5.39	4.71
2000	1.90	3.87	4.10	**3.50**	1.81	**2.40**	5.94	2.59	5.32	4.74
2001	2.00	4.05	4.32	**3.62**	1.88	**2.45**	6.22	2.87	5.55	4.74
2002	2.09	4.21	4.51	**3.50**	1.96	**2.29**	6.43	2.82	5.72	4.64
2003	2.06	4.28	4.59	**3.95**	2.05	**2.55**	6.66	2.79	5.91	4.65
2004	2.00	4.18	4.50	**4.19**	2.04	**2.67**	6.71	2.60	5.90	4.63
2005	1.87	4.19	4.54	**4.07**	2.09	**2.66**	6.77	2.46	5.86	4.60
2006	1.72	4.12	4.53	**3.81**	2.18	**2.69**	6.82	2.46	5.83	4.35
2007	1.77	4.00	4.46	**3.66**	2.07	**2.79**	6.88	2.47	5.80	4.27
2008	1.75	3.90	4.43	**3.44**	2.10	**2.75**	7.14	2.40	5.90	4.41
2009	2.05	4.17	4.73	**3.81**	2.24	**3.07**	7.84	3.07	6.45	4.83
2010	1.96	4.03	4.65	**3.71**	2.17	**2.79**	7.76	2.84	6.22	4.65
2011	1.92	4.06	4.76	**3.56**	2.21	**2.89**	7.56	2.85	6.00	4.56

Source: World Development Indicators (World Bank, 2012)

However, in the other regions such as East Africa and the Pacific, public health expenditure as a percentage of GDP in 2010 was about 5 percent, whereas private health expenditure as a percentage of GDP in that year was 2.17 percent. A situation where the contribution of private health expenditure outweighs that of public health expenditure suggests that governments in SSA are not devoting enough resources to the health sector. This is a major source of worry, given the high poverty levels in the

region. It might also contribute to a high rate of out-of-pocket payment, which can lead to the incidence of catastrophic health expenditure among households. This needs to be addressed to avoid a further worsening of health outcomes in the region.

The World Health Organisation (WHO) provides three indicators of the level of health expenditure in any economy, which specifically provides a means of assessing which countries are spending enough and which ones are spending less than required to achieve the desired health targets. Tables 3 and 4 below give a summary of the pattern of health expenditure in the region within the categories specified by WHO (2013). Table 3 categorises countries into those spending less than 20 United States Dollars ($), those spending between $20 and $44 and the countries spending more than $44.

It can be realised from Table 3 that there has been an increase in the level of health expenditure per capita in all countries in SSA, with a decrease in the number of countries spending less than $20 from 24 countries in 2001 to six countries in 2010. This has resulted in an increase in the number of countries spending between $20 to $44 and the significant increase in the number of countries spending more than $44. This is remarkable for a region characterised by poverty and inadequacy of resources. However, for countries like the Central African Republic, Democratic Republic of Congo, Eritrea, Ethiopia, Madagascar and Niger, health expenditure per capita has been stagnant from 2001 to 2010 with these countries still spending less than $20 per capita on health care.

Table 3: Trends in Total Health Expenditure per capita in SSA ($)

Less than $20	**$20 – $44**	**More than $44**
	Year 2001	
Benin, Burkina Faso, Burundi, central African republic, Chad, Comoros, DRC, Eritrea, Gambia, Ghana, Guinea Bissau, Kenya, Liberia, Madagascar, Malawi, Mali, Mozambique, Niger, Nigeria, Rwanda, Togo, Uganda, Tanzania **(24 countries)**	Angola, Cote d'Ivoire, Guinea, Lesotho, Mauritania, Senegal, Sierra Leone, Zambia **(10 countries)**	Cape Verde, Botswana, Equatorial Guinea, Gabon, Mauritius, Sao Tome and Principe, Seychelles, South Africa Swaziland **(10 countries)**
	Year 2005	
Burundi, central African republic, DR Congo, Eritrea, Ethiopia, Gambia, Guinea, Liberia, Madagascar, Malawi, Mozambique, Niger, Rwanda, Tanzania **(14 countries)**	Angola, Benin, Burkina Faso, chad, Comoros, Congo, cote d'Ivoire, Ghana, guinea Bissau, Kenya, Lesotho, Mali, Mauritania, Senegal, Sierra Leone, Togo, Uganda, Zambia **(18 countries)**	Botswana, Cameroon, cape Verde, equatorial guinea, Gabon, Mauritania, Namibia, Nigeria, Sao tome and Principe, Seychelles, south Africa, Swaziland **(12 countries)**
	Year 2010	
Central African republic, DR Congo, Eritrea, Ethiopia, Madagascar, Niger **(6 countries)**	Benin, Burkina Faso, Burundi, chad, Comoros, Gambia, guinea, Kenya, Liberia, Malawi, Mali, Mauritania, Mozambique, Sierra Leone, Togo, Tanzania **(16 countries)**	Angola, Botswana, Cameroon, cape Verde, Congo, Cote d'Ivoire, equatorial guinea, Ghana, guinea Bissau, Lesotho, Mauritius, Namibia, Nigeria, Rwanda, Sao tome and Principe, Senegal, Seychelles, south Africa, Swaziland, Uganda, Zambia **(23 countries)**

Source: Compiled from WHO 2013

Table 4: Total Health Expenditure per capita and Out-Of-Pocket payments in SSA

	Out-of-pocket health expenditure less than 20 percent	**Out-of-pocket health expenditure more than 20 percent**
Total health expenditure per capita more than $44	Angola, Botswana, Lesotho, Namibia, Seychelles, South Africa, Swaziland **(7 countries)**	Cameroon, Cape Verde, Cote d'Ivoire, Equatorial Guinea, Gabon, Ghana, Guinea-Bissau, Mauritius, Nigeria, Rwanda, Sa Tome and Principe, Senegal, Uganda, Zambia **(15 countries)**
Total health expenditure per capita less than $44	Malawi, Tanzania, Mozambique **(3 countries)**	Benin, Burkina Faso, Burundi, Central African Republic, Chad, Comoros, DR Congo, Eritrea, Ethiopia, Gambia, Guinea, Kenya, Liberia, Madagascar, Mali, Mauritania, Niger, Sierra Leone, Togo. **(19 countries)**

Source: Compiled from WHO 2013

Finally, a category of the level of health expenditure and the level of out-of-pocket payment in the region is provided in Table 4. This gives a general understanding of the total level of investment in health care, and the amount of expenditure by households to access health services in the region. From Table 4, there is a high number of countries with the level of out-of-pocket health expenditure higher than the amount of investment from the state on health care provision in these countries. For instance, there are 19 countries with per capita health expenditure less than $44, yet has a bigger percentage of this amount being spent by households in the form of out-of-pocket health expenditure, with only three countries out of that group with an out-of-pocket health expenditure being less than 20 percent.

Furthermore, 15 out of the number of countries with per capita health expenditure more than $44 also have out-of-pocket expenditure more than 20 percent, with only seven of the countries with out-of-pocket expenditure being less than 20 percent. Moreover, only a few countries in SSA have a working health insurance system. Hence, this creates a burden for households, especially in the event of illness. Perhaps this is one of the reasons many households in SSA rely on self-medication or unqualified traditional health care providers; inability to pay for health care and lack of a system to guide savings towards ill health. This situation, if not guided, can degenerate into catastrophic health expenditure. This can result in households not seeking appropriate care, which can worsen health outcomes and result in high poverty levels.

2.4 Health Outcomes in Sub-Saharan Africa

In a broad sense, health outcomes are defined as the state of health of an individual, group, or population. It is a measure of how healthy a population is given some prevailing conditions in the nation. Several indicators have been used in the literature to capture health outcomes due to the difficulty in measuring health and the inadequacy of any single measure. At the micro level, health outcomes have been measured by an indicator of disability or by self-reported health status, such as a person responding to a set of questions on whether or not he/she has limitations in performing certain activities, or how the person rates his/her health; as good, average, or worse, as the person may feel within him/herself.

At the macro level, life expectancy and mortality rates have been used to capture the state of wellness of a person or population. Life expectancy can be measured at any age with the associated conditions at that age. The most widely used in the literature is life expectancy at birth. Life expectancy at birth (LEB) indicates the number of years a new-born infant is expected to live given that prevailing patterns of mortality at the time of birth were to stay the same throughout the individual's lifetime. The mortality rate, on the other hand, is a measure of the number of deaths, in general, or due to a specific cause, in a population per 1000 individuals per year (for example, Adult, Maternal, Infant and Under-five mortality rates).

Two measures of mortality rates that are mostly used in the literature are the infant and under-five mortality rates. Infant mortality rate refers to the probability of dying before age one, per 1000 live births. Under-five mortality rate, on the other hand, measures the probability of dying between age one and age five. These measures are

simple indicators of the availability, utilization and effectiveness of health care systems and thereby used for monitoring and designing population health programs (Anyanwu and Erhijakpor, 2007). Reduction in the under-five mortality rate by two-thirds between 1990 and 2015 is one of the eight Millennium Development Goals. This is equivalent to an annual average rate of reduction of infant and under-five mortality of 4.3 percent.

Both under-5 mortality (UMR) and infant mortality (IMR) were very high during the 70's and the 80's. However, since 1990, considerable progress has been made in reducing under-five mortality. In the developing regions, UMR declined by 35 percent, from 97 deaths per 1,000 live births in 1990 to 63 in 2010. Despite population growth, the number of under-five deaths worldwide fell from more than 12 million in 1990 to 7.6 million in 2010 (UN, 2012). Infant mortality rates (IMR) have also been declining in all the regions of the world. In the developing region, for instance, IMR declined from an average of 98 per 1,000 live births in 1990 to 63 in 2010. These declines could be attributed to improvements in medical technology, which has led to the identification and mitigation of early childhood diseases that served as a threat to life for most infants in most of the developing world. Another significant factor has been the increase in the rate of immunisation against some known childhood killer diseases. This same development has led to increases in health expenditure to acquire such medications. Increases in health expenditure may possibly lead to the provision and improvement in health facilities, medical breakthroughs via research, training of health personnel and the provision of essential drugs among others. These facilities and services help in the treatment and curbing of certain diseases, which could otherwise have resulted in deaths among children.

Despite the significant reduction in UMR across the world, the rates are still high in SSA. It can be seen from Figure 2 that UMR (the red bars) remains high in SSA compared to the world average and that of the other regions of the world. The gap between MDG 4 and reality is huge in SSA where UMR was 170 in 1995 and 108.3 in 2011 – far short of the target of 62 in 2015. However, six countries in SSA are on track for MDG 4: Cape Verde, Eritrea, Mauritius, Seychelles, Botswana and Malawi (UNICEF, 2009). In the year 2010, West and Central Africa recorded the highest rates of UMR of about 143 of every 1,000 children born, compared to an average of six in the industrialised countries (UNICEF, 2012). According to Anyanwu and Erhijakpor (2007) two sets of countries that have worsened health outcomes are those that have been hit hardest by HIV, like countries in Southern Africa and those that have been at war recently like Congo. Indeed, the outbreak of diseases and the incidence of wars contribute to poor health outcomes.

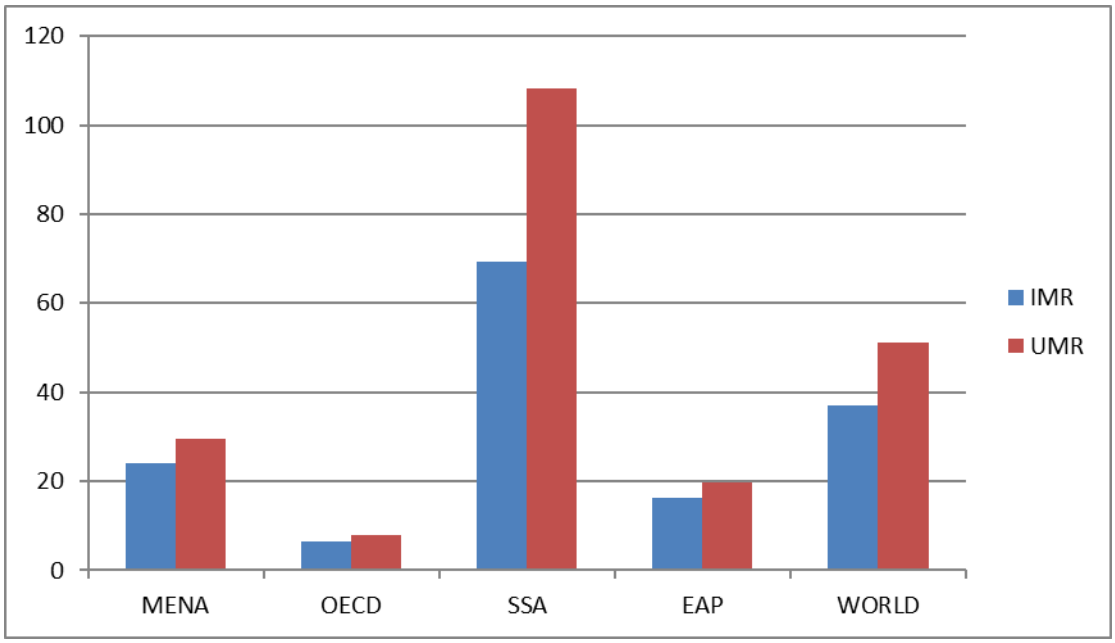

Figure 2: Infant and Under-five Mortality Rates
Source: World Development Indicators (World Bank, 2012).

Infant mortality rate (IMR) has declined across all the regions of the world since 1995. For instance, IMR (blue bars), as shown in Figure 2, in the world reduced from about 103 per 1,000 live births in 1968 to 51 in 2000 and then to 38 in 2010. In addition, MENA, which had the highest rates across the world in the 60s, now has one of the lowest rates by reducing IMR from 171 per 1,000 live births in 1960 to 24.1 in 2011. Over the last two decades, almost all regions have seen slower declines in infant mortality than in under-five mortality. Globally, deaths within the first month of life fell from 32 per 1,000 live births in 1990 to 23 in 2010, thus an average decline of 1.7 percent per annum. This rate is lower than the 2.2 percent per annum reduction of UMR over the same 20-year period. Some identified causes of IMR include inadequate care at birth and after birth, malnutrition, poor sanitation and exposure to acute and chronic diseases (World Bank, 2012).

It has been argued in the literature that diseases (predominantly acute respiratory infections, diarrhoea and malaria) for which practical, low-cost interventions (including immunization, oral rehydration therapy (ORT) and antibiotics) exist cause most of the child deaths in the developing regions of the world. Even though these are low-cost interventions, they require a commitment from government and practical increases in expenditure to be able to extend such services to all. Mothers' education has also been argued to be a strong factor that also influences child deaths. Children of educated mothers are more likely to survive compared to children of mothers with no education (UN, 2012). In 2010, children of mothers with no education in SSA were 1.4 percent more at risk of dying before their fifth birthday than children of mothers with only primary education. It is, therefore, possible to speed up the decline

in under-five mortality by expanding interventions that target women empowerment, especially via education.

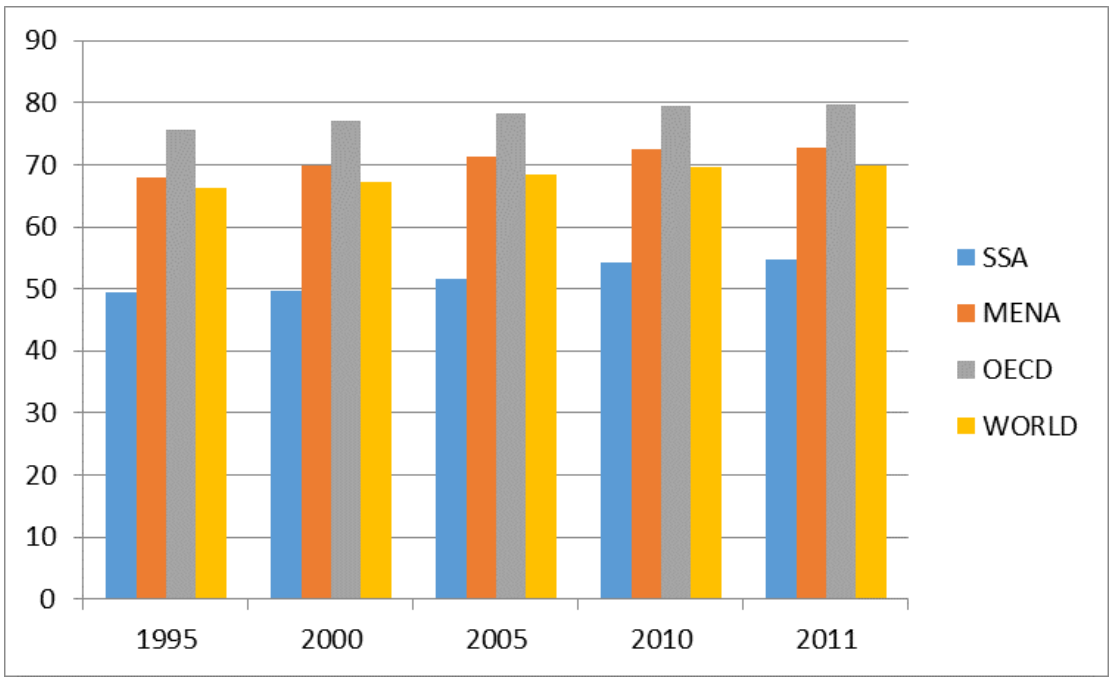

Figure 3: Life Expectancy at Birth
Source: World Development Indicator (2013)

Another important indicator of population health outcome is Life Expectancy at Birth (LEB). Figure 3 shows the pattern of life expectancy over the period of study. Life Expectancy at Birth (LEB) reflects the overall mortality level of a population. It summarizes the mortality pattern that prevails across all age groups. Life expectancy makes use of all the information from mortality and uses the life tables to calculate the number of years a newborn infant will live, assuming the mortality rates in the country remain the same during the person's lifetime. In 2009, life expectancy at birth globally was 68 years, ranging from 57 years in low-income countries to 80 years in high-income countries. Since 1990, life expectancy has increased globally by 4 years, but during the 1990's the value in Europe has shown stagnation and in Africa, it has even decreased (World Bank 2012). In Europe, the phenomenon was due mainly to

adverse mortality trends in the former Soviet Union countries, according to the World Bank (2012). The decrease in Africa was due to the high incidence of HIV/AIDS, but the increasing availability of antiretroviral therapy has reduced the spread of the epidemic and the mortality due to HIV/AIDS has been decreasing since 2005, allowing life expectancy at birth to increase again (World Bank, 2012).

Currently, LEB in SSA is 56 years lagging behind the world average of almost 71 years (Wold Bank, 2012). Thus, it is necessary for Sub-Saharan African governments to improve health care delivery, in order to reduce mortality and improve life expectancy.

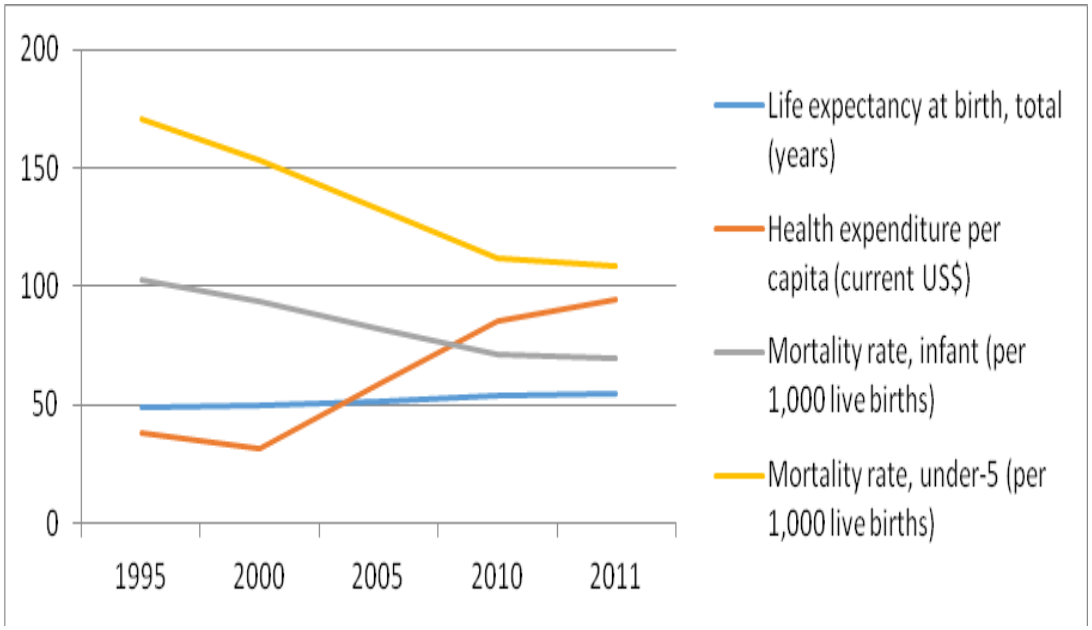

Figure 4: Health Expenditure and Health Outcomes in SSA
Source: World Development Indicators (World Bank, 2012)

Figure 4 illustrates the pattern of health expenditure and health outcomes in the region for the period under study. Although the region still accounts for the largest disease burden in the world, health outcomes in the region are currently better than a decade

ago. Despite the high population growth rate, the region on the average, has witnessed consistent increases in health expenditure per capita especially since 2003. An expansion in health expenditure implies the provision of more health facilities, training of health personnel and the provision of essential drugs necessary to improve health status. Therefore, as health expenditure increases, all other things being equal, there would be the availability of facilities to improve health delivery thereby leading to the improvements in health outcomes.

A cursory look at Figure 4 shows that the region has gained a significant reduction in mortality rates than improvement in life expectancy at birth. This is not very surprising as improvement in life expectancy at birth results not only from mortality reductions, but also reduction in disease morbidity and improvement in general conditions of living which are all significant factors that affect life expectancy at birth. This might also be a sign that most of the investment in health technology and policies in SSA has been geared towards reducing mortality rates than improving the general conditions of living and reducing disease morbidity.

2.5 Pattern and Trends in Economic Growth in Sub Saharan Africa

Economic growth refers to the growth in Gross Domestic Product or Gross Domestic Product per capita of an economy over time. In other words, it refers to an increase in the capacity of an economy to produce goods and services over time. It is normally calculated as a percentage change in Gross Domestic Product of the current year relative to that of the previous year. Economic growth can be measured in nominal terms or in real terms (adjusted for inflation). Mostly, it is preferable to calculate in real terms (inflation-adjusted terms) to eliminate the distorting effect of inflation on

the price of goods and services produced. In addition, in order to be able to compare one country's economic growth to another, it is calculated in per capita terms thereby taking into account population differences between the countries. An increase in growth caused by the efficient use of inputs is referred to as intensive growth, whereas growth due to the increased use of inputs is termed extensive growth. Theories of growth have identified factors such as physical capital, growth in technology and human capital as important factors that influence economic growth. Economic growth implies increasing levels of income in the nation, which makes it possible for the nation to provide for the people and enhance welfare.

Economic growth across African countries, especially SSA has been relatively strong compared to the negative growth rates that were recorded in most countries in the 80's. On average, GDP in SSA averaged about 5 percent between 2000 and 2007, with a peak of over 6 percent in 2007. Similarly, per capita GDP averaged about 3 percent with a peak of over 3 percent during the same period. Despite this strong performance, growth in SSA countries still fell short of the annual average of 7.21 and 4.3 percent experienced in East and South Asian countries respectively. Overall, most countries recorded positive GDP growth rates as opposed to the pervasive negative growth rates in previous decades.

Sundaram, Schwank, and von Arnim (2011) report that real income growth failed to keep pace with population growth in SSA between 1970 and 2000. The authors continue that after posting a modest average annual growth rate in real per capita income of about 0.7 percent in SSA during the 1970s, the rates turned negative during the 1980s and 1990s. Since 2000, SSA countries have posted improved growth rates,

largely thanks to primary commodity-driven recoveries, and most seem to have recovered relatively quickly from the global economic crisis. Even so, average real per capita income is still barely higher than in 1970 and SSA fell behind all other regions on most development indicators. This is particularly worrisome for a resource endowed region. As suggested by the World Bank (2005), GDP growth in the 70's was higher in Africa than in Asia, and expectations were that African countries would grow faster due to their superior resource endowments. However, the World Bank's report continues that SSA failed to adjust to changing global economic conditions and went on to experience over two lost decades of development from the late 1970s until the early 2000s.

Sundaram et al. (2011) argue that the regional average of growth rates also conceal vast differences within the region with countries affected by violent conflict and political instability being the worst growth performers, and mainly resource-rich countries also profiting from the commodity booms since 2000. Furthermore, the weak and often erratic growth performances have been accompanied by regressive trends in income distribution in many countries, with a particularly marked drop in the average per capita income of the poorest 20 percent in SSA. Not only is this likely to undermine human resource development and social as well as political cohesion in SSA, it is also likely to restrict future growth prospects. For instance, the average growth rate of SSA (excluding Nigeria) was 0.9 percent, a slight recovery from the meagre 0.2 percent achieved in 1991 according to the United Nations Economic Recovery (1993). The AfDB (1993) however, suggests that these averages mask a great diversity among individual countries.

According to the 2013 Regional Economic Outlook of the International Monetary Fund (IMF), SSA recorded an average annual growth of 5 percent in 2012, adding that economic activity remained strong in SSA slowing only marginally from the pace observed in 2010–11. This slowdown, according to the report was concentrated in Nigeria and South Africa, the region's two largest economies, with growth picking up by 0.5 percentage points in the rest of the continent. Investment has played an important role in driving growth in much of the region—most notably in fragile states, where mineral projects and political stabilization in Côte d'Ivoire were key factors at work. The report further suggests that in over half of the countries in the region, oil, mining, export-oriented agriculture, and tourism were among the leading growth sectors in 2012.

Table 5: Trends in the growth rate of per capita GDP

Region	Middle East and North Africa (MENA)	Organisation for Economic Cooperation and Development (OECD)	Sub Saharan Africa (SSA)	World Average
1995	0.44	1.70	0.99	1.35
1996	2.90	2.14	2.20	1.78
1997	1.45	2.68	0.96	2.23
1998	2.40	1.84	-0.34	1.04
1999	0.63	2.56	-0.25	2.00
2000	3.15	3.23	0.97	2.93
2001	-0.30	0.67	0.97	0.53
2002	0.27	0.87	0.86	0.83
2003	2.93	1.23	1.71	1.47
2004	5.03	2.34	3.71	2.74
2005	3.19	1.84	3.06	2.27
2006	3.57	2.26	3.37	2.84
2007	2.79	1.93	4.13	2.77
2008	2.69	-0.66	2.30	0.20
2009	-0.39	-4.33	-0.70	-3.29
2010	2.62	2.22	2.19	2.80
2011	3.63	1.01	1.77	1.63

Source: World Development Indicators (World Bank, 2012)

Growth was relatively stronger on average in oil-exporting and low-income countries in 2012. Among oil exporters, Angola experienced a visible acceleration owing mostly to a significant recovery in the oil sector and improved electricity production. Nigeria's growth remained strong in spite of the slowdown as a result of the adverse effects of the 2012 floods on both oil and non-oil production. Niger (oil) and Sierra Leone (iron) registered significant accelerations related to new extractive operations. Uganda experienced some deceleration because of tighter policies designed to reduce high inflation. Economic growth in middle-income countries slowed significantly in 2012, led by developments in South Africa, partly caused by labour unrest in the mining sector, but also reflecting continuing problems in Europe, still the country's most important export destination. Among fragile countries, the most significant development was the rebound in Côte d'Ivoire, where output growth is estimated to have reached almost 10 percent in 2012. Conflict-affected states, unsurprisingly, experienced significant economic setbacks in 2012, with output declining in both Guinea-Bissau and Mali.

However, economic growth in SSA was less impressive in the decade preceding the 2000's. The decade preceding the 2000's is believed to be the period of worst economic growth ever witnessed by African countries (Sundaram et al., 2011; Adedeji, 2002). Economic growth was so bad in the 1980s that the decade was labelled the lost decade for the region. Warnings about looming gloomy economic performance began in the mid-1970s, pointing specifically at structural problems associated with the countries. These projections were products of the conviction that earlier development strategies based on the unfulfilled promises of the European Community in the First and Second Yaoundé Conventions had failed dismally,

invoking untold negative shock on African development efforts. Several homegrown, self-designed and self-reliant growth and development initiatives were developed for correcting, in an urgent manner, the perceived structural imbalance and avert the impending economic woes. Some of the prominent initiatives include the Monrovia Declaration of Commitments, Lagos Plan of Action: and Final Act of Lagos. Largely, lean financial resources limited the implementation of these programmes.

In the early 1980s, the World Bank conducted an independent assessment of economies of African countries and came up with the conclusion that the problem with these economies was structural (World Bank 1981). Several policies based on the neo-liberal philosophy were prescribed for implementation across all African countries. This became the basis for the World Bank/IMF intervention popularly known as the Structural Adjustment Programme (SAP). There are diametric opinions on the impact of this policy on the economic performance of African countries. While some believe the program recorded some level of success, others believe that it was a complete failure. Despite these divergent views, one thing is clear: the policy did not succeed as anticipated nor did it have the intended impact as has been suggested in the literature.

The 1960-75 has been described as “Africa's golden era” (Adedeji, 2002). The reason for this conclusion is not far-fetched. As countries emerged from independence with strong determination and optimism, the region performed excellently well in almost all macroeconomic variables. There were visionary, dedicated and committed leaders building the developmental stage for the growth of their economies. During this period, GDP, exports, agricultural production and manufacturing grew at annual rates

of 4.5, 2.8, 1.6 and 6.0 percent respectively (Adedeji, 2002). Agriculture was the dominant driver of the economies during this period, employing a greater percentage of the population and generating substantial foreign exchange. However, toward the end of the 1970s, the table turned and the region began experiencing symptoms of social, economic, political and governance crisis.

In recent years, there has been a significant shift in the structure and composition of GDP in most African countries. There has been a significant shift away from agriculture toward services and industry. In 2007, for instance, the African Development Bank (2008) reports that services (44.3 percent) accounted for the largest share of GDP in SSA, followed by industry (41.7 percent) and agriculture (14 percent). Compared to 2000, the relative shares of agriculture, manufacturing and services declined in 2007. This shortfall was compensated for by increasing mineral and oil output in the resource endowed countries. The Overall picture of economic growth in African countries reveals volatile and unsustainable growth pattern. In many countries, strong growth in a year is usually followed by a very poor growth performance the following year. For most of the countries, it is very difficult to understand and form a pattern for economic performance and growth. It implies that policies aimed at influencing economic growth performance are still not having the desired impact. It also suggests that African countries are still not able to mitigate and leverage the negative effects of exogenous shocks on growth.

According to the Regional Economic Outlook of the International Monetary Fund (IMF, 2014), significant and widespread increases in per capita GDP in Sub-Saharan African countries have helped improve human development indicators. Between 2000

and 2013, Sub-Saharan African countries experienced an increase in the median per capita GDP of 75 percent. Also, most Sub-Saharan African countries showed a marked improvement in human development, as measured by the human development indices (HDI) computed by the United Nations, especially those that were worse off at the beginning of the period. Human development indicators have generally evolved in line with changes in GDP per capita. Countries that have experienced the largest increases in income and human development include those rich in mineral resources, such as Angola, Ghana, and Mozambique, as well as countries that are not primarily commodity exporters, such as Ethiopia, Rwanda, and Tanzania. Countries with higher GDP per capita tend to have better human development indices, and growth in GDP per capita and improvements in human development have often been larger in some of the countries that have been lagging behind.

The report, however, states that Improvements in human development partly reflect advances in health status and education. Primary enrolment and completion rates show remarkable progress, in line with developments in other developing countries. Infant and maternal mortality have declined substantially in the region and have fallen faster than in other developing economies in the last decade. The prevalence of undernourishment has also declined significantly. Higher access to clean water and sanitation across the region has helped improve health indicators. Despite the overall progress, per capita GDP growth in sub-Saharan Africa only kept pace with the rest of the world after 2000. This partly reflects relatively high population growth according to the report (three out of four countries in SSA made it to the top quartile in the distribution of the world's population growth rates). The region's growing young population reflects high fertility and declining infant mortality rates. In fact, progress

in achieving the MDGs has been uneven, lagging behind other developing countries and slower than needed to reach the 2015 targets. The report thus identifies macroeconomic policies, investments in human and physical capital, and structural transformation of a country's economy as important factors to GDP growth of a country. Thus, a key factor that has been recognised by the report is the contribution of improved health status, but acknowledges that the age dependency ratio, due to declining mortality and high fertility, might hamper the region's ability to sustain such growth.

The review indicates that while the African poor economic performance has been long recognised, the region is yet to fully comprehend the nature of the factors constraining economic growth and the appropriate policy prescriptions to tackle them. Economic growth in Africa is also characterised by high volatility and has been greatly unsustainable despite the positive growth rates recorded since 2000. This may be partly due to policy inconsistencies, policy reversals, and exogenous shocks emanating from international politics and commodity prices. Figure 5 illustrates the growth pattern in the region from the period 1990. Despite the significant improvement in economic growth in SSA, growth has still maintained an unstable pattern, even though the region has generally maintained a positive growth rate. Growth was in the negatives prior to 1995 but took an upward trend, falling into the negatives again in 1998. Growth, however, improved again from 1999 and kept an upward trend despite occasional fluctuations as illustrated on Figure 5.

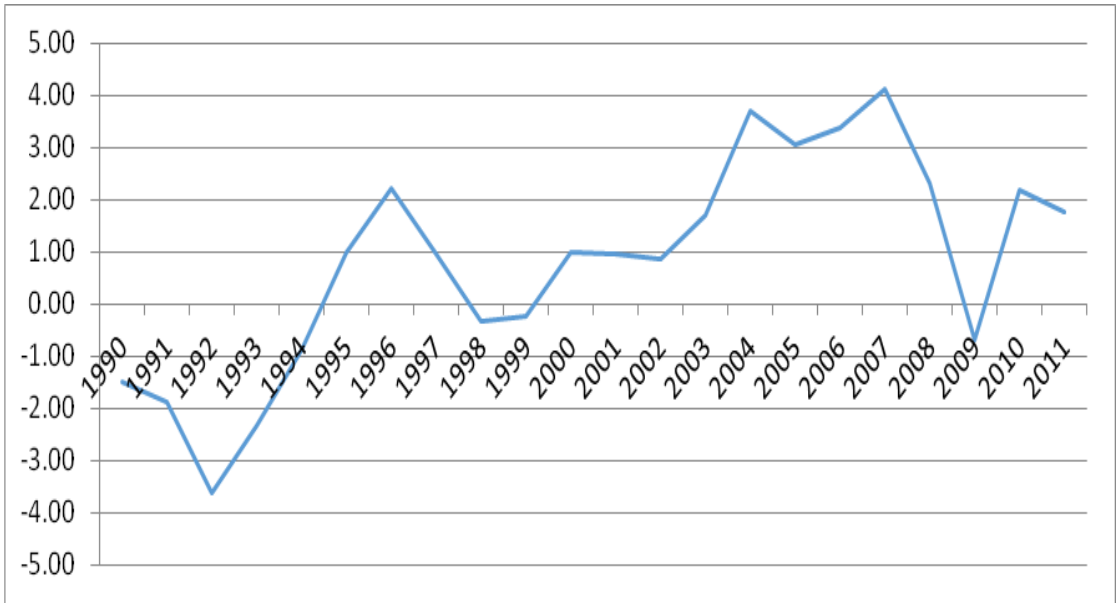

Figure 5: Economic Growth in SSA (1990 - 2011)
Source: World Development Indicators

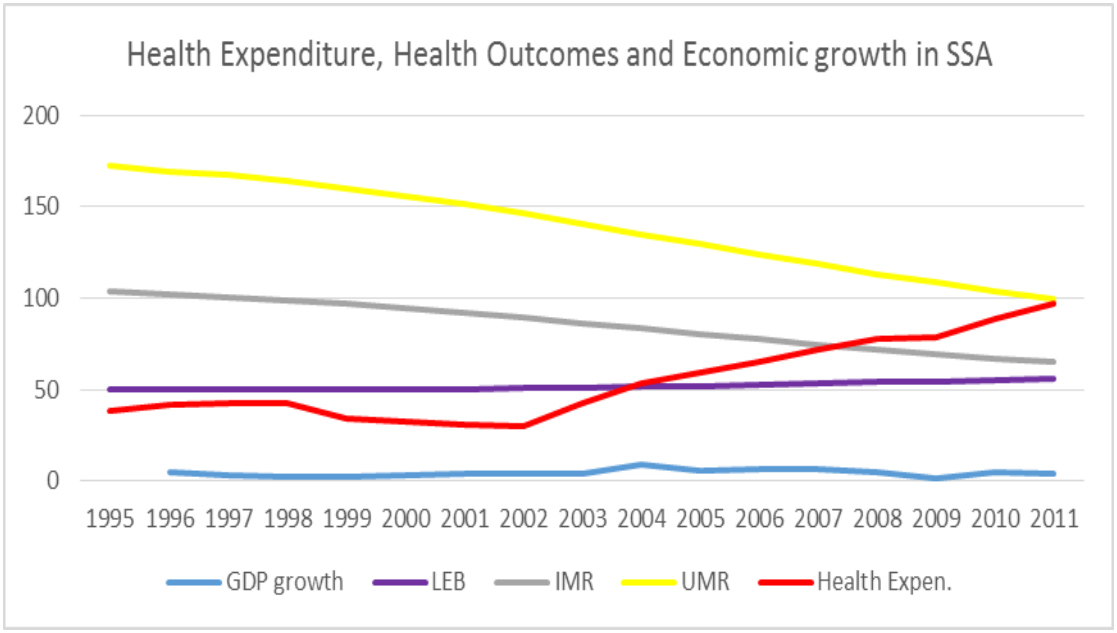

Figure 6: Health Expenditure, Health Outcomes and Economic Growth in SSA
Source: World Development Indicators (2012)

Figures 6 shows the pattern and trends in health expenditure, health outcomes and economic growth in SSA. From Figure 6, it is obvious that economic growth, despite the positive growth rates, has not improved significantly as a result of improved health outcomes. For instance, infant and under-five mortality rates have declined

continuously, but growth has still not improved much over the same period. Hence, it is unclear the relationship between health status and economic growth in SSA. Besides, the increase in health expenditure in the region has seemingly not also had much effect on GDP growth in SSA. Thus, the question still remains, does health status affect growth rates? And is there any relationship between health outcomes and Economic growth in SSA?

2.6 Summary of Chapter

In this chapter, a brief history of health systems in SSA was presented, from the era of the dominant traditional practice to modern medicine. However, of importance is the quest to integrate the two systems due to the large shortfall in the level of coverage of modern medicine, and the reliance of some rural communities on traditional health care. Perhaps, an integration of the two systems will help to increase health service utilisation and thus improve health outcomes as has been suggested by WHO. Moreover, it is evident from the review that SSA accounts for a greater proportion of the global child and infant mortality rates with a low level of investment in health care. Although SSA has made some progress in reducing the mortality rates over the past years, progress is very slow in the region compared to the other regions of the world. The rates of progress in SSA are far below the required rates of decline needed to achieve the targets on MDGs 4 and 5 in 2015.

On health expenditure, the review has indicated that countries in SSA are still spending less on health outcomes compared to the rest of the world. Notwithstanding this, the increase in total health expenditure has been driven more by increases in private health expenditure than that of the public. Further, it has been reported by

WHO that a dominant share of private health expenditure is paid out-of-pocket. This might be unsustainable given the rate of poverty in the region. Also, we notice from the review that the region achieved a greater fall in mortality rates than improvements in life expectancy. We suspect this might be due to significant investment in mortality reduction technology, or probably other factors that also affect LEB have not been addressed. These include disease morbidity and environmental factors which affect a person's wellbeing. Besides this, the review has indicated that immunisation has contributed to the significant reduction in mortality rates in the region.

Lastly, the review on economic growth indicates the high volatility of economic growth rates in the region, despite the positive growth rates recorded in most countries since the year 2000. The question that still remains is the sustainability of this growth pattern. Besides the recent pick-up of economic growth in 2000, the contribution of health outcomes and health expenditure is not very clear from the pattern presented in Figure 6. Despite the consistent fall in mortality rates, it is not clear the contribution of health status to the sustained positive growth rates in SSA. Even though the regional economic outlook of the IMF argues that health capital is a factor that has contributed to the growth pattern of the region, it identifies that the age dependency ratio could be a drag to sustaining the growth performance, given the improvement in health outcomes, and the high fertility rate in the region.

CHAPTER THREE

LITERATURE REVIEW

3.1 Introduction

The relationship among health expenditure, health outcomes and economic growth continue to receive attention in the literature as researchers and policy makers attempt to find a means of improving health outcomes through research and policy. This chapter presents a review of both the theoretical and empirical literature on the relationship among health expenditure, health outcomes, and economic growth, with some emphasis on studies from the SSA region. The chapter is organised into three main sections, with sub-sections under each of the sections discussing different aspects of the work. First, section 3.2 presents a review of the theoretical framework(s) that have been used in the empirical literature. Then, a review of the findings of the literature is presented in Section 3.3. Section 3.4 summaries the chapter with an overview and summary of the literature reviewed. The gaps identified in the literature are discussed in section 3.5.

3.2 Theoretical Literature Review

3.2.1 Health Expenditure and Health Outcomes

The theory postulates that health investment is important in the effort to improve health outcomes. One important measure of the level of health investment that has been identified in the literature is the level of health expenditure in a country. Indeed, this stems from the fact that the use of health expenditure, specifically, public health expenditure can serve as an important policy tool for the government in any economy, through the provision and administration of health care services. Thus, there is the recognition of this aspect of health expenditure serving as an important input, just like

exercising and dieting in improving health outcomes. Thus, empirical researchers have made efforts to verify the extent of the impact of health expenditure on health outcomes. The question is whether health expenditure influences health outcomes and the extent of influence.

In answering this question, of the importance of health expenditure to health outcomes, researchers have employed one of two approaches: the Grossman health capital model and the Health Production Function (HPF). The Grossman health capital model follows the seminar work by Grossman (1972) on "Health capital and the Demand for Healthcare". This is mostly used in micro studies in which individuals are treated as utility maximizers whose basic interest in investing in health care is to maximise the utility derived from "good health" subject to the constraints of income, time and a health depreciation function. The Health Production Function, on the other hand, follows the traditional model of the production function for any standard good in economics. This approach treats the health system as a production unit with the primary aim of producing health care. In this instance, health is treated as a commodity that is produced by the health system just like any other commodity. In both approaches, health expenditure is introduced as one of the inputs into healthcare "production," along with other equally important social determinants of health.

These two approaches have, however, utilised similar variables in the analysis. Studies that have used the Grossman approach have aggregated to the macro level, using per capita terms. It might suffice to say that the basic difference between the two approaches is the fact that the Grossman model is a micro model and hence has to be aggregated to be able to use in the macro level analysis. Even though this has been

criticised by some researches based on the Arrow's Impossibility theorem, due to aggregation problems, this model has actually performed well in macro analysis and given researchers some benchmark to measure results. Moreover, to deal with issues of aggregation and to avoid situations of inequality in the results, especially using panel data, studies have used the variables in per capita terms. Nevertheless, as Nixon and Ulmann (2008) rightly observed, these two approaches are classified as "production functions," in which similar variables have been used in the literature to investigate the relationship between health expenditure and health status among populations. The two approaches are given a detailed discussion in the following paragraphs, bringing out the basics of the models.

The Grossman Health capital model

The first approach based on the Grossman (1972) health capital model assumes that an individual is born with a stock of health that diminishes over time, but can be replenished through acts of health investment. The available health stock of the person produces a stream of healthy time payoffs that determines the individual's market (investment) and non-market (consumption) participation in the economy. When this health stock deteriorates below a certain point, death occurs. In this model, individuals use medical care and their own time to produce "good health." Thus, the health of the individual after birth depends on the investment he/she makes which depends on the amount of time the individual spends producing health and the amount of medical inputs purchased (both preventive and curative) in improving his/her health status.

Consequently, in this model, the health of the person is endogenous, which implies that the individual determines his/her optimal length of life and by implication, chooses when he/she wants to die. This is questionable since death does not depend on the amount of investment made. Notwithstanding this, the model is a good approximation of health investments. The health status of the individual is assumed to affect his/her utility directly from the value the individual places on good health and indirectly through increasing healthy time available for work and hence, increased labour income, enabling the individual to live the life he/she wants.

The individual's objective is to maximise his/her utility subject to the constraint of income and time, which are also very necessary for other activities of the individual. The individual, therefore, focuses on how to maximise his/her utility by investing in health such that his/her marginal utility is equal to the marginal cost of the investment. Since the individual's stock of health at birth and the rates of depreciation are given, the optimal quantities of gross investment determine the optimal quantities of health capital. Thus, the individual is only interested in ensuring that the marginal benefit/utility he/she gains from investing in health care is equal to the marginal cost of consuming health care services, since the consumption of health care services also comes with a cost (assuming that the individual is rational).

This is the underlying framework of the Grossman (1972) model of health capital; that health investment is very vital in improving the health of an individual in the society and that of a nation as a whole. This requires that, any individual or society that wants to see an improvement in health outcomes should invest more in health. For the individual, this goes beyond the monetary investment to time and other

lifestyle habits. This is, however, same for the entire society since the society is made up of individuals, hence the provision of health care is incomplete if the individuals in the society fail to utilise the services provided, or match it up with other lifestyle and environmental requirements.

Grossman (1972) presents this investment in health care by an individual as a utility maximising problem where the individual maximises his/her utility subject to the constraints of budget and time. This is done in an inter-temporal framework, where the individual maximises his/her lifetime utility. The utility function of the individual is made up of the consumption of health (H_t) and other goods (Z_t). In maximising the utility, Grossman makes a distinction between the demand for health and the demand for health care. The demand for health is necessary for the individual to carry out his/her day to day activities. For instance, the person cannot go to work if sick; hence, the model considers good health as a consumption good. Then, there is the demand for health care, which is the demand for medical services to improve the health of the person. This is considered as an investment good where the person invests in improving his/her health. Hence, the demand for health care is a derived demand, thus for good health. This study is carried out under the framework of the demand for health care, thus the investment model.

The utility function of the individual is stated as:

$U = U(H_t, Z_t), \quad t = 0, 1, 2 \ldots$ ……………………………………..………… (1.1)

From equation 1.1, the individual is assumed to gain positive utility from the consumption of goods and health services in each period (as implied in the quasi concavity assumption of utility maximisation). In maximising the utility of the

individual, the health depreciation function is an important constraint. The individual is assumed to produce health by the amount of time he/she spends making appropriate investment in his/her health, but the health of the individual depreciates by a certain rate, δ. By definition, net investment is gross investment less depreciation. This can be stated as;

$H_{t+1} - H_t = I_t - \delta t H_t; \quad (0 < \delta_t < 1)$…….. (1.2)

Where; H_{t+1} is the amount of health investment of the individual at time t+1. H_t is the amount of health investment of the individual at time t. I_t is gross investment and δ_t is the rate of depreciation. The rate of depreciation (δ_t) is exogenously determined, but the model assumes it might be related to age, except there are health shocks, like accidents, that might increase the rate dramatically. The rate of depreciation may increase or decrease depending on the amount of medical services consumed and the amount of health produced by the individual. Likewise, the individual is assumed to produce gross investment in health and the other commodities that enter his/her utility function according to a set of household production functions as specified:

$I_t = I_t (M_t, TH_t; E)$ … …… (1.3)

$Z_t = Z_t (X_t, T_t;)$……(1.4)

Where; I_t and Z_t represent individual's production of health care and other goods respectively. Mt is a vector of medical inputs bought from health care systems that contribute to gross investment in health. X_t is a vector of inputs that contribute to the production of the other goods (Z_t). TH_t and Tt are time inputs in the production process for health and other goods respectively. E is the individual's stock of knowledge or human capital. According to Grossman, "the semicolon before

education (E) highlights the difference between education and the other endogenous goods and time inputs. Thus, the model examines the individual's behaviour after he/she has acquired that education.

The time constraint in the model also requires that Ω, the total amount of time available in any period, must be exhausted by all possible uses, thus;

$TW_t + TH_t + T_t + TL_t = \Omega$ ……..... (1.5)

Where TW_t is time allocated for work, TH_t is time allocated for the production of health, T_t is time allocated for the production of other goods and TL_t is time lost due to sickness. The budget constraint for the individual must satisfy the equality between his/her discounted lifetime expenditure on the purchase of both medical and other inputs (M and X) and the individual's lifetime income plus the initial wealth of the individual. This is formulated by combining the expenditure and income flows of the individual and his/her time constraint. If we assume that the individual does not become sick over the period of interest ($TL_t = 0$), then the individual's healthy time is equal to Ω. The budget constraint of the individual, combined with the time constraint yields equation 1.6.

$$\sum_{t=0}^{n} \frac{P_t M_t + Q_t X_t + W_t (TW_t + TH_t + T_t)}{(1+r)^t} = \sum_{t=0}^{n} \frac{W_t \Omega}{(1+r)^t} + A_0 \quad \text{---------- 1.6}$$

In equation 1.6, P_t and Z_t represent the prices of medical inputs and other consumption goods respectively, W_t is the hourly wage rate, TW_t is the number of hours of work, A_o represents initial assets and r is the discount rate. The individual's objective is to maximize equation 1.1 subject to the constraints specified in equations 1.2 to 1.6. If it is assumed that the marginal utility of healthy time is zero, thus healthy time does not enter directly into the utility function of the individual, then health

becomes a purely investment good. The individual, therefore, focuses on how to maximise his/her utility by investing in health such that his/her marginal utility is equal to the marginal cost of the investment. Since the individual's stock of health at birth and the rates of depreciation are given, the optimal quantities of gross investment determine the optimal quantities of health capital. Thus, the individual is only interested in ensuring that the marginal benefit/utility he/she gains from investing in health care is equal to the marginal cost of consuming health care services, since the consumption of health care services also comes with a cost. The first order optimality conditions for gross investment in period t-1 are:

$$\left.\begin{aligned}\frac{\pi_{t-1}}{(1+r)^{t-1}} = \frac{W_t G_t}{(1+r)^t} + \frac{(1-\delta_t)W_{t+1}G_{t+1}}{(1+r)^{t+1}} + \ldots + \frac{(1-\delta_t)\ldots(1-\delta_{n-1})W_n G_n}{(1+r)^n} + \\ \frac{Uh_t G_t}{\lambda} + \ldots(1-\delta_t)\ldots(1-\delta_{n-1})\frac{Uh_n G_n}{\lambda}\end{aligned}\right\} \quad (1.7)$$

Equation (1.7) states that the present value of the marginal cost of gross investment in health in period t-1 is equal to the present value of the marginal benefit of health investment. Thus, an individual is assumed to invest in health care to the point where the marginal utility of holding a marginal unit of health stock is equal to the marginal user cost.

Grossman (2000) derives a reduced form equation that can be estimated from household/individual survey data as:

$LnH = \alpha \ln M + \rho E - \delta t - \ln\varepsilon$ ..... (1.8)

Equation 1.8 thus presents a health demand function, which, according to Grossman (2000) also represents a health production function as the individual is assumed to invest in health care through the demand for good health. M represents health investment, such as the use of medical services, healthy lifestyle, and the individual's

own time used for health producing activity. E represents the education of the individual.

The Grossman (1972) model predicts that education increases the efficiency of health production and hence leads to an improvement in health outcomes. The reasoning is that the higher the level of education of the individual, the better the individual takes care of his/her health. This implies that, educated individuals are better users of health inputs. Additionally, it predicts that the price of health care influences the demand for health negatively. Thus, health care is a normal good following the standard demand curve. Lastly, the depreciation of health is assumed to be associated with age, hence, the aged will demand more health care services, thus having a positive relationship between age and the demand for health care. This approach has been used by Thornton (2002), Fayissa and Gutema (2005) and Akanni (2012) in their investigation of the effect of health expenditure on health outcomes.

The Health Production Function

The second approach that has been used in the study of the effect of health expenditure on health outcomes has been based on the Theory of Production in Economics. The underlying feature of this approach is the concept of the production function which assumes that good health is the sole output of the health system and as such focuses on measuring how the effect of health expenditure, which is an investment into the health system, affects health outcomes. The concept of the production function is the relation between inputs into a system and output from that system. This approach has been used in studies conducted by Filmer and Pritchett (1999), Anyanwu and Erhijakpor (2007) and Nixon and Ulmann (2008)). This

approach considers health care expenditure or health resources and other socioeconomic factors as the inputs and health outcomes/status measured as the output from the health system.

Studies that have used the production function in the analysis of health outcomes have been based on the Cobb-Douglas specification of the production function. These have identified the appropriate socioeconomic inputs, in addition to health expenditure that influences the wellbeing of the population and hence improvement or otherwise of health outcomes. Mortality and life expectancy have been generally used to measure the improvement in health outcomes in such studies. Filmer and Prichett (1999), one of the studies that explicitly specified the production function, formulated it as:

$$HS = \left(\frac{H_i}{N_i}\right)^{\alpha} X \left(\frac{NH_i}{N_i}\right)^{\beta} X \left(\frac{NH_i}{N_i}\right) X e^{A_i} \text{ ---------- (2.1)}$$

Equation 2.1 explicitly presents a health production function, in the tradition of the Cobb-Douglas specification, specified by Filmer and Prichett (1999). HS is a proxy for health outcomes. H_i is health expenditure in country i and NH_i is the rest of GDP, which, according to the authors, includes all non-public sector health spending. NH_i is used as a proxy for income. N_i is the total population in country i and e is the natural exponential function. A_i is a country-specific factor. Dividing through equation 2.1 by GDP and taking logs results in equation 2.2.

$$\ln HS = \alpha \ln\left(\frac{Hi}{Ni}\right) + \beta \ln\left(\frac{NHi}{Ni}\right) + \ln(\alpha + \beta) \ln\left(\frac{GDPi}{Ni}\right) + Ai \text{ ---------- (2.2)}$$

Equation 2.2 expresses the log of health outcomes as a function of the log of public health expenditures as a share of GDP, non-public health sector spending as a share of

GDP (inherently assuming that H + NH = GDP), GDP per capita and the country specific factor A_i. Further, the authors assume A_i to depend on a set of observable and non-observable socioeconomic factors that are specific to a country and affect health outcomes in that country. This is specified in equation 2.3 as:

$$\ln HS = \beta_1 \ln\left(\frac{GDP_i}{N_i}\right) + \beta_2 \ln\left(\frac{H_i}{GDP_i}\right) + \beta_3 \ln(Xi) + \varepsilon_i \text{ ---------- (2.3)}$$

Equation (2.3) specifies the natural log of health outcomes as a function of the log of mean per capita income (GDP_i/N_i), the log of public health expenditure as a share of GDP (H_i/GDP_i) and other socioeconomic factors (X_i). The socioeconomic factors the authors considered were the level of female education, access to safe water, religion, ethnolinguistic fractionalisation and urban population. Finally, to derive the effect of health care expenditure on health outcomes, the derivative of equation 2.3 was taken with respect to health care expenditure, which yields the elasticity of health outcomes. They further argue that equation 2.3 can be expressed as the number of deaths averted or the expenditure per the number of deaths averted. The authors further present this as another means of expressing the amount of health expenditure that is not from GDP, or alternatively the amount of GDP that must be converted to health expenditure to avert an additional death, or to improve health outcomes in the nation. This is the basic model of the Health production function in the health care literature.

3.2.2 Health Outcomes and Economic Growth

The theory of economic growth in its basic and initial form only recognised physical capital as the driver of economic growth, holding other variables as pre-determined, at least by the arguments of the Neoclassical growth model. The recognition of health outcomes as a driver of economic growth became important in the literature based on

two reasons. First was the recognition that physical capital and technology alone could not account for differences in income across countries (Romer and Chow, 1996). Secondly, researchers recognised that the quality of the labour force (human capital), previously defined as education, has a significant effect on economic growth and hence needs to be taken into account in understanding the drivers of growth (Romer and Chow, 1996). Other researchers further suggested that health capital is an important component of human capital (Grossman, 1972). This, therefore, entails analysing the components of economic growth of the economy while understanding the appropriate effect and entry points for health capital as a component of human capital in economic growth. Growth theorists, therefore, started incorporating health capital into the basic Solow model. Hence, an understanding of the contribution of health capital to economic growth begins with the Solow model.

The basic Solow model, which has been the workhorse of economic growth for decades, identifies growth factors as capital, labour and technology. Thus, researchers using the Solow model have made efforts to understand why some countries have grown rich while others have remained poor; why some have grown quickly and others slowly and what eventually determines the long-run economic growth rates of these nations. One important aspect of the Solow model was the prediction of convergence of income. There are basically two types of convergence discussed in the literature; conditional convergence, which states that the lower the starting level of per capita GDP, relative to the long run or steady state position, the faster the growth rate of per capita GDP. The other is absolute convergence, which states that poor economies tend to grow faster than rich ones. The Solow (1956) model also predicted that the growth of per capita income must eventually stop at some point because of

the assumption of diminishing returns to capital and the absence of continuing improvements in technology.

A constant saving rate is one of the underlying assumptions of the Solow (1956) model. The empirical results from tests of the Solow model concluded that increased use of capital explained 12.5 percent of the change in GDP per capita with the concept of technical change explaining the 'residual' 87.5 percent. This is highly questionable, especially in the aspect of policy. How can policy be used to influence economic growth when 87.5 percent of the rate of growth cannot be explained? Hence, researchers postulated that the difference might be due to the quality of the labour force (human capital). Additionally, the assumption of convergence was challenged by the endogenous growth theorist who characterised the growth of the economy by the assumption of non-decreasing returns to the set of reproducible factors of production, knowledge and technology. The endogenous growth models are underpinned by the fact that savings drive the economy. Nonetheless, unlike the Solow model in which savings are exogenous, it is endogenous in their model. Thus, from the endogenous growth models, countries that save more grow faster indefinitely and the idea of convergence in per capita income among countries need not be necessarily satisfied.

Following the arguments, the neoclassical Economists further suggested that economic growth was fuelled more by capital, this time defining capital more broadly as both physical and human capital. This was pioneered by Mankiw, Romer and Weil (MRW, 1992), known as the Augmented Solow model (augmented with human capital), or the MRW model. The mechanism of this model follows the basic Solow

model, except the inclusion of education and it maintains all the assumptions of the Solow model, in particular, the assumption of a constant savings rate and an exogenous population growth rate. Their model concluded through empirical evidence that differences in human capital could explain the cross-country differences in the level and growth rate of income (Romer and Chow, 1996). This model, however, defined human capital narrowly to include only education, hence ignoring health capital.

Other researchers following the MRW approach made efforts to incorporate health capital as an important component of human capital. Indeed, despite the effect of education on growth, a person with poor health may not contribute to economic activities in the nation, collaborating Grossman's (1972) model of human capital. Knowles and Owen (1995, 1997), therefore, augmented the MRW (1992) model by introducing both education and health capital to investigate the contribution of human capital to economic growth. This they did in two ways: first by explicitly including health capital as a separate input factor of production and secondly, as a labour augmenting factor. The authors report in both cases a significant contribution of health capital to economic growth, which is also consistent with the earlier evidence of the productivity-enhancing effects of improved health outcomes (see also Mushkin, 1962; Grossman, 1972). This became the focus of researchers interested in the contribution of health outcomes to economic growth. The review above is based on the understanding of the basic Solow model, thus a presentation of the mechanics of the neoclassical growth model is carried out in the paragraphs that follow.

The Neoclassical model begins by specifying a Cobb-Douglas production function with two factor inputs, capital and labour as follows:

$$Y_{it} = K_{it}^{\alpha} A_t L_{it}^{1-\alpha} \quad \text{---------- (3.1)}$$

Equation 3.1 is the basic Solow model, specified in the framework of panel data analysis, hence introducing the subscripts i and t for the cross-sectional units and the time observations. In equation 3.1, Y_{it} is total output, K_{it} is physical capital, L_{it} is labour and A_t is technology. It is assumed that there are only two inputs and they are paid their marginal products (this is on the assumption that the economy is operating in the competitive market), according to the underlying assumptions of the Solow model. Also, α is a constant and neo-classical theory predicts that empirically it will be equivalent to the factor's share of GDP income. Thus, the sum of these shares to the factors of production is restricted to one, hence, assuming constant returns to scale.

This assumption has come under criticism as its failure implies that the competitive assumption would be violated and therefore results from the model may be unreliable (increasing returns violates the competitive economy assumptions). Furthermore, the neoclassical prediction of convergence requires diminishing marginal products to the factors, hence the restriction of α being less than one imposed. The production function is assumed to satisfy the Inada conditions. The Inada conditions imply that the marginal products are positive but diminishing. In particular, this implies convergence of per capita income as the marginal products of capital and labour tend to zero as more capital and labour are employed in the economy.

The model further assumes that labour (L) and technology (A) grow exogenously at rates n and g, which can be specified in equation 3.2 as;

$$L_t = L_0 e^{at}; \quad A_t = A_0 e^{gt} \text{ ---------- (3.2)}$$

Thus, effective labour A_tL_t, as specified in equation 3.1, grows at rate n+g when we express the model in logarithm. The model assumes that a constant fraction of output is invested (s). In addition, there is a constant rate of depreciation (δ). Thus, the capital stock evolves over time as:

$$K(t+1) - K(t) = sY(t) - \delta K(t) \text{ ---------- (3.3)}$$

Equation 2.3 is the evolution of capital over time, according to the Solow model. Further expressing equation 3.1 in per capita terms results in equation 3.4 capturing the growth rate of per capita GDP. Again, this helps to isolate separate effects of growth in the labour force and growth in capital.

Defining $k_t = (K_t/L_t)$ and $y_t = (Y_t/L_t)$ as the stock of capital and the level of output per unit of labour respectively, equation 3.1 is re-stated in equation 3.4.

$$y(t) = k(t)^{\alpha} \text{ ---------- (3.4)}$$

Substituting equation 3.4 into equation 3.3, the evolution of capital can be restated in equation 3.5. Further, in equation 3.5, defining changes in a variable with a dot, as $\dot{k} = k(t+1) - k(t)$, then the evolution of capital per unit of effective labour is stated as specified in equation 3.5;

$$\dot{k}(t) = sy(t) - \delta k(t) = sk(t)^{\alpha} - (\delta + n + g)k(t) \text{ ---------- (3.5)}^{9}$$

[9] $(\dot{k} \equiv \frac{\dot{K}}{AL} - nk - gk)$

The Solow model assumes the economy converges to the steady state rate of output. In the steady state, the growth rate of capital per unit of labour is assumed to be constant. Hence, we can equate equation 3.5 to zero and solve for the optimal value of k* at the steady state to arrive at equation 3.6

$$\mathbf{O} = sk^{*\alpha} - (\delta + n + g)k^{*}$$

$$k^{*} = \left[\frac{s}{(\delta + n + g)}\right]^{\frac{1}{1-\alpha}} \quad \text{---------- (3.6)}$$

Thus, the steady state value of capital in the Solow model is expressed as a function of the the rate of savings, the rate of depreciation of physical capital, the population growth rate, the rate of growth of technology and the marginal share of capital in income. Further, substituting equation 3.6 into 3.1 and taking logs yields equation 3.7.

$$\ln\left[\frac{Y(t)}{L(t)}\right] = \ln A(0) + gt + \frac{\alpha}{1-\alpha}\ln(s) - \frac{\alpha}{1-\alpha}\ln(n+g+\delta) \quad \text{---------- (3.7)}$$

Equation (3.7) is the simplified form of the Solow model and has been used as the basic model in empirical studies.

The introduction of human capital, primarily education in earlier models as another input of production only indicated that the model is re-specified, but still maintaining the assumptions of the Solow model. The production function in equation (3.1) is now re-specified in equation 3.8 as:

$$Y_{it} = K_{it}^{\alpha} E_{it}^{\beta} A_{it} L_{it}^{1-\alpha-\beta} \qquad \alpha + \beta < 1 \quad \text{---------- (3.8)}$$

In equation 3.8, E is the stock of human capital (education), the evolution of which is governed just as the same for physical capital in the basic Solow model. This is presented in equation 3.9 as;

$$\dot{e}_{it} = \omega_{it}^{e} y_{it} - (a+\delta)e_{it} = \omega_{it}^{h} e_{it}^{\beta} - (a+\delta)e_{it} \quad \text{---------- (3.9)}$$

ω_t^h is a fraction of output invested in human capital in the time period t and $e_{it} = (E_t / L_t)$ is the human capital per unit of labour. With the introduction of human capital in the form of education, equation (3.7) is specified in equation 3.10 as:

$$\ln y_{it} = \beta_0 + \frac{\alpha}{1-\alpha-\beta}\ln \omega_{it}^{k} + \frac{\beta}{1-\alpha-\beta}\ln \omega_{it}^{e} - \frac{\alpha+\beta}{1-\alpha-\beta}\ln(n+g+\delta) + \varepsilon_t \quad \text{---------- (3.10)}$$

Equation 3.10 is similar to the Solow model specified in equation 3.7, except for the introduction of human capital in the form of education. This is the augmentation by MRW (1992).

Furthermore, with health capital augmentation, the Solow model can be specified in equation 3.11. This is the augmentation of the MRW model, also known as the extended MRW aggregate Cobb-Douglas production function by Knowles and Owen (1996).

$$Y(t) = K(t)^{\alpha} E(t)^{\delta} H(t)^{\beta} \left(A(t)L(t)\right)^{1-\alpha-\beta-\delta} \quad \text{---------- (3.11)}$$

$0< \beta, \alpha, \delta < 1, \quad 0< \beta + \alpha + \delta < 1$

Where Y is real output, K is physical capital, E is education, H is health capital, L is labour and A is the level of technology. α, β and ψ are the shares of physical capital, education and health capital in total output, respectively. The model assumes the existence of a steady state with $0< \beta + \alpha + \delta < 1$. The logic of the model follows the assumptions underlying the Solow model. The evolution of health capital is stated in equation 3.12. Augmenting equation 3.10 with health capital yields equation 3.13.

$$\dot{h}_t = \omega_{it}^h y_{it} - (a+\delta)h_{it} = \omega_{it}^h h_{it}^\beta - (a+\delta)h_{it} \text{ ---------- 3.12}$$

$$\ln\left(\frac{Y_{it}^*}{L_{it}}\right) = \ln A_{i0} + gt - \left(\frac{\alpha}{1-\alpha}\right)\ln \rho_{it} + \left(\frac{\alpha}{1-\alpha}\right)\ln s_{ki} + \left(\frac{\beta}{1-\alpha}\right)\ln \tilde{e}_{it}^* + \left(\frac{\gamma}{\lambda}\right)\ln \tilde{h}_i \text{ ----- (3.13)}$$

Thus, studies that have incorporated health capital as a determinant of economic growth have estimated a variant of equation 3.13 in the analysis. Several different approaches have been used and mostly it has been done with country-level data, with a few studies that have focused on a cross-country analysis.

3.3 Methodological Review

Previous studies investigating the effect of health expenditure on health outcomes and the effect of health outcomes on economic growth applied the Ordinary Least Squares, the Two-Stage Least Squares and the traditional panel data models of Fixed Effects and Random Effects models. Very few of these studies have applied the Generalised Method of Moments (GMM) estimator. Additionally, in investigating the causal relationship among the variables, studies have applied the Restricted Least Squares, hence performing the Wald test on the lags. Others have estimated the VAR models and performed the granger causality test on the lags of the variables to determine the nature and direction of causality among the variables.

The Ordinary Least Squares (OLS) approach proceeds by pooling the countries together and assuming homogeneity. Hence, country-specific effects that might have the potential of influencing the results are not controlled for. This method has been employed in studies by Musgrove (1996), Filmer and Prichett (1997, 1999), Baldacci et al., (2003), Issa and Outarra (2005), Gottret and Scieber (2005), and Anyanwu and Ehrjiakpor (2007) in investigating the effect of health expenditure on health

outcomes. Additionally, in estimating growth models, studies by Aurangzeb (2003), Kirigia et al., (2005), Acemoglu and Johnson (2007), Aghion et al., (2007) and Akram et al., (2008) have also applied the Ordinary Least Squares approach. The pooled least squares regression model assumes homogeneity of the cross-sectional units across time, thus assuming that the units being investigated are relatively similar or homogenous. This might not be the case in reality and can therefore bias the results. If the model yields large standard errors (small T-Stats), this could be a warning flag that the groups are not homogenous and a more advanced approach is required. Additionally, such models can suffer from reverse causality among the variables, which the Ordinary Least Square approach fails to address.

In dealing with one of the disadvantages of this model, some researchers have resulted to the use of the Two-Stage Least Squares approach in estimating the effect of health expenditure on health outcomes. This is done by identifying appropriate instruments that can be used to deal with such situations if they do exist in the data. Studies conducted by Filmer and Prichett (1997, 1999), Baldacci et al., (2003), Issa and Outarra (2005), Gottret and Scieber (2005), and Anyanwu and Ehrjiakpor (2007) have used this approach. The difficulty with this approach lies in the identification of the most appropriate instrument that perfectly correlates with the variable being instrumented for. This has always been a cause of disagreement in the literature. Additionally, this estimator also fails to control for the country-specific factors that may be fixed or random in especially panel studies. This can also bias the results.

The Fixed and Random Effects estimators have also been used widely by studies due to the advantages it has over the pooled ordinary least squares regression model

and the two stage least squares estimation techniques. The fixed effect model controls for the country-specific characteristics that can influence the results. This model assumes that the country-specific characteristics are correlated with the individual predictors and, therefore, resolves them before estimation. The fixed effects model is estimated using the ordinary least squares estimator. The random effects model, on the other hand, assumes the country specific effects are uncorrelated with the other predictors in the study and treats them as part of the error term. It is estimated using the Generalized Least Squares estimator (GLS). Studies conducted by Filmer and Prichett (1997, 1999), Baldacci et al., (2003), Issa and Outarra (2005), Gottret and Scieber (2005), Novignon et al., (2012) and Anyanwu and Ehrjiakpor (2007) have used this approach. These two approaches are mostly used together with the researcher conducting the Hausman's specification test to identify which of them is more appropriate for discussion. These two models in panel analysis have been agreed to yield better results than the ordinary least squares technique and the two stage least squares approach.

In recent times, the Generalised Method of Moments (GMM) estimator has been used in investigating such relationships. The GMM estimator imposes moment conditions on the model. This is done when endogeneity is a problem in the model. Kamiya (2010) and He (2009) have used this model in empirical works. This model is preferable in empirical growth models, as it helps in dealing with issues of endogeneity. The Generalised Method of Moment's estimator has been the preferred model, especially in growth models also due to its ability to capture the rate of convergence in growth, which has been very popular in the literature recently.

Studies have attempted to investigate the rate of conditional convergence among countries with similar characteristics in the literature.

Finally, in analysing the causal relationships, studies have traditionally used the Vector Autoregressive (VAR) model, which uses the lags of the variables in the system as regressors. A traditional VAR model is a reduced form model that estimates a system of equations by using non-contemporaneous lags of each dependent variable in the system, creating a Dynamic Model. A Panel VAR model estimates a VAR across multiple Panels or groups by using lags of endogenous and exogenous variables for each group. In the VAR framework, all the variables are treated as endogenous and their lags are used as the predictors. Granger causality test is then performed to identify the direction of causality in the framework.

The ordinary least squares have traditionally been used for the estimation of VAR models. This has mostly been done using time series data. In the use of panel data, studies have resorted to one of three approaches in estimation; the ordinary least squares, the fixed and random effects with the Wald test restrictions for causality and the Generalised Method of Moments (GMM) to deal with possible endogeneity. Many studies have, however, used the first two approaches with just a few using the Generalised Method of Moment's estimator. The GMM is, however, believed to be superior due to its ability to deal with endogeneity and the fixed effects that may be present in the data.

3.4 Empirical Literature Review

3.4.1 Health Expenditure and Health Outcomes

The question that researchers and policy makers alike mostly ask is "does health expenditure matter in achieving better health outcomes?" This question, which has been asked by both developed and developing countries has received attention in the literature. It has been examined at several levels using cross-country data, time series data and at the household level using survey data including the Demographic and Health Surveys. In addition, several measures have been used to capture health outcomes ranging from maternal and child mortality to specific diseases such as malaria treatment and HIV/AIDS treatment programmes. The literature has, however, produced mixed evidence.

Some studies have concluded that spending on health care services is not associated with noticeable improvements in health outcomes, thus concluding that health expenditure does not matter for health outcomes. For instance, Musgrove (1996) concludes that there is no evidence that health expenditure influences health outcomes. The author used infant mortality rate as a measure of health outcomes. The study used 1990/1 cross-sectional data on 69 countries and estimated with the ordinary least squares estimator. The study nevertheless reports a strong positive effect of per capita income on health outcomes. Thus, increases in per capita income are associated with reductions in the infant mortality rates.

Likewise, Filmer and Pritchett (1997; 1999), in two separate studies conclude that public health expenditure is not a crucial determinant of health outcomes. The study reported a small and statistically insignificant coefficient of public health

expenditure on under-five (UMR) and infant mortality (IMR) rates using 1992/3 cross-national data for 173 countries and 98 developing countries respectively to empirically examine the impact of both non-health factors and public spending on health in determining under-five mortality and infant mortality. In both studies, the Ordinary Least Squares (OLS), median regression and two-stage least squares (2SLS) estimation techniques were used. The study reports that factors such as income per capita, the distribution of income, female education, the degree of ethnic fragmentation and the predominant religion explains about 95 percent of the variation in mortality rates across countries.

Filmer and Prichett (1997, 1999) offer three reasons that might explain why public health expenditure might be ineffective in influencing health outcomes. The first reason offered is that cross-national differences in the efficacy of the public sector imply that public spending on health does not always translate into a larger supply of effective health services. Secondly, the authors argue that the impact of a greater supply of effective health services in the public sector on health outcomes depends on individual demand and the market supply of health services. Lastly, public health expenditure, according to the authors, is spent on expensive, but ineffective curative services. These are the reasons offered by the authors in explaining the possibility of health expenditure being ineffective in influencing health outcomes.

Other studies have, however, reported a significant effect of health expenditure on health outcomes. One of such is the study by Cremieux, Ouellete and Pilon (1999). The authors conducted a panel-data study to analyse the effect of health expenditure on gender-specific infant mortality and life expectancy in Canadian provinces over

the period 1978-1992. Their results indicate that increases in health expenditures were critical in improving health outcomes by lowering infant mortality and improving life expectancy. Other variables such as physician per capita and per capita income were equally identified by the study to be important in affecting health outcomes over the years. The study employed the Generalised Least Squares (GLS) and fixed effect estimation techniques in the empirical analysis of the data.

Gupta et al. (2003), also report a positive impact of health expenditure on health outcomes. Specifically, the study reports that health expenditure reduces under-five mortality rates using data for 1990-99 from 70 countries. They, however, concluded that public spending on health is more important for reducing under-five mortality in low-income countries than in high-income countries. This suggests that there is a higher return on public health expenditure in the developing countries compared to the developed ones. This has important consequences for developing economies, such as SSA. Other variables used in the study were literacy rate and consumption.

In another study, Gupta et al. (2002) using cross-sectional data for 50 developing and transition countries observed in 1993-1994 concluded that increased health spending even though leads to a reduction in infant and under-five mortality rates, the relationship is mathematically weak. The study used the ordinary least squares and the two stage least squares estimation techniques. The authors, however concluded that the weak relationship could be due to the complex bureaucracies and the high inefficiencies that exist in the public sector of developing and transition economies. Factors such as adult literacy rate, per capita GDP, access to sanitation and urbanization were also controlled for in the study.

Baldacci et al. (2003) report from their study that public health expenditure leads to a fall in infant and child mortality rates. The authors, conducted a study using 1996-98 cross-sectional data for 94 countries to assess the effect of government health expenditure on health using the two stage least squares (2SLS) and the ordinary least squares (OLS) estimation techniques. In their study, other determinants of health outcomes such as GDP per capita, total fertility rate, spending per pupil and urbanization were also controlled for.

Berger and Messer (2002) on the effects of public financing of health expenditures, insurance coverage and other factors on health outcomes (using mortality rate per 1000 population) used 1960-1992 data across 20 OECD countries. Their results indicate that mortality rates depend on a mix of healthcare expenditure and the type of health insurance coverage. They report that increases in the publicly financed share of health expenditures are associated with increases in mortality rates even though increases in total health expenditures results in decreases in mortality rates. The study controlled for the effect of female labour force participation, GDP per capita, the proportion of the population with at least post-secondary education and tobacco consumption per capita.

Furthermore, a study conducted by Buor and Bream (2004) using cross-sectional data from 28 countries in SSA in 1998 reports that health outcomes (using maternal mortality) in SSA are not only determined by medical factors. After analysing the data using bivariate correlation and categorical cross-tabulations, they find that health expenditure per capita has a strong negative association with maternal mortality in SSA. Thus, increasing health expenditure leads to a reduction in

maternal mortality. Other variables in the study, according to the authors, which equally influence Maternal Mortality Rate (MMR), are Gross National Product (GNP) per capita, female literacy and births attended by skilled health personnel. They, therefore, advocate that there should be an adequate allocation of resources for the health sector in order to improve maternal health in SSA.

Issa and Ouattara (2005) also investigated the impact of private and public health expenditures on Infant Mortality Rates (IMR) for 160 countries for the period 1980-2000 employing the Ordinary Least Squares (OLS), the fixed and random effects and the system- Generalised Method of Moments (GMM) estimation techniques. The results of their study, controlling for real per capita GDP, female literacy and carbon dioxide emission, indicates that increases in health expenditure lead to a fall in infant mortality rates (IMR). The study, however, suggests that this effect is channelled through public health expenditure at low development levels and through private health expenditure at high development levels, implying that public health expenditure plays a significant role in reducing IMR in developing countries than private health expenditure. This has significant policy implications. If public health expenditure is more significant in developing countries than private health expenditure, then it is important for governments to allocate more resources to the health sector to improve health outcomes.

Alves and Belluzzo (2005) used census data from Brazil for the period 1970-2000 to investigate the determinants of infant mortality rates. The findings of their study indicate that poor child health (in terms of mortality rates) in Brazil can be explained by the levels of education, sanitation and poverty. Paxson and Scady (2005) also

report that the infant mortality spike during the Peruvian financial crisis coincided with a 30 percent fall in per capita GDP between 1987 and 1990. They show that public health expenditure fell by 58 percent in that period, its budget share falling from 4.3 to 3 percent. They, therefore, conclude that this, together with a decline in private health expenditure, is a likely explanation for the rise in Peruvian infant mortality rates during the financial crises.

Gottret and Scieber (2006) used data for 113 countries covering mainly low and middle income countries and reported that government health expenditure plays a critical role in improving health outcomes in those countries than any other variable such as education, roads, sanitation, GDP per capita and donor funding. Their finding, however, indicates that an increase in government health expenditure has a larger impact in reducing under-five mortality than maternal mortality. They reported that their results were robust over three different estimation techniques, the Ordinary Least Squares (OLS), Two Stage Least Squares (2SLS), and the Generalised Method of Moments (GMM).

Anyanwu and Ehijakpor (2007) investigated the effect of health expenditures on health outcomes in Africa using data from 47 African countries from the World Development indicators, WHO (WHOSIS), African Development Bank database and Easterly and Levine dataset for the period between 1999 and 2004. The Ordinary Least Squares (OLS), the instrumental variables Two Stage Least Squares (2SLS), and the fixed effects estimators were used in the empirical analysis. The study reports that health expenditure has a statistically significant effect in reducing infant mortality and under-five mortality rates in Africa. Additionally, ethnolinguistic

fractionalization and HIV prevalence rates were also reported to increase the mortality rates, whereas higher numbers of physicians and female literacy reduces mortality rates.

Fayissa and Gutema (2008) report a strong negative effect of increases in health expenditure on life expectancy at birth when estimating a health production function for SSA using data from the World Bank's World Development Indicators (2002). Thus, an increase in health expenditure results in a fall in life expectancy at birth. They explained that the results might be due to inefficient health systems in SSA. The study covered 33 Sub-Saharan African countries over the period 1990 to 2000. The parameters of the function were estimated by the method of one-way and two-way panel data analyses. Moreover, the study reports that an increase in income per capita, a decrease in illiteracy rate, an increase in food availability, a decrease in alcohol consumption, an increase in urbanization and a decrease in Carbon dioxide emissions improves life expectancy at birth.

Akinkugbe and Afeikhena (2006) investigating Public health care spending as a determinant of health status in Sub-Saharan Africa (SSA) and the Middle East and North Africa (MENA) conclude that health expenditure leads to a significant fall in infant and under five mortality and improves life expectancy at birth in both SSA and MENA. The study used pooled, multi-country annual time series data for the period 1980 to 2003 for 45 SSA and 12 MENA countries from the World Bank (2004) World Development Indicators. Availability of physicians, female literacy rate and immunisation were also found to be important contributors to health

outcomes. The study, however, report that income per capita was not a significant determinant of health status in SSA, but was significant for MENA.

Equally, Alvarez et al. (2009) using an ecological multi-group study compared variables associated with Maternal Mortality Rates (MMR) between 45 countries in SSA using data collected between 1997 and 2006. At the end of the study, a relationship between the MMR and some educational, sanitary, and economic factors was observed. Their results indicate that there is an inverse, but significant correlation between MMR and per-capita government expenditure on health. Before arriving at this result, other explanatory variables were included as controls in their analysis. These variables include prenatal care coverage, births assisted by skilled health personnel, access to an improved water source, adult literacy rate, primary female enrolment rate, education index and the Gross National Income per capita.

Biggs et al. (2010) analysed the relationship between GDP per capita in purchasing power parity, extreme poverty rates, the Gini coefficient for personal income and three common measures of public health: life expectancy, infant mortality rates, and tuberculosis (TB) mortality rates. Introducing poverty and inequality as modifying factors, the study assessed whether the relationship between GDP and health differed during times of increasing, decreasing, and constant poverty and inequality. The study used data for twenty-two Latin American countries from 1960 to 2007 from the December 2008 World Bank's World Development Indicators, World Health Organization Global Tuberculosis Database 2008, and the Socio-Economic Database for Latin America and the Caribbean. The authors report that increases in GDP have

a sizable positive impact on population health, but the effect was related to the level of poverty and inequality in the society.

For instance, the authors observe that when poverty was increasing, greater GDP had no significant effect on life expectancy or TB mortality, and only led to a small reduction in IMR. When inequality was rising, greater GDP had only a modest effect on life expectancy and IMR, and no effect on TB mortality rates. In sharp contrast, during times of decreasing or constant poverty and inequality, there was a very strong relationship between increasing GDP and higher life expectancy and lower TB and IMR. In addition, they report that inequality and poverty exert independent, substantial effects on the relationship between national income level and health. Thus, they conclude that how much healthier depends on how increases in wealth are distributed.

Kamiya (2010) applies the system Generalised Method of Moments (system GMM) to estimate the determinants of under-five mortality for cross-country panel data from 141 developing countries. The study finds evidence of a reduction in mortality due to an increase in health expenditure. The study, in addition, reports that GDP per capita and access to improved sanitation have statistically significant and favourable effects in reducing child mortality. However, the coverage of immunisation, skilled birth attendants and the number of physicians per 1,000 people did not have any effect on mortality rates.

Freire and Kajiura (2011) analysed the effect of public and private health expenditures on the achievement of health-related MDGs. They report that three-

quarters of the variation of health-related MDG indicators can be explained by public and private health expenditure per capita when controlling for levels of income and demographic factors such as the age dependency ratio, urbanization and population density. In addition, the authors report that marginal gains in health performance are higher for countries with low per capita public health expenditures. The paper also investigated a country's potential for increasing health expenditure and suggests that some of the countries that are behind in their progress towards the achievement of the MDGs have the potential to complement the shortfall through increasing their public health expenditure to levels that are compatible with their per capita income and demographic structure.

Mallaye and Yogo (2012) used a sample of 28 sub-Saharan African countries for the period 2000-2010 to examine the effect of health aid on health outcomes. After taking into account the endogeneity and using the instrumental variable approach, the study reported that health aid improves health outcomes in SSA countries. More specifically, for each additional unit of health aid, the study reported that life expectancy increases by 0.14, the prevalence of HIV decreases by 0.05 and infant mortality decrease by 0.17. This effect, according to the authors, operates mainly through the improvement in the female primary completion rate. The authors, however, cautioned that the magnitude of the effects is too small if African countries would like to achieve MDGs through additional health aid. Furthermore, the authors used the Oaxaca-Blinder decomposition and reported that differences in terms of the amount of health aid received do not explain the health outcomes gap between post-conflict countries and stable countries, but are explained by governance and the female primary completion rate.

Novignon et al. (2012) investigating the effects of public and private health care expenditure on health status in Sub-Saharan Africa conclude that health expenditure leads to improvement in life expectancy at birth and a reduction in infant mortality and the crude death rate. The study further reports that the effect of public health care expenditure is higher than the effects of private health expenditure and suggests that a means of improving health status is for the government to increase expenditure on health care. The study used data from 44 SSA countries from the World Development Indicators (WDI, 2012). The study estimated both the fixed effects and the random effects models. Also, the study concludes that the prevalence of HIV/AIDS leads to higher crude death and mortality rates and a fall in life expectancy, whereas real GDP per capita leads to improvement in life expectancy at birth and a fall in crude death and mortality rates.

In a related study to investigate the effect of public sector health spending on health outcomes in Sub-Saharan Africa, Akanni (2012) used data from the World Development Indicators (WDI) for 2003 to 2007. The study employed the fixed effects and the two-stage least squares regression approach in analysing the data. The study reports that public health spending leads to a fall in infant, under-five and the crude death rates and leads to an improvement in life expectancy at birth. In addition, income per capita, better immunisation, external funding of health care and fertility rates generally lowers mortality rates and improves life expectancy at birth, according to the study. The author recommended that even though health expenditure improves health outcomes, the mix of expenditure is very important and, therefore, cautions that governments should be cautious in increasing their share of the total health expenditure. This is probably because of the crowding out effect, that

government expenditure displaces private expenditure if the private sector is functioning well.

Farag et al. (2012) conducted a study on health expenditures, health outcomes and the role of good governance in which they examined the relationship between country health spending and infant and child mortality. The study used data from 133 low and middle-income countries for the years 1995, 2000, 2005 and 2006. Their results indicate that health spending has a significant effect in reducing infant and under-5 child mortality with an elasticity of 0.13 to 0.33 for infant mortality and 0.15 to 0.38 for under-5 child mortality in models estimated using fixed effects methods. Government health spending was also reported to have a significant effect on infant and child mortality. The authors report that the size of the coefficient depends on the level of good governance achieved by the country, indicating that good governance increases the effectiveness of health spending.

Kim and Lane (2013) analysed the relationship between public health expenditure and national health outcomes among developed countries using data collected from 17 OECD countries between 1973 and 2000. The study used two public health outcome indicators, the infant mortality rate and life expectancy at birth as dependent variables. The authors further used a mixed-effect panel data model in the analysis. The authors report a statistically significant association between government health expenditure and public health outcomes. Particularly, the findings shows a negative relationship between government health expenditure and the infant mortality rate, and a positive relationship between government health expenditure and life expectancy at birth, according to the authors. They suggest that higher

government spending on medical goods and services can be shown to provide better overall health results for individuals.

3.4.2 Health Outcomes and Economic Growth

The literature on the determinants of economic growth has produced diverse results. The classic 1956 Solow exogenous framework for the analysis of economic growth, since its introduction, has been the driving force behind such studies and the literature on the determinants of economic growth has grown significantly, both theoretically and empirically. Generally, Solow (1956) models economic growth as a function of labour and the stock of physical capital, with technology being held as an exogenous factor. However, the weak explanatory power of earlier empirical studies based on this model has drawn the attention of researchers to other determinants of growth, particularly the quality of the active labour force, human capital.

This has led researchers to augment the Solow model with human capital, particularly education and health capital in the framework of analysis. Incorporating these have led to divergent conclusions; some researchers report a significant effect of human capital on economic growth, whereas others found no effect. These models have been estimated using several different estimation techniques, from the Ordinary Least Squares models, the traditional panel data models of fixed and random effects and the more recent Generalised Method of Moments (GMM) technique.

Research examining the link between health and economic growth, at either the individual or the national level, has generally examined two types of health measures: inputs into health and health outcomes. Inputs into health are the physical

factors that influence an individual's health. These include nutrition and the availability of medical care. Other studies have used health expenditure as a proxy for investment in health which serves as an input into health outcomes. Some studies have also used the prevalence of diseases, hence computing the economic cost of such diseases. Typically, malaria prevalence and HIV/AIDS cases have been used in such studies. Other studies have used data on health outcomes in the growth models. In such studies, life expectancy at birth and mortality data have been used to estimate the effect of health outcomes on economic growth. A variety of conclusions has been reached in the literature. We examine some of these conclusions in the paragraphs that follow.

Knowles and Owen (1997) present a structural growth equation incorporating education and health as labour-augmenting variables in an aggregate production function. Although the model was an extension of the neoclassical framework, with diminishing returns to physical capital, the growth rates of output per worker need not be identical across countries, even in their steady states as the authors suggested. Cross-country empirical estimates from their study suggest a strong positive relationship between economic growth and health outcomes (using life expectancy at birth as a proxy), even after allowing for possible simultaneity. The authors argue that their findings are consistent with other evidence on the productivity-enhancing effects of improved health outcomes. By contrast, the relationship between output per worker and education was found to be insignificant.

Blooms and Sachs (1998), as cited in Hamoudi and Sachs (1999), provided empirical evidence on the relationship between health and economic growth. The study reports

that health plays a significant role in determining economic growth rates. The study used cross-country data between 1965 and 1990, using a basic growth model, and reported that an increase in life expectancy at birth by one percent accounted for an acceleration of GDP per capita growth rates by over 3 percent per annum. In addition, health and demographic variables explained over half of the differences in growth rates between Africa and the rest of the world over the same period of study.

Arora (2001) investigates the influence of health outcomes (using life expectancy) on the economic growth paths of ten industrialised countries over the course of 100 to 125 years. The study reports that changes in health outcomes increased the pace of growth by 30 to 40 percent, altering permanently the slope of the growth paths. The author argues that the finding is robust across five measures of long-term health and it remains largely unchanged when investment in physical capital was included in the model. Health-related variables correlated positively with years of schooling in the study. However, schooling variables by themselves did not replicate the results obtained from health-related measures. The author concludes that health improvements do not merely follow economic progress. The study used co-integration and the error correction methodology in the empirical analysis.

Bhargava et al. (2001) report significant effects of Adult Survival Rates (ASR) on economic growth rates for low-income countries. The results suggested that a one percent change in ASR was associated with an approximate 0.05 percent increase in the growth rate of per capita GDP. The authors suggest that health affected economic growth asymmetrically for poor and rich countries. Specifically, the study reports a

negative effect of health outcomes on economic growth in countries such as USA, France and Switzerland.

Aurangzeb (2003) using annual data for Pakistan's economy for the period 1973 to 2001 investigated the possible co-integration between health capital and economic growth. The study used health expenditure as a proxy for health capital in an augmented Solow growth model in a Cobb-Douglas functional form. The study used the Johansen co-integration analysis and the Error Correction Model. Further, the study included an openness variable (the ratio of trade to Gross Domestic Product) in the model in order to capture the effect of technological changes on economic growth. The study reports a significant and positive relationship between Gross Domestic Product and Health Expenditure, both in the long and short-run in Pakistan. Finally, the study reports a positive effect of openness on growth, in the long run, but negative in the short run.

Bloom et al. (2001) using 2SLS technique report that life expectancy and schooling have a positive and significant effect on Gross Domestic Product (GDP). Improvement in health outcomes increases the output level not only through labour productivity, but also through capital accumulation. The study also reports that improvement in life expectancy by one year resulted in an increase of 4 percent in output. By using the average height adult survival rate and life expectancy as indicators of health status, Weil (2007) finds that health is an important determinant of income variations in different countries. Approximately 17-20 percent of the cross-country variation in income can be explained by cross-country differences in the status of health according to the author.

Bloom et al. (2003) estimated a production function to investigate the effect of health on economic growth using data from a panel of countries observed every 10 years from 1960 to 1990 from the Penn World tables. The study used the non-linear two-stage least squares estimator in the analysis using life expectancy as the proxy for health and GDP per capita as a proxy for economic growth. The results indicated that life expectancy has a positive, sizable and statistically significant effect on economic growth. The study concludes that the effect of life expectancy on economic growth appears to be a labour productivity effect and not the result of it serving as a proxy for worker experience. The study, in addition, reports that labour, technological catch up and governance have a positive effect on GDP, while the land area in the tropics has a negative effect.

Gyimah-Brempong and Wilson (2003) investigated the effects of health capital on the growth rate of per capita income in Sub-Saharan African and OECD countries using an expanded Solow growth model, panel data and a dynamic panel estimator. The study reports that the growth rate of per capita income is positively influenced by health investment (using health expenditure as a proxy for health investments) and stock of health (using the child mortality rate as a proxy for the stock of health) after controlling for other covariates. The study reports that the stock of health capital affects the growth rate of per capita income in a quadratic way: the growth impact of health capital decreases at relatively large endowments of health stock. They further suggested that about 22 and 30 percent of the transition in the growth rate of per capita income in Sub-Saharan African and OECD countries respectively, can be attributed to health capital. The structure of the relationship between health

capital and the growth rate of income in Sub-Saharan African countries is similar to the structure of the relationship in OECD countries as suggested by the authors.

Aguayo-Rico et al. (2005) followed Bloom's production function approach and adopted a new definition of health capital, which includes health services, socioeconomic conditions, lifestyle and environment to capture the impact of health on life cycle savings and capital accumulation. They confirmed the significant effect of health on output and growth with a dataset of 52 countries for the period 1970-2000.

Kirigia et al. (2005) also report the importance of health to economic growth. The study estimated the effect of maternal mortality on gross domestic product in the WHO African Region using cross-sectional data from the United Nations Development Program (UNDP) and the World Bank Publications covering 45 countries. The study used a double log production function and the ordinary least squares estimator in the empirical analysis. The findings from the study indicate that maternal mortality has a negative and significant effect on GDP. An increase in the maternal mortality rate leads to a fall in GDP per capita in the WHO African Region according to the results of the study. The study thus concludes that as the nations strive to attain economic growth, efforts should be made to reduce the rate of maternal mortality as it promises significant economic returns. The study, in addition, reports that arable land per capita, capital accumulation, educational enrolment and exports have a positive effect on GDP, thereby leading to increases in GDP per capita. Also, labour and imports were reported to have a negative effect on GDP per capita.

Acemoglu and Johnson (2007) estimated the effect of life expectancy on economic performance. The study reports that improvement in life expectancy leads to about 2 percent increase in population, but a smaller effect on total GDP, thereby suggesting that improvement in life expectancy leads to a fall in GDP per capita. The study used the OLS and 2SLS estimates and constructed predicted mortality using it as an instrument for life expectancy. The study concludes that there is no evidence that improvement in life expectancy leads to increase in income per capita. This result has generated some discussion in the literature with some authors suggesting the possibility of the specification having an effect on the results obtained. For instance, it is speculated that if the study had used GDP per capita as the measure of growth, the results might have turned out differently, hence influencing later studies that have rather used GDP per capita instead of GDP in cross-country studies.

Akram et al. (2008) investigated the impacts of different indicators of health outcomes on economic growth in Pakistan. Co-integration and Error Correction techniques were applied to time series data of Pakistan for the period of 1972-2006. The study finds that per capita GDP is positively influenced by health indicators in the long run and health indicators cause per capita GDP. However, in the short run the health indicators do not have any significant impact on per capita GDP. Their empirical findings also reveal that health indicators have a long run impact on economic growth. This suggests that the impact of health is only a long-run phenomenon. The major import of their findings is that the desire for high levels of per capita income can be achieved by increasing and improving the stock of health human capital, especially when current stocks of human capital are low.

Ashraf, Lester, and Weil (2008) report that the effects of health improvements on income per capita are substantially lower than those that are often quoted by policy-makers, and may not emerge at all for three decades or more after the initial improvement in health. The results suggest that proponents of efforts to improve health in developing countries should rely on humanitarian rather than economic arguments, according to the authors.

He (2009) in his study, " In Sickness and in Health: The story of health as told by an augmented Solow growth model and cross-country dynamic panel data" tests whether the Solow model augmented with multiple forms of human capital can explain cross-country differences in growth and also investigates the effect of health on the growth of per capita income. Following Knowles and Owen (1995), the study introduced both education and health as human capital into the Solow model and extended their cross-section analysis to a dynamic panel data analysis to control for omitted variable and endogeneity biases, using a robust and consistent system Generalised Method of Moments (GMM) estimator. Data for a sample of 111 developed and developing countries over 1960-2004 was used in the study. The study concludes that both the stock of health and the investment or accumulation of health capital appears strongly associated with output growth, particularly for low-income countries. The study reports conditional convergence within the sample studied with a speed of around 2 percent per annum.

Aghion et al. (2010) investigated the relationship between health outcomes (measured by life expectancy) and economic growth in light of modern endogenous growth theory using data for 96 countries over the period 1960-2000, and the OECD

2009 health database. The study reports that a higher initial level and a higher rate of improvement in life expectancy both have a significant positive impact on per capita GDP growth based on cross-country regressions over the period 1960-2000. The study used both the Ordinary Least squares and instrumental variable estimation techniques. Further, the study concluded that only the reduction in mortality under age forty in OECD countries generated productivity gains over the period, suggesting this as the possible reason for the weakened effect of health on growth in cross-OECD studies that used life expectancy at birth.

Qadri and Waheed (2011) investigating Human Capital and Economic Growth using time Series data from Pakistan (1978 to 2007) stated that human capital is generally considered as a positive contributor to economic growth. The study used a health adjusted education indicator for human capital as used in the standard Cobb-Douglas production function and confirmed the long run positive relationship between human capital and economic growth in Pakistan. The study further performed sensitivity analysis in order to check the robustness of the initial findings. The authors reported that their estimation results support the findings of previous studies that human capital is positively related to economic growth. The health adjusted education indicator was found to be a highly significant determinant of economic growth in the study, which indicates that both health capital and education sectors should be given special attention in order to ensure long-run economic growth, according to the authors.

Saha (2013) examines the impact of health on Total Factor Productivity (TFP) growth for the Indian economy. The author reports that the Granger Causality test

shows a one-way causality from health as captured by life expectancy at birth to TFP growth for the Indian economy. The author further notes that improvement in health, as measured by life expectancy at birth, in India affects TFP growth positively and significantly. The study, therefore, suggested that the Indian government should invest more to deliver better health care facilities which would further help in enhancing the productivity of the Indian economy

Frimpong and Adu (2014) investigated the extent to which the health of the population affects the economic performance using panel data for 30 Sub-Saharan African countries for the period 1970–2010. Using a theoretical model based on an augmented Solow growth model, the authors estimated the relationship between population health capital (using life expectancy as a proxy) and economic growth in Sub-Saharan Africa using panel co-integration econometric strategy. The study reports that the health status of the population has not significantly driven economic performance in SSA. The authors further report that accounting for the effect of HIV/AIDS resulted in a significant negative effect of population health on economic growth, through the effect of HIV/AIDS. This, however, is not adequate since the effect of HIV/AIDS accounts for the effect of just a single disease on economic growth without necessary taking into consideration an aggregate measure of health status.

A brief overview of these studies thus reviews that the literature is inconclusive regarding the impact of health outcomes on economic growth at the macroeconomic level as well as the direction of causation, although these studies have tried to provide a clearer understanding of the relationship between health and economic

growth. There is, therefore, hardly any doubt that a possible relationship between health outcomes and economic growth could exist. Perhaps, a fundamental reason why it is difficult to reach a definitive conclusion regarding the link is the web of interrelationships involved in the determination of a nation's income. Consequently, the focus of this study is to establish the relationship between health outcomes and economic growth in the case of SSA.

3.4.3 Health Expenditure, Health Outcomes and Economic Growth

Studies on the causal relationship among health expenditure, health outcomes and Economic growth have differed in their findings. Most of these studies have mostly focused on the relationship between health expenditure and economic growth without account for a measure of health outcomes in the study. This is likely to bias the findings of such studies. The only exception is the study by Day and Tousignant (2005). The authors estimated a dynamic model of the relationship among real per capita GDP, real per capita spending on health and an indicator of health outcomes using unit root and co-integration tests, with and without allowances for structural break(s). The study used Canadian data from 1950 to 1997. Generalized impulse response analysis was used to explore the dynamic relationships among the three variables. The study used the infant and age-standardized mortality rate and a single composite index of health constructed by applying principal components analysis to a set of common health indicators. The study reported a weak but statistically significant relationship among per capita health spending, health outcomes and per capita GDP. The study concluded that the weak relationship might be due to model misspecification or decreasing returns to increases in health spending at high levels of population health.

Bukenya (2009) explored the possible dynamic relations between health care expenditure and economic growth, measured by gross state product, in the southeast United States by employing a time series approach (VAR methodology). The author reports the presence of a weak, but positive relationship between personal health care expenditure and economic growth in the United States. The paper, however, acknowledged the presence of unit roots in the data but failed to detect co-integration. The author reports that the results of the VAR analysis are correspondingly limited, but the shapes of the impulse response functions do confirm the proper positive relationship between positive personal health care expenditure changes and economic growth in the United States.

Rahman (2010) investigated the causal relationship among health expenditure, education expenditure and Gross Domestic Product (GDP) for Bangladesh using time series data from 1990 to 2009. The study by employing the Error Correction Methodology (ECM) reports that the inclusion of expenditure on health and education as investment in health and education capital improves the significance of the coefficient of human and physical capital in the growth model for Bangladesh. The author also reports that the estimates from the VAR Granger Causality test indicates the existence of unidirectional causality from health expenditure to GDP. In addition, the author reports the existence of bidirectional causality between education expenditure and GDP and also between education expenditure and health expenditure.

Balaji (2011) reports no long run relationship between health expenditure and economic growth in India using data from 1960-2009 from four southern Indian

states and applying the Johansen and Julius co-integration and Granger causality. Erdil and Yetkiner (2004) also applied Granger causality approach to panel data model with fixed coefficients in order to determine the relation between GDP and health expenditure per capita. The study in the analysis employed a large micro panel data set with a VAR representation. The authors report the existence of bidirectional causality in the sample used. The study further reports that the pattern of causality is different in low and middle income countries where there was a unidirectional causality running from GDP to health care expenditure, compared to what was found in high-income countries where a unidirectional causality run from health care expenditure to GDP.

Baltagi and Moscone (2010) considered the long-run economic relationship between health care expenditure and income using a panel of 20 OECD countries observed over the period 1971- 2004. The paper studied the non-stationarity and co-integration properties between health care spending and income in a panel data context controlling for both cross-sectional dependence and unobserved heterogeneity. The study modelled Cross-sectional dependence through a common factor model and through spatial dependence. Heterogeneity, on the other hand, was through fixed effects in panel homogeneous and heterogeneous models. The authors report that health care is a necessity rather than a luxury, with elasticity much smaller than that estimated in previous studies.

Chen (2010) analyzed the dynamic relationship between health (as measured by infant mortality rate) and wealth (as measured by GDP per capita) for a panel of 58 developing countries using quinquennial data covering the period 1960 through

2005. The author examined the causal links between the two fundamental macro measures of economic development. The author argue that the panel enables him to examine the causal links using several methods that differ in how cross-country and temporal heterogeneity is imposed: cross-country homogeneity with temporal heterogeneity and cross-country heterogeneity with temporal homogeneity. Under the latter case, the author considered sensitivity to assuming fixed versus random causal coefficients. In addition, the author explored the robustness of outcomes to the level of economic development (as measured by national income) and the inclusion of another covariate (education). The author reported bidirectional causality between real GDP per capita and infant mortality rate, supporting works that adopt health care expenditure as the measure of health, and many cross-sectional multivariate studies that explore such questions. The study concluded that policies that support growth in income and directly address infant mortality are desirable strategies for development.

Amiri and Ventelou (2010) investigated the causal relationship between health care expenditure and GDP in the United States of America by comparing periods. The authors argued that there could be a bidirectional relationship between health expenditure and GDP, where health expenditure is a function of GDP and good health is considered as an input to the macroeconomic production function, stimulating GDP. The study used a modified version of the Granger (1969) causality test proposed by Toda and Yamamoto (1995) to investigate the relationship between GDP per capita and health care expenditure per capita in the United States. The study compared the periods of 1965 to1984, 1975 to 1994, 1985 to 2004 and 1965 to 2004. The results reported by the authors indicate that the three periods have

different causal relationships. The study reported bidirectional relationship between health care expenditure and GDP in 1965 to 1984, unidirectional relationship from health care expenditure to GDP from 1975 to 1994 and unidirectional relationship from GDP to health care expenditure for 1985 to 2004. However, for the entire period of study, the study reported unidirectional causality from health care expenditure to GDP, suggesting a significant influence of health care expenditure on overall economic growth in the United States of America.

Tang (2011) employed the Granger causality test within a multivariate co-integration and error-correction framework to investigate the relationship among health care spending, income and relative prices in Malaysia with an annual sample from 1970 to 2009. The main findings were that in the short-run, there is unidirectional Granger causality running from relative price to health care spending, while relative price and income have bidirectional Granger causality in Malaysia. In the long run, however, health care spending and income have a bi-directional Granger causality while there is unidirectional Granger causality running from relative price to health care spending and income according to the author. In addition, the study examined the dynamic interaction among the variables in the system through the forecast error variance decomposition and impulse response function analyses. The results indicated that all the variables behaved endogenously in the long-run. Thus, the variables Granger-cause each other in the long run even though there might be deviations in the short-run.

Wang (2011) used international total health care expenditure data of 31 countries from 1986 to 2007 to explore the causality between health care expenditure and

economic growth. The study employed both the panel regression analysis and the quantile regression analysis. The estimates of the panel regression revealed that expenditure growth will stimulate economic growth, but economic growth reduces expenditure growth. The results from the quantile regression, on the other hand, revealed that when economic growth is quantile, in countries with low level of growth, the influence of expenditure growth on economic growth is different. In countries with medium and high levels of economic growth, the influence of expenditure growth on economic growth is positive; when health care expenditure growth is quantile, the influence of economic growth on expenditure growth is more different.

Bakare and Olubokun (2011) investigated the relationship between health care expenditures and economic growth in Nigeria using data from the Central Bank of Nigeria and the Federal Bureau of statistics from 1970 to 2008. The study employed the ordinary least square multiple regression analytical method. The study reported a significant and positive relationship between health care expenditures and economic growth. The study concluded that public health expenditure has a vital relationship to the growth and development of any nation. It normally improves health, life expectancy, efficiency and productivity of labour, according to the study.

Mehrara and Musai (2011) examined the causal relationships between Health expenditure and GDP for Iran using annual data over the period 1970-2008. The study employed the Gregory-Hansen (1996) co-integration technique, allowing for the presence of potential structural breaks in the data to empirically examine the long-run co-movement between health spending and output. Their results indicated a

long-run relationship between health spending and output with an income elasticity for health care spending being greater than one during the period after the Islamic Revolution (1979-2008) in Iran. The Granger Causality test indicated a strong unidirectional effect from GDP to health expenditure and provides no support to the view that health expenditure promotes long-term economic growth.

Ogunleye (2011) examining the tripartite relationship among health production, health outcomes and economic growth for SSA countries employed the Arellano-Bond Dynamic GMM technique for 40 SSA countries. The study reported that alcohol consumption, urbanization and carbon emission had statistically significant effects on child mortality while all these variables and food availability turns out to be significant determinants of life expectancy. The study further reported that the health variables used in the study (child mortality and life expectancy at birth) have the right signs but none were significant in influencing economic growth. The author alludes to the fact that health indicators are so poor in SSA countries that they are unable to influence growth. The author also suggests that the insignificant effect of health on growth could be emanating from the complex relationship between child mortality and life expectancy, on the one hand, and per capita economic growth, on the other.

The author explains that the marginal increase in life expectancy recorded by most SSA countries has further increased population growth and consequently total population. This rise in the population appears to have reduced the available resources per capita, thus weakening the potential economic benefits of improved health, the author claims. Further, most economies in Africa are still unable to match

health production with health demands, thus leaving a huge health gap that needs to be filled. Finally, the authors suggest that the results could be an amplification of the peculiarity of African countries and the extent to which they differ from developed economies that tend to establish different findings. The study, however, failed to access the causal relationship among the three variables. Besides, the claim that an increase in population size could be the reason for the insignificant effect of health status on growth could be due to the failure of the study to account for the age dependency ratio.

Elmi and Sadeghi (2012) investigated the causality and co-integration relationships between economic growth and health care expenditures in developing countries during 1990-2009. The paper concentrated on panel co-integration and causality in VECM (Vector Error Correction Model) framework. The study reported short-run unidirectional causality from GDP to health care spending. However, there was a long run bidirectional causality between economic growth and health spending. Thus, the findings indicated that income is an important factor across developing countries in the level and growth of health care expenditure in the long-run. The study also reported that the health-led growth hypothesis in developing countries is confirmed due to the bidirectional relationship between health spending and GDP.

Hassan and Kalim, (2012) scrutinized the existence of a long run association and triangular causality among real GDP per capita, per capita education expenditures and per capita health expenditures in Pakistan. The authors applied the Ng - Perron test to investigate stationarity, ARDL bounds testing approach to examine the existence of a long run relationship and Granger Causality test to examine the short

run, long run and combined short and long run triangular causality among the variables for the time series data of Pakistan from 1972 - 2009. A bidirectional relationship was reported to exist between per capita real GDP and per capita education expenditures in the short run, whereas per capita health expenditures and real GDP per capita were reported not to granger cause each other in the short run. The study further reported bidirectional granger causality among all the variables in the long run.

3.5 Measurement of Health Outcomes

Research on the relationship between health outcomes and economic growth mostly suffer from the limitations of aggregate measures of health outcomes. The measurement of health outcomes in empirical analysis mostly tends to be difficult because firstly, health is multifaceted, so that it defies simple definition and no single variable summarizes it. Secondly, measurement error in health status is likely related to income and labour market outcomes, according to Strauss and Thomas (1998). Thus, studies have used several measures to capture health outcomes, albeit with their merits and demerits. Measures that have been used in the literature include Life Expectancy at Birth (LEB), mortality rates (Under-five, Infant and Maternal mortality rates), and Adult Survival rates. Disease-related measures of health e.g. malaria or HIV/AIDS have been adopted in studies that focused on some low-income countries (Cole and Neumayer, 2006). Additionally, Kirigia et al. (2005) used maternal mortality rate as a measure of health outcomes.

Life Expectancy (LE) has been widely used as an indicator of general health status. This is because its calculation is not only based on the annual cross-section of deaths,

which captures the survival aspects of health, but also captures improvements in life expectancy associated with reductions in morbidity and debility. Life expectancy can be measured at any age, but what is mostly used in the literature is Life Expectancy at Birth (LEB). Life expectancy at birth indicates the number of years a newborn infant is expected to live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. The use of life expectancy at birth as a proxy for health status has been varied in the literature. Some studies directly use the natural logarithm of life expectancy at birth or a certain age (He, 2009; Barro, 1996; Arora, 2001; Bloom et al., 2001, 2004), while some use the reciprocal of life expectancy at age one. Other studies have adopted the transformation used by Anand and Ravallion (1993), which is expressed as 22ln(80)LE, where (80)LE is the shortfall of average life expectancy (LE) at birth from 80 years (Knowles and Owen, 1995; McDonald and Roberts, 2002).

The use of life expectancy as a proxy of health status has been criticized for some reasons. Bloom and Canning (2003) argue that health should have been measured in all its dimensions: mortality, morbidity, disability and discomfort. Moreover, life expectancy is simply a weighted average of mortality rates at all ages and is highly sensitive to infant and child mortality rates (presumably less relevant for current productivity) so that conceptually it is not a good measure to reflect adult health and worker productivity. Furthermore, as Grossman (1972) suggested, health capital depreciates over time, however, life expectancy reveals only the lifetime of the stock of human capital but nothing about population ageing and its resulting problems.

Some researchers have employed Adult Survival Rates (ASR) as a proxy of health because of some potential advantages. ASR is defined as the probability of surviving to age 60 from age 15 given the prevailing age-specific mortality rates (using the current life table), and usually expressed per thousand. ASR has a close link with the Adult Mortality Rate, which is the probability of dying between the ages of 15 and 60, that is, the probability of a 15-year-old dying before reaching age 60, subject to current age-specific mortality rates between those ages. First, ASR is constructed from World Bank demographic files containing mortality data on countries and are supposed to be more closely related to adult health and workforce productivity and less sensitive to child mortality rates. Second, capital formation and technological innovations require skilled workers and experience while investments in education and training critically depend on survival probabilities, which are likely to have more interpretation power. Bhargava et al. (2001) and Bloom et al. (2004) used the average ASR calculated as the weighted average by the share of the economically active population.

Using the Adult Survival Rats (ASR) as a measure of health outcomes has been criticised. ASR measures mortality rate rather than morbidity and does not reflect the diminishing ability of individuals to perform productive tasks due to poor nutrition at an early age. Using ASR as the sole indicator of health likely causes an under-estimation of productivity loss (HE, 2009). In addition, health improvements above age 60 are likely to be important due to the trend of late retirement, particularly in developed countries. Unfortunately, ASR does not necessarily consider the person's health status after age 60.

Life expectancy and ASR are both broad measures of population health though they may not accurately reflect the productivity of the labour force because they are only based on mortality information. Webber (2002) as cited in He (2009) suggests that life expectancy reflects neither investment in health capital nor all dimensions of health and argues that its impact on output might provide more information on educational, rather than health-related policies. He instead used caloric intake per head as a proxy of health and argued that this measure was well suited to formulating policies to increase economic growth. However, the nutrition-related measure of health is likely to have a greater impact in low-income countries than in high-income countries where over consumption of calories may cause obesity and indeed reduce workers' productivity (He, 2009).

Health care expenditure (per capita) has also been used in some studies such as Heshmati (2001), Gyimah-Brempong and Wilson (2004) and Hartwig (2010). Using health care expenditure is more likely to capture the change in health investment and its time series properties. However, higher health care expenditure does not necessarily result in better health status. The link from health spending to health outcomes might be weak due to both market and government failures, to be specific, the financing and delivery of health care. The lack of sound health institutions may also undermine health investment (Jack and Lewis, 2009).

Thus, there is no consensus in the literature on the choice of health status indicators because none of them is ideal to capture both mortality and morbidity. What a researcher uses depends on the availability of data. Using different measures of health status may be one of the reasons why the results presented in health-related growth

studies sometimes contradict one another. Moreover, He (2009) argues that at a practical level, the accuracy of the data, particularly in many developing countries is poor, hence interventions that affect morbidity but not mortality may have effects on productivity, but these effects are unlikely to be taken into account if mortality-based indicators are used. Nevertheless, for a cross-country growth study, the choice among these specifications may not cause any substantial difference in the results.

3.6 Summary of Literature

Empirical works that have investigated the effects of health expenditure on health outcomes have generated differing conclusions. Some have reported a positive effect of health expenditure on health outcomes, whereas others have reported an insignificant effect. For instance, Musgrove (1996) and, Filmer and Pritchett (1997, 1999) both concluded that health expenditure is not a crucial determinant of health outcomes. Fayissa and Gutema (2008) reported a strong negative effect of increases in health expenditure on life expectancy at birth and Gupta et al. (2002) reported that the effect of public health expenditure on health is weak.

On the other hand, studies by Nixon and Ulmann (2006), Anyanwu and Ehijakpor (2007), Oluyele and Afeikhena (2008) and Kamiya (2010), have reported a positive effect of health expenditure on health outcomes. The conclusions from these studies have, however, differed. Issa and Ouattara (2005) suggest that the effect of health expenditure on health outcomes is channelled through public health expenditure at low development levels and through private health expenditure at high development levels. Novignon et al. (2012) and Anyanwu and Ehijakpor (2007) both propose an increase in public health expenditure to improve health outcomes. Novignon et al.

(2012) however suggest that the effect of public health expenditure is stronger than that of the private. Berger and Messer (2002) suggest that publicly financed health expenditure leads to increases in mortality rates despite the fact that increases in total health expenditure reduces mortality rates. Akanni (2012) also cautions governments to take precautions in increasing their share of health expenditure since the mix of health expenditure is very important in influencing health outcomes.

Furthermore, studies on the effect of health outcomes on economic growth in SSA have generally produced inconclusive evidence. Gyimah-Brempong and Wilson (2003) report significant effect of health outcomes on economic growth, while Ogunleye (2011) and, Frimpong and Adu (2014) report an insignificant effect. These studies have, however, failed to account for the dependency ratio and openness to trade which can affect economic growth. In addition, while Acemoglu and Johnson (2007) concluded that improvement in health outcomes leads to a fall in GDP per capita, He (2009) and Aghion et al. (2010) argue that health outcomes are strongly associated with output growth, particularly for low-income countries. Besides, Ashraf et al. (2008) argue the effects of health improvements on income per capita are substantially low and may not emerge at all for three decades or more after the initial improvement in health, hence suggesting that proponents of efforts to improve health in developing countries should rely on humanitarian rather than economic arguments.

The literature on the causal relationship among the three variables has produced mixed evidence. Besides, most studies have focused on the relationship between health expenditure and health outcomes and have generally not included a measure

of health outcomes in the analysis. Additionally, there is no known study that has evaluated this relationship for SSA as a region. For instance, a study conducted by Balaji (2011) reports a short run causality running from health expenditure to economic growth, with no long run evidence. Mehrara and Musai (2011) and Elmi and Sadeghi (2012) on the other hand report a short run causality running from economic growth to health expenditure. Amiri and Ventelou (2010) also report bidirectional causality between health expenditure and economic growth. Thus, the evidence is mixed in the literature on the nature and direction of causality. The common issue with these papers is, however, the negligence of a measure of health outcomes in the equations which can cause a bias in the results. Unfortunately, only one study has made an effort to investigate the three variables in one single framework, Day and Tousignant (2005) who reported a weak triangular causality in Canada. It is important that these variables are investigated in totality.

3.7 Gaps in the Literature

Based on the literature discussed in the sections above, we identify the following gaps in the literature, which we seek to provide some insights into in the context of SSA.

1. The review on health expenditure and health outcomes does not provide clear-cut empirical evidence on the effects of health expenditure on health outcomes. This is evident in the mixed results found in the literature from the various studies that have assessed the effects of health expenditure on health outcomes. This study, therefore, joins the debate to assess whether health expenditure has any significant influence on health outcomes, particularly in SSA.

2. Studies on the effects of health expenditure on health outcomes have mostly failed to incorporate the effect of such social determinants of health outcomes as the prevalence of diseases, environmental conditions, the use of preventive health care/immunisation and population dynamics in the analysis. This has the potential to lead to a bias in the results obtained in such studies. For instance, it is known that immunisation against some know diseases over the years has contributed to a decline in infant mortality rates and the high incidence of HIV/AIDS has caused a significant reduction in life expectancy and increased mortality rates in some countries. Failure to account for these factors may lead to misleading results.

3. Known studies on the contribution of health outcomes to economic growth in the region have left out two important variables, the demographic dividend and openness to trade. Yet, it has been argued in the literature that these variables have significant effects on economic growth. Thus, to capture the impact of improvement in health status on economic growth, it becomes appropriate to incorporate these in the analysis. Unfortunately, known studies on health outcomes and economic growth have failed to account for this. This probably explains the mixed nature of the results obtained in three known related studies, namely Gyimah-Brempong and Wilson (2003) who concluded that health outcomes have significant impact on economic growth, and Ogunleye (2011) and, Frimpong and Adu (2014) who found no evidence to support the growth enhancing impact of favourable health outcomes.

4. In addition to the foregoing, the causal relationship among health expenditure, health outcomes and economic growth has largely remained un-investigated. There is currently no known study, to the best of our knowledge, on SSA addressing this very important issue. An understanding of the nature of this relationship could possibly help us provide answers to two basic questions, namely, (a) is health wealth? And (b) does the health-led growth hypothesis exist in SSA? The "health-wealth" hypothesis suggests a bidirectional relationship between health outcomes and economic growth, while the "health-led" growth hypothesis suggests bidirectional causality between health expenditure and economic growth. Thus, this study seeks to provide an insight into these two hypotheses and hence provoking a discussion on them in the context of SSA.

CHAPTER FOUR

THEORETICAL FRAMEWORK, MODEL SPECIFICATION AND EMPIRICAL METHODOLOGY

4.1 Introduction

In this chapter, we present the theoretical framework, model specification and the empirical methodology employed for the study. The theoretical frameworks underlying the study are discussed in section 4.2, with sub-sections 4.2.1 and 4.2.2 presenting the Grossman (1972) Demand for Health model and the Augmented Neoclassical Growth model respectively. In sub-section 4.2.3, an analytical disposition to establish a causal link among health expenditure, health outcomes and economic growth is presented. Section 4.3 discusses the model specifications for the three objectives outlined in chapter one. Finally, in section 4.4, the empirical methodology in estimating the models specified is discussed. A description of the data and variables for the study is carried out in section 4.5.

4.2 Theoretical Framework

4.2.1 Effect of Health Expenditure on Health Outcomes

The literature suggests that health expenditure serves as an investment in the health production of the individual and/or population of a nation. This investment is expected to influence the person's health status. Thus, it is expected that increasing health expenditure should have a significant influence on health outcomes by reducing mortality and increasing life expectancy. This is the underlying framework of the Grossman (1972) model of health capital; that health investment is very vital in improving the health of an individual in the society and that of a nation as a whole. This requires that any individual or society that wants to see an improvement in health

outcomes should invest more in health care. For the individual, this goes beyond the monetary investment to time and lifestyle changes. This is, however, same for the entire society since the society is made up of individuals, hence the provision of health care is incomplete if the individuals in the society fail to utilise the services provided, or match it up with lifestyle and environmental requirements.

The discussion of the Grossman (1972) model for this study follows the specification by Fayissa and Gutema (2008) in their study, "A health production function for Sub-Saharan Africa (SSA)." The health production function is specified in equation 4.1 as:

$H=F(X)$ …… (4.1)

Where H is a measure of health outcomes and X is a vector of health inputs to the health production function (F). The elements of the vector X includes: income, health expenditure, education, environmental factors, health system factors that measure the use of health care and age structure of the population as a measure of the depreciation of health according to the Grossman model.

The model by Grossman (1972) was developed for analysis of health production at the micro level. The interest here is, however, to analyse the production system at the macro level. There is, therefore, the need to switch from micro to macro analysis, without losing the theoretical ground. This is done by representing the elements of the vector X with per capita variables and regrouping into sub-sectoral vectors of economic, social, and environmental factors as represented in equation 4.2:

$H = F(Y, S, V, D)$ ---------- (4.2)

In equation 4.2, H is a vector of health outcomes, Y is a vector of per capita economic variables, which includes income and health expenditure per capita; S is a vector of

per capita social variables, which includes education, population, age structure and the prevalence of diseases. V is a vector of environmental factors, which includes sanitation and water availability. D is a vector of health service utilisation variables, using the rate of immunisation as a proxy. In its scalar form, equation 4.2 can be stated in equation 4.3 as;

$$H = F(y_1, y_2, ..., y_n; s_1, s_2, ..., s_n; v_1, v_2, ..., v_n; d_1, d_2, ..., d_n) \quad \text{---------- (4.3)}$$

Where Y = (y_1, y_2… y_n); S= (s_1, s_2… s_n); V= (v_1, v_2… v_n), D = (d_1, d_2… d_n) and n represents number of variables in each sub-group. Using calculus, equation 4.3 can be transformed to an explicit form by forming a probability density function for the variables y, s, v and d. This is expressed in equation 4.4 as;

$$H = \Omega \prod y_i^{\alpha_i} \prod s_i^{\beta_m} \prod v_i^{\lambda_i} \prod d_i^{\gamma_i} \quad \text{---------- (4.4)}$$

From equation 4.4, α_i, β_m, λ_i, and γ_i, are elasticities from the model and Π is the probability density function. Ω is an estimate of the initial health stock pointed out by the Grossman (1972) model. It measures the health status that would have been observed if there was no health depreciation or health improvement due to changes in socioeconomic and environmental factors used in the production system. In the basic Grossman model, Ω is assumed to be inherited from the parents. Further, taking the logarithm of equation 4.4 and rearranging yields equation 4.5.

$$LnH = Ln\Omega + \sum \alpha_i (\ln y_i) + \sum \beta_i (\ln s_i) + \sum \lambda_i (\ln v_i) + \sum \gamma_i (\ln d_i) \quad \text{---------- (4.5)}$$

Where i ranges from 1, 2, 3… n and ∑ is a summation operator which sums all the factors within each scalar variable. LnH is the natural logarithm of the measures of health outcomes. Lny is the natural logarithm of the economic variables, Lns

represent the natural log of the social variables, Lnv represents the natural log of the environment variables and Lnd represents the natural log of the health care variables.

Equation 4.5 represents a health production function based on the Grossman health capital model. A specific form for the purposes of estimation can be obtained from equation 4.5 by incorporating the respective variables under each section taking account of the cross-sectional and time factors. The model predicts that education increases the efficiency of health production and thus expected to improve health outcomes. The idea is that the higher the level of education of the individual, the better the individual takes care of his/her health. Also, it predicts that health investment improves health outcomes. Also, depreciation which is associated with age is postulated to worsen health outcomes. The Grossman model also makes room for other factors that might also improve or hinder the health production activities of the individual, such as environmental and lifestyle factors. These are introduced as deemed appropriate, either from data availability or from the literature. Thus, equation 4.5 serves as the framework within which this study is carried out to determine the effect of health expenditure on health outcomes.

4.2.2 Effect of Health Outcomes on Economic Growth

The literature on the relationship between health outcomes and economic growth has evolved over time. There are at least three channels that have been identified in arguing that health status matters for economic growth (Aghion at al., 2010). It has been suggested that higher life expectancy is likely to translate to higher domestic and national savings, which in turn implies higher capital accumulation, which feeds back to higher economic growth. In addition, higher life expectancy could imply higher investment in education, which implies higher human capital formation, which is also

expected into translate to growth. Thirdly, it is argued that low child mortality could translate to low fertility rate, which in turn slows down population growth and thus could translate to higher per capita GDP (Murtin, 2013). Thus, improved health outcomes could imply higher productivity, more creativity, and better adaptation to technologies. Healthier people are better workers. They can work harder and for longer hours.

In examining the relationship between health outcomes and economic growth, one can look at health as a peculiar form of human capital. In this regard, health can be treated as a direct factor of production, where output is assumed to be affected by improvements in health outcomes. On the other hand, health could be modelled as a component of human capital, which can be treated as affecting production through the impact on a composite human capital factor. The literature has suggested that the effect of health outcomes on Economic growth could be the same in both ways (Knowles and Owen, 1997, 1999). In this study, the effect of health outcomes on economic growth is modelled by incorporating health outcomes into the production function, following the approach used in the Augmented Solow model. Romer and Chow (1996), and Barro (1997) have emphasized that human capital is an important factor in determining economic growth in light of the Augmented Solow model.

The augmented model includes education (E_{it}) and health capital (H_{it}) in the production function as specified in equation 5.1:

$$Y_{it} = A_t K_{it}^{\alpha} E_{it}^{\beta} H_{it}^{\lambda} L_{it}^{1-\alpha-\beta-\lambda} \qquad \alpha + \beta + \lambda < 1 \quad \text{---------- (5.1)}$$

Where Y_{it}, K_{it} and L_{it} represent per capita Gross Domestic Product (GDP), physical capital, and labour of the country i at time t respectively. A_t is the baseline level of

technology, reflecting how a country converts inputs into outputs. The baseline level of technology (A_t) is assumed the same for all countries over time. The model is further transformed into per capita terms defining $k_t = (K_t/L_t)$ and $y_t = (Y_t/L_t)$ as the stock of capital and the level of output per unit of labour respectively. This is expressed in equation 5.2 and linearized using the natural logarithm as expressed in equation 5.3.

$$y_{it} = A_i k_{it}^{\alpha} e_{it}^{\beta} h_{it}^{\lambda} \quad \text{----------} \quad (5.2)$$

$$\ln y_{it} = A_i + \alpha \ln k_{it} + \beta \ln e_{it} + \lambda \ln h_{it} \quad \text{----------} \quad (5.3)$$

Following the Solow model, it is assumed that L_t and A_t grow at an exogenously determined rate of n and g, respectively, by the relations: $L_t = L_o e^{nt}$ and $A_t = A_o e^{nt}$. If it is further assumed that a constant fraction s_e, s_k and s_h of output are invested in education, physical capital and human capital respectively, and δ is the rate of depreciation of capital, then the evolution of k, h and e, following the Solow growth model as discussed in chapter three, are governed by the equations 5.4 to 5.6:

$$k_t = s_k y_t - (n + g + \delta) k_t \quad \text{----------} \quad (5.4)$$

$$e_t = s_e y_t - (n + g + \delta) e_t \quad \text{----------} \quad (5.5)$$

$$h_t = s_h y_t - (n + g + \delta) h_t \quad \text{----------} \quad (5.6)$$

Supposed it is further assumed that the economies are at their steady states, which imply, by definition, k*, h* and e* representing the steady state values are equal to zero, then the right hand side of equations 5.4, 5.5 and 5.6 can be equated to zero. The steady state values can be restated in equations 5.7 to 5.9.

$$k^* = \left(\frac{s}{n+g+\delta} \right)^{\frac{1}{1-\alpha}} \quad \text{---------- (5.7)}$$

$$e^* = \left(\frac{s}{n+g+\delta} \right)^{\frac{1}{1-\alpha}} \quad \text{---------- (5.8)}$$

$$h^* = \left(\frac{s}{n+g+\delta} \right)^{\frac{1}{1-\alpha}} \quad \text{---------- (5.9)}$$

Equations 5.7 to 5.9 follows from the assumptions underlying the Augmented Solow model. Substituting the steady state values stated in equations 5.7 to 5.9 into equation 5.3 and rearranging yields equation 5.10. Equation 5.10 is similar to the original Solow model, except for the introduction of both education and health capital into the model, in the tradition of the Augmented Solow model of Mankiw, Romer and Weil (MRW, 1992).

$$\ln y_{it} = \ln A_0 + g_t - \frac{(\alpha+\beta+\lambda)}{(1-\alpha-\beta-\lambda)} \ln(n+g+\delta) + \frac{\alpha}{(1-\alpha-\beta-\lambda)} \ln s_k + \frac{\beta}{(1-\alpha-\beta-\lambda)} \ln s_e + \frac{\lambda}{(1-\alpha-\beta-\lambda)} \ln s_h \quad \text{--- (5.10)}$$

Thus, empirical studies that have followed the MRW model have used equation 5.10 as the underlying framework. Studies, subject to the availability of data have either estimated equation 5.10, or the regression approach, which entails linearizing the production function and estimating as done in Barro (1996).

4.2.3 Health Expenditure, Health Outcomes and Economic Growth

The absence of a theoretical foundation about the nature of the interrelationship among these three variables raises a point of concern. The theoretical frameworks discussed above, so far, have presented the effect of one variable on the other: the effect of health expenditure on health outcomes, and the contribution of health outcomes to economic growth. The question that comes to mind then is how these

three variables are connected. Can it be concluded that there is any relationship among these variables, or are they related by coincidence? These questions can only be understood from the empirics. Several conclusions can be drawn from the overview of the literature on the relationship among health expenditure, health outcomes and economic growth.

The theoretical framework in the light of the Grossman (1972) model discussed has suggested that health expenditure, as an investment into health capital, serves to improve health outcomes. The Augmented Solow model, on the other hand, has also discussed the importance of health outcomes to economic growth, suggesting that health outcomes are important in facilitating economic growth. These two economic models, the Grossman Health capital model and the Augmented Solow Model, have established economic growth as a function of health outcomes and health outcomes as a function of health expenditure. Hence, the two theoretical frameworks have presented a clear pathway for the effect of health expenditure on health outcomes and the effect of health outcomes on economic growth.

However, it has been suggested that economic growth implies growth in income levels. This is believed to have an effect on health expenditure which is a function of income. In addition, health expenditure is argued to affect economic growth since it is an investment into health capital. Muskin (1962) refers to this as the health-led growth hypotheses. This, thus suggests a causal relationship between health expenditure and economic growth. Finally, growth in income helps the nation to provide better social amenities which improves the standard of living and health conditions while health is

argued to contribute to economic growth. This suggests bidirectional causality between health outcomes and economic growth.

The final question is how do we link these three variables in a common framework? The Vector Autoregressive Model postulated by Sims (1989) has been suggested to be the best approach in dealing with interrelated variables. The VAR treats all variables in the model as endogenous and exogenous thus allowing the possibility of studying causal associations. Thus, in our attempt to investigate the causal relationship among the three variables, we employ the VAR methodology.

4.3 Model Specification

4.3.1 Effect of Health Expenditure on Health Outcomes

The study investigates the effect of health expenditure on health outcomes using the Grossman (1972) demand for health model. We consider three indicators of health outcomes, life expectancy at birth, infant mortality rate and under-five mortality rate. For each indicator (H) considered, we specify the effect of health expenditure on health outcomes as;

$H_{it} = f (HEP_{it}, X_{it}, Dit)$ ----------6.1

In equation 6.1, H_{it} is a health outcome indicator of the country i at time t. HEP_{it} is per capita health expenditure in the country i at time t. This is measured as total health expenditure per capita. Further, in the analysis, we disaggregate total health expenditure into public and private health expenditures to understand the different effects of public and private health expenditures on health outcomes. X_{it} and D_{it} are vectors of socio-demographic variables and health care utilisation. These socio-demographic factors include per capita income, proper sanitation, education,

population age structure and access to clean water. Other variables in the study include the prevalence of diseases and the rate of immunisation as a proxy for preventive health care use. From equation 6.1, we specify equations 6.2 to 6.4 for the purposes of estimation. Equation 6.2 uses total health expenditure as the measure of health investment. Further disaggregating into public and private health expenditures, equation 6.2 is re-stated in equation 6.3. Finally, the study tests the interaction between public and private health expenditures in equation 6.4.

$$\ln h_{it} = \alpha_0 + \alpha_1 \ln HEP_{it} + \alpha_2 \ln x_{it} + \alpha_3 d + u_{it} \quad \text{---------- (6.2)}$$

$$\ln h_{it} = \beta_0 + \beta_1 \ln prm_{it} + \beta_2 \ln pum_{it} + \beta_3 \ln x_{it} + \beta_3 d + u_{it} \quad \text{---------- (6.3)}$$

$$\ln h_{it} = \delta_0 + \delta_1 \ln(pr * pu)m_{it} + \delta_2 \ln x_{it} + \delta_3 d + u_{it} \quad \text{---------- (6.4)}$$

In the equations 6.1 to 6.4, "ln" represents the natural logarithm of the variable. We proxy health outcomes (h_{it}) with Infant (IMR) and Under-five Mortality rates (UMR), and Life Expectancy at Birth (LEB). α, β and δ are the coefficients of the explanatory variables. These represent the effect of a one unit/percent change in the respective variable on health outcomes, holding other variables constant. β_o, α_o, and δ_o are the intercept terms in equations 6.2 to 6.4 and u_{it} is the error term which is assumed to be independent and identically distributed. In equation 6.3, prm_{it} and pum_{it} represent private and public health expenditure respectively. Equation 6.4 tests the interaction $(pr*pu)m_{it}$ between public and private health expenditures in SSA. The coefficient measures the extent of the complementary relationship between public and private health expenditure in influencing health outcomes in SSA.

4.3.2 Effect of Health Outcomes on Economic Growth

In investigating the effect of health outcomes on economic growth, the study postulates a functional relationship that links health outcomes and economic growth as expressed in equation 7.1:

$Y_{it} = f(K_{it}, L_{it}, S_{it}, H_{it})$ ---------- 7.1

Equation 7.1 expresses the output (Y) of goods and services in the country i at time t as a function of physical capital (K_{it}), labour (L_{it}) and human capital, which is captured using two variables; education (S_{it}) and health outcomes (H_{it}). The econometric estimation of the effect of health outcomes on economic growth in this study is based on Barro's (1996) model of growth. Barro (1996) derived a theoretical framework for studying the relationship between health outcomes and economic growth by extending the neoclassical growth model to incorporate health capital as a component of the production process. Barro (1996), following the regression approach, proposed that the output of goods (Y) depends on physical capital (K), labour hours (L) and two forms of human capital, worker schooling and education (S) and the state of worker health (H).

Assuming the Cobb-Douglas form for simplicity and ease of estimation, the model was formulated as;

$$Y = A \cdot K^{\delta} S^{\lambda} H^{\gamma} (Le^{xt})^{1-\delta-\lambda-\gamma} \quad \text{---------- 7.2}$$

$\delta > 0$, $\lambda > 0$, $\gamma > 0$, and $0 < \delta + \lambda + \gamma < 1$.

Equation 7.2 is the growth model with health outcomes (H) and education (S). A is the exogenous baseline level of technology, and x is the exogenous rate of labour-augmenting technological progress. Equation 7.2 is further converted into per capita

terms by dividing through by Le^{xt}, labour and the labour augmenting technological progress. This results in equation 7.3:

$$y = A \cdot k^{\delta} s^{\lambda} h^{\gamma} \quad \text{---------- 7.3}$$

In equation 7.3, the variables y, k, s, and h are quantities of output, physical capital, education, and health outcomes per unit of effective labour.

Barro (1996) assumes that a household maximises utility by dividing output (y) between consumption goods and investment in the three kinds of capital: physical capital, education and health capital. An increase in output (y) increases health capital (h) because it increases the ability to invest in health care. At the same time, better health outcomes can increase output both directly and indirectly. An improvement in the health of workers (h) directly raises output for any given level of physical capital (k) and education (s). In addition, an improvement in health indirectly increases output because it ensures a longer life with less working time lost to illness and raises the rate of return on past investments in human capital. Thus, it reduces the depreciation rate of both forms of human capital. Consequently, better health increases the incentive for further investments in both education and health. These indirect effects suggest that the economic gains from improving health outcomes can be high. Secondly, if the rate of return on investment in human capital increase as the economy grows, the ratios of education and health to physical capital and output should also increase, thus, education and health become important as income rises.

The model for econometric estimation is specified by taking the natural log of equation 7.3 expressed in equation 7.4 as:

$$\ln y_{it} = \ln A + \delta \ln k_{it} + \lambda \ln s_{it} + \gamma \ln h_{it} + \varepsilon_{it} \quad \text{---------- 7.4}$$

In equation 7.4, h_{it} represents health outcomes, using life expectancy at birth (LEB), and infant (IMR) and under-five (UMR) mortality rates as proxies. ε_{it} is a random disturbance error term which is independent and identically distributed (i.i.d). δ, λ, and γ are the coefficients of the explanatory variables. Barro's (1996) model assumes that labour input (L) in equation 7.4 corresponds to total population, so that variation in the ratio of workers to the population is not considered.

In a more realistic model, improvement in health that increases life expectancy and/or reduces mortality rates will also increase the proportion of the population that are not working and the proportion of children, which may reduce, rather than increase output when expressed in per capita terms. To measure this effect, another variable was introduced into the model to represent the Age Dependency Ratio (ADR), that is, the ratio of the non-working population to the working population. The non-working population consists of those who are not able to work and it is made up of the younger ones under the working age and those above 65 years. Additionally, it has been suggested in the literature that openness of a country to trade can also have an effect on the growth of the nation through technological improvement. Hence, we proxy LnA in equation 7.4, which cannot be directly observed with the log of openness (lnopen). Openness is defined as the ratio trade to GDP ((Imports + exports)/GDP). The coefficients (δ, λ and γ) in equation 7.4 are replaced with β's in equation 7.5 for ease of reading.

$$\ln y_{it} = \beta_1 \ln k_{it} + \beta_2 \ln s_{it} + \beta_3 \ln h_{it} + \beta_4 \ln Agedep_{it} + \beta_5 \ln open_{it} + \varepsilon_t \text{ -------- (7.5)}$$

In keeping with the theory underlying Barro's (1996) model, equations (7.4) and (7.5) represent long run relationships established over extended periods. According to the

model, estimating long run relationships may be particularly important in determining the economic gains from health outcomes, because the increased rates of return on human capital that drive incentive effects may take the full length of a working life to develop. The growth rate of GDP per capita is used as a measure of economic growth to avoid the effect of country size filtering through the results since we have a sample of countries with different population sizes in the study. Further, in equation 7.6 we replace the dependent variable with the growth rate of GDP per capita, which cannot be logged due to the presence of negative values. We generate the growth rate of per capita GDP (Δy_{it}) as the change in the current year's GDP relative to that of the previous year[10]. Thus, equation 7.5 is restated in equation 7.6 as:

$$\Delta y_{it} = \beta_1 \ln Open_{it} + \beta_2 \ln k_{it} + \beta_3 \ln s_{it} + \beta_4 \ln h_{it} + \beta_5 \ln Agedep_{it} + \varepsilon_{it} \text{ ---------- (7.6)}$$

The empirical specification of the economic growth model is aimed at explaining the effect of health outcomes on economic growth in SSA. Given this aim, the empirical strategy endeavours to make maximum use of both the time and cross-country dimensions of available data, which dictates using data at an annual frequency in the estimation. Using annual data for estimation purposes necessitates making an allowance for the possibility that the annual observations on economic growth may not represent long-run equilibrium values in any given year, because of slow adjustment to changes in other variables. Therefore, to allow for the possibility of partial adjustment, we specify a dynamic semi-log linear equation for economic growth, which includes a lagged dependent variable of economic growth. The empirical model is therefore specified in equation 7.7 by including the lag of the dependent variable in the model.

[10] $(GDP_t - GDP_{t-1})/GDP_{t-1}$

$$\Delta y_{it} = \beta_0 + \beta_1 \Delta y_{it-i} + \beta_1 \ln Open_{it} + \beta_2 \ln k_{it} + \beta_3 \ln s_{it} + \beta_4 \ln h_{it} + \beta_5 \ln Agedep_{it} + \varepsilon_{it} \text{ ------- (7.7)}$$

Equation 7.7 is the final model to be estimated to account for the effect of health outcomes on economic growth in this study.

4.3.3 Health Expenditure, Health Outcomes and Economic Growth

In the analysis of the causal relationship among health expenditure, health outcomes and economic growth, the study employs the technique of the Vector Autoregressive (VAR) model pioneered by Sims (1989). Sims (1989) has demonstrated that Vector Autoregressive (VAR) models are particularly powerful tools for investigating the interrelationships among variables related to time and for obtaining reliable forecasts. The test for causality among health expenditure, health outcomes and economic growth in SSA in this study is performed following the standard three-step procedure in the literature for such analysis.

First, the study tests for the order of integration in the series using panel unit root tests. Since the time span of the individual series is relatively short, the study utilises recently developed panel unit root techniques in order to increase the power of the test. Secondly, having established the order of integration in the series, we carry out heterogeneous panel co-integration tests for the existence of long run relationships among the variables. Finally, we perform dynamic heterogeneous panel causality tests to assess the nature and direction of causality among the variables in the Panel Vector Autoregressive (PVAR) framework either at levels or at first difference.

The PVAR model we estimate in this study is based on the test developed by Love and Ziccino (2006) which can be estimated using the statistical software Stata. This

test uses the Generalised Method of Moments (GMM) estimator in estimating the PVAR model. The GMM method can help reduce the estimation bias often inherent in panel data estimation. It controls for problems often associated with cross-sectional estimators. These include unobserved problems associated with country-specific and time-specific effects, endogeneity in explanatory variables and when lagged dependent variables are used as regressors, which is the case in the PVAR analysis. This is superior to the traditional Ordinary Least Squares (OLS) estimation of the PVAR model.

Vector Autoregressive (VAR) is an econometric model used to capture the linear interdependencies among multiple time series. VAR models generalize the univariate autoregressive (AR) models by allowing for more than one evolving variable. All variables in a VAR model are treated symmetrically in a structural sense (although the estimated quantitative response coefficients may not necessarily be the same). Each variable has an equation explaining its evolution based on its own lags and the lags of the other variables. VAR modelling does not require much knowledge about the forces influencing a variable, as do structural models with simultaneous equations. The only prior knowledge required is a list of variables, which can be hypothesized to affect each other. The Panel Vector Autoregressive (PVAR) methodology combines the traditional VAR approach, which treats all the variables in the system as endogenous and related to time, with the panel-data approach introducing cross-sectional units and allowing for unobserved individual heterogeneity in the data.

For a set of n panel variables, a PVAR model of order p (PVAR (p)) can be specified in equation 8.1 as:

$$y_{it} = b_0 + b_1 y_{it-1} + b_2 y_{it-2} + ... + b_p y_{it-p} + u_{it} \quad \text{----------} \quad 8.1$$

Where the b_i's are (nxn) coefficient matrices and μ_{it} is the random disturbance term. In equation 8.1, y_{it} represents the variables for a cross section unit i at time t, and y_{it-1} to y_{it-p} represents the lags of the variables that are used as the explanatory variables. P is the lag length, which we restrict to one owing to the short time span. We do not expect this to affect the results as we are only interested in determining the nature, and the direction of causality among the variables and the time path of their behaviour, especially in responding to shocks. A specific functional form of equation 8.1 is stated in equations 8.2 to 8.4 as;

$$y1_{it} = b_{10} - b_{12} y2_t + b_{13} y3_{it} + c_{11} y1_{it-1} + c_{12} y2_{it-1} + c_{13} y3_{it-1} + \mu_{1t} \quad \text{----------} \quad 8.2$$

$$y2_{it} = b_{20} - b_{21} y1_{it} + b_{23} y3_{it} + c_{21} y1_{it-1} + c_{22} y2_{it-1} + c_{23} y3_{it-1} + \mu_{2t} \quad \text{----------} \quad 8.3$$

$$y3_{it} = b_{30} - b_{31} y1_{it} + b_{32} y2_{it} + c_{31} y1_{it-1} + c_{32} y2_{it-1} + c_{33} y3_{it-1} + \mu_{3t} \quad \text{----------} \quad 8.4$$

In equations 8.2 to 8.4, $y1_{it}$, $y2_{it}$ and $y3_{it}$ represent health expenditure, health outcomes and economic growth respectively. The b's and c's are the coefficients of the variables. In matrix form, equations 8.2 to 8.4 can be stated as:

$$\begin{bmatrix} 1 & b_{12} & b_{13} \\ b_{21} & 1 & b_{23} \\ b_{31} & b_{32} & 1 \end{bmatrix} \begin{bmatrix} y1_{it} \\ y2_{it} \\ y3_{it} \end{bmatrix} = \begin{bmatrix} b_{10} \\ b_{20} \\ b_{30} \end{bmatrix} + \begin{bmatrix} c_{11} & c_{12} & c_{13} \\ c_{21} & c_{22} & c_{23} \\ c_{31} & c_{32} & c_{33} \end{bmatrix} \begin{bmatrix} y1_{it-1} \\ y2_{it-1} \\ y3_{it-1} \end{bmatrix} + \begin{bmatrix} \mu_{1t} \\ \mu_{2t} \\ \mu_{3t} \end{bmatrix} \quad \text{----------} \quad 8.5$$

Equation 8.5 can be expressed in a simple vector form in equation 8.6 as the structural or the primitive system for the relationship.

$$BY_{it} = \Gamma_0 + \Gamma_1 Y_{it-1} + \mu_{it} \quad \text{----------} \quad 8.6$$

B in equation 8.6 refers to the coefficients of the dependent variables, Γ_o and Γ_1 refers to the constant terms and the coefficients of the lagged variables respectively. In order to estimate this system, it is necessary to normalize the left hand side vector by multiplying through the equations by the inverse of the coefficients of the dependent variables (B) to ensure that the variables on the left hand side are truly exogenous and thus can be estimated. This is represented in equation 8.7 as:

$$B^{-1}BY_{it} = B^{-1}\Gamma_0 + B^{-1}\Gamma_1 Y_{it-1} + B^{-1}\mu_{it} \quad \text{---------- 8.7}$$

Equation 8.7 results in equation 8.8, which is the PVAR model in standard form for estimation. This transformation ensures that the variables are only explained by their own lags and the lags of the other variables in the system.

$$Y_{it} = B_0 + B_1 Y_{it-1} + \mu_{it} \quad \text{---------- 8.8}$$

Expanding equation 8.8 results in equations 8.9 to 8.11. The constant terms in equations 8.8 to 8.11 have been suppressed. In addition, the variables of interest, health expenditure per capita (HEP), Health outcomes (LEB) and Gross Domestic Product per capita (GDP), have been incorporated into equations 8.9 to 8.11. The suppression of the constant terms will not have any significant effect on the estimated results of the model.

$$GDP_{it} = \beta_i^{GDP} GDP_{it-1} + \lambda_i^{GDP} HEP_{it-1} + \pi_i^{GDP} LEB_{it-1} + \mu_{it} \quad \text{---------- 8.9}$$

$$HEP_{it} = \beta_i^{HEP} GDP_{it-1} + \lambda_i^{HEP} HEP_{it-1} + \pi_i^{HEP} LEB_{it-1} + \mu_{it} \quad \text{---------- 8.10}$$

$$HEA_{it} = \beta_i^{HEA} GDP_{it-1} + \lambda_i^{HEA} HEP_{it-1} + \pi_i^{HEA} LEB_{it-1} + \mu_{it} \quad \text{---------- 8.11}$$

In equations 8.9 to 8.11 we use GDP per capita due to the likelihood of taking first differences in the event that the data is not stationary. This may pose a problem if we use GDP growth rate. The lagged dependent variables in the equations are correlated with the error terms, including the fixed effects, hence, OLS estimates will be biased.

Thus, the Generalised Method of Moments estimator (GMM) is applied. We identify the sources of causation by testing the significance of the coefficients β, λ and π in the estimated models.

4.4 Empirical Methodology

4.4.1 Health Expenditure and Health outcomes

The study analyses the effect of health expenditure on health outcomes using the traditional panel data models of the pooled least squares, random effects and the fixed effects. The pooled least squares model is specified in equation 9.1 as;

$$y_{it} = \alpha_{it} + X_{it}\beta + \varepsilon_{it}, \qquad \text{i=1... N; t =1... T} \quad \text{---------- (9.1)}$$

Assume: $\varepsilon_{it} \sim iid(0, \sigma_{\varepsilon}^2)$ and $\sigma_i^2 = \sigma_t^2 = \sigma^2$

In equation 9.1, y_{it} is the dependent variable while X_{it} represents the explanatory variables. β represents the coefficients of the explanatory variables. The Pooled least squares model assumes that the sample does not have significant country and time effects. This kind of panel data model is open to criticism, especially if the assumption of significant time and country effects breaks own. It is, however, necessary to estimate the pooled model and perform statistical tests to confirm.

The Fixed Effect (FE) model assumes the existence of significant cross-sectional difference that do not change with time. It also assumes the possibility of correlation among some of the variables and the error terms in the model. In the FE model, the unobserved heterogeneity can bias the estimates from the model if this is not controlled. These time-invariant characteristics (heterogeneity) are, however, assumed to be unique to each cross-sectional unit and not correlated among the cross sections. This is the rationale behind the assumption of the correlation between the entity's

error term and the predictor variables. FE removes the time-invariant characteristics by taking deviations of the model from the mean, so that the net effect of the predictors on the outcome variable can be assessed. The fixed effects model is specified in equation 9.2. The term α_i is also called an unobserved effect or individual/country effect.

$$y_{it} = \alpha_i + X_{it}\beta + \varepsilon_{it}, \qquad i=1,\ldots,N \; ; \; t=1,\ldots\ldots T \qquad \text{---------- (9.2)}$$

$$E(\varepsilon_{it}) = 0 \; Var(\varepsilon_{it}) = \sigma_{\varepsilon}^2$$

The fixed effects model is estimated using the Ordinary Least Squares (OLS) estimator.

Finally, the random effects model assumes that the errors are uncorrelated with the explanatory variables. Thus, the random effects model assumes that the variations across the cross sections are uncorrelated with the predictor or independent variables in the model. As noted by Greene (2012), "the crucial distinction between fixed and random effects is whether the unobserved individual effect embodies elements that are correlated with the regressors in the model, not whether these effects are stochastic or not". The random effects model is specified in equation 9.3 as:

$$y_{it} = X_{it}\beta + v_{it} \; ; \; \upsilon_{it} = \alpha_i + \mu_{it} \qquad \text{----------} \qquad (9.3)$$

The random effects model is estimated using the Generalised Least Squares (GLS) estimator due to the nature of the error term (Johnston and DiNardo, 2000).

Post estimation tests

The study conducts three tests to choose the most appropriate model for discussion. The first test is the Chow (1960) test, which tests the presence of fixed effects in the model. The second test is the Breusch and Pagan (1980) Lagange Multiplier test

(LM) for the presence of random effects. We conduct the Hausman (1978) test to choose between the fixed effects and the random effects models. Lastly, we test for Heteroskedasticity using the Whites's (1980) test.

i. Chow (1960) test

The first test we conduct for model specification is the Chow (1960) test for the presence of fixed effects. The Chow (1960) test provides a test of the pooled (restricted) model versus the fixed effects (unrestricted) model. This test is simply a joint test of whether the fixed effects are significant. This test is carried out after the estimation of both the pooled model and the fixed effects model. The test statistic for the Chow test, with the null and alternate hypothesis are as stated:

$$CHOW = \frac{(RRSS - URSS)/(N-1)}{URSS/(NT-N-K)} \approx F_{(N-1),(NT-N-K)}$$

H_o: the pooled (restricted) model is correct

H_1: The FE (unrestricted) model is correct

The Chow (1960) test is an F test with (N-1), (NT-N-K) degrees of freedom. RRSS refers to the Restricted Residual Sum of Squares, which is derived from the Pooled model. The URSS is the Unrestricted Residual Sum of Squares, which is calculated from the fixed effects model. The null hypothesis (H_o) states that the pooled model is appropriate. The alternate hypothesis, on the other hand, implies that the fixed effects model is appropriate. Thus, a rejection of the null hypothesis indicates the presence of fixed effects.

ii. Breusch and Pagan (1980) Lagrange Multiplier

The Breusch and Pagan (1980) Lagrange Multiplier (LM) test is conducted to test for the presence of random effects in the model. This tests the null hypothesis that there

are no individual effects, hence OLS is applicable. Thus, the variance of the individual effects is equal to zero, in which case the pooled model is more appropriate. “Rho,” the heterogeneity coefficient also known as the intra-class correlation coefficient, can be obtained after the estimates and used for this test. If “Rho” is significant, it implies the random effects model is more appropriate than the pooled model.

$$rho = \frac{(sigma\_u)^2}{(sigma\_u)^2 + (sigma\_e)^2}$$

Where: sigma_u = standard deviation of residuals within groups.
sigma_e = standard deviation of residuals (overall error term)

Ho: Pooled model is more appropriate

H1: Random effects model is more appropriate

The null hypothesis states that the pooled model is more appropriate; whereas the alternate hypothesis states that the random effects model is more appropriate. If the test is significant, we reject the null and conclude that the random effects model is more appropriate, suggesting the presence of significant heterogeneity effect.

iii. Hausman (1978) test

The Hausman’s (1978) test is applied to test for the presence of fixed or random effects. In the presence of correlation between the individual effects and the regressors, the GLS estimates are inconsistent, while the OLS fixed effects results are consistent. If there is no correlation between the individual effects and the regressors, both estimators are consistent, but the fixed effects estimator is inefficient. Under the null hypothesis of no correlation, there should be no difference between the

estimators. To carry out the test, there is the need to first estimate the coefficients from the regressions and their covariance. This can be obtained directly after running the regression for the fixed effects and random effect models using the Ordinary Least Squares (OLS) and the Generalised Least Squares (GLS) estimators respectively.

$$H = \left(\hat{\beta}_{RE} - \hat{\beta}_{W}\right)' \left[\hat{V}(\hat{\beta}_{W}) - \hat{V}(\hat{\beta}_{RE})\right]^{-1} \left(\hat{\beta}_{RE} - \hat{\beta}_{W}\right)$$

H_0: $\hat{\beta}_{RE} - \hat{\beta}_{W} = 0$: the correct model is a random effects model

H_1: $\hat{\beta}_{RE} - \hat{\beta}_{W} \neq 0$: the correct model is a fixed effects model

The β's are the estimates of the coefficients from the regression equations. The null hypothesis (H_o) suggests that the random effects model is appropriate suggesting that the errors are not correlated with the explanatory variables. This is tested against the alternate hypothesis (H_1) that the random effects model is not appropriate, suggesting that the errors are correlated with the explanatory variables. The Hausman test is performed after running both the fixed and random effects models.

iv. White (1980) test for Heteroskedaticity

The final test we conduct in this analysis is the test for heteroscedasticity using the Whites (1980) test. For OLS estimation results to be efficient and unbiased, the variance of the error terms of all the dependent variables must be constant (i.e. homoscedastic). However, due to the presence of outliers in the data, incorrect data transformation, incorrect functional forms, improvement in data collection technique, the omission of important variables, skewness in the distribution of one or more regressors included in the model and incorrect model specification, the variance of the error terms of the dependent variables are not always constant (Gujarati, 2003). In such situations, there is the problem of heteroscedasticity. Although it is a problem,

which is usually associated with cross-sectional data, it is sometimes present in panel data. When heteroscedasticity is present, even though OLS parameter estimates are still unbiased and consistent they are inefficient (i.e. they have larger than minimum variances).

The presence of heteroscedasticity makes the estimated variances of the regression parameters biased (they will no longer have minimum variance), thereby resulting in incorrect statistical tests for the parameters and biased confidence intervals (t and F tests based on them will be misleading). Thus, we conduct a test for the presence of heteroscedasticity in the OLS estimates using the General Heteroskedasticity Test proposed by White (1980). The White test is a statistical test that establishes whether the residual variance of a variable in a regression model is constant or not. This test is easy to implement and does not rely on the normality assumption of the variables, which is a limitation in the other tests of heteroscedasticity. We compute robust standard errors in the presence of heteroscedasticity for testing our hypothesis.

4.4.2 Health Outcomes and Economic Growth

The dynamic panel model specified in equation 7.7 is characterised by autocorrelation due to the presence of the lagged dependent variable among the explanatory variables and individual effects characterising the heterogeneity among the countries according to Baltagi (2008). These characteristics render the OLS estimator biased and inconsistent while the fixed effect estimates are biased (Baltagi, 2008). Because of this correlation, the dynamic panel data estimation of equations 7.7 suffers from the Nickell (1981) bias. The Nickell (1981) bias arises when the lagged dependent variable is included in the fixed effects model. This tends to correlate with the error

term. The Nickell bias disappears only if the period (t) tends to infinity. This may not always be so in panel data given the difficulty in acquiring long series for panel studies. In the presence of the Nickell bias, the preferred estimator is the Generalised Method of Moments (GMM) suggested by Arellano and Bond (1991), which differences the model to get rid of country-specific effects or time-invariant effects in the model. This also eliminates any endogeneity that may be due to the country specific effects or any time-invariant effects and the regressors. This also has the advantage of ensuring that all the regressors are stationary by the differencing.

The Arellano and Bond (1991) estimator is considered to be more efficient compared to other estimators. Arellano and Bond (1991) used a Generalised Method of Moments (GMM) and argued that additional instruments can be obtained in a dynamic panel data model if the orthogonality conditions that exist between lagged values of y_{it} and the disturbances, v_{it} are utilised[11]. The Arellano and Bond (1991) estimator is designed for short panel series (short time) and larger cross sectional units. In addition, it is suitable for a linear functional relationship with a single left-hand-side variable that is dynamic, depending on its own past realizations and independent variables that are not strictly exogenous, meaning correlated with past and possibly current realizations of the error. The model has fixed individual effects, heteroscedasticity and autocorrelation within cross sectional units but not across them.

In the analysis of health outcomes and economic growth, we employ the Arellano and Bond's Generalised Method of Moments (GMM) estimator. Further, following Arellano and Bond, two diagnostics are computed using the Arellano and Bond GMM

[11] See Baltagi (2008), chapter 8 and Arellano and Bond (1991) for detailed illustration of the Arellano and Bond estimator

procedure to test for first and second order serial correlation in the disturbances. A special feature of dynamic panel data GMM estimation is that the number of moment conditions increases with time (t). It is, therefore, important to check the validity of instruments in panel data estimates. We perform this using the Sargan (1958) and Hansen (1982) test for the validity of over-identification restrictions. There is convincing evidence that too many moment conditions introduce bias while increasing efficiency. Baltagi (2008) has suggested that a subset of the moment conditions be used to take advantage of the trade-off between the reduction in bias and the loss in efficiency in empirical analysis. Thus, we perform the Hansen (1958) and Sargan (1982) tests of over-identifying restrictions to test for instrument validity in the model.

4.4.3 Health Expenditure, Health Outcomes and Economic Growth

i. Heterogeneous Panel Unit Root Test

Panel unit root tests are traditionally used to test for the order of integration (stationarity) in the variables of the data set. It has become well known that the traditional Augmented Dickey-Fuller (ADF) tests of unit root suffer from the problem of low power in rejecting the null of stationarity of the series, especially for short-spanned data. Recent literature suggests that panel-based unit root tests have higher power than unit root tests based on individual time series. A number of such tests have appeared in the literature. Recent developments in the panel unit root tests include: Levin, Lin and Chu (LLC, 2002), Im, Pesaran and Shin (IPS, 2003), Maddala and Choi (2001), and Hadri (2000).

Among the different panel unit root tests developed in the literature, LLC and IPS are the most popular. Both tests are based on the ADF principle. However, LLC assumes homogeneity in the dynamics of the autoregressive coefficients for all panel members. In contrast, the IPS is more general in the sense that it allows for heterogeneity in these dynamics. Therefore, it is described as a "Heterogeneous Panel Unit Root Test." It is particularly reasonable to allow for such heterogeneity in choosing the lag length in ADF tests when imposing uniform lag length is not appropriate. In addition, slope heterogeneity is more reasonable in the case where the study uses cross-country data. In this case, heterogeneity arises because of differences in economic conditions and degree of development in each country. As a result, the test developers have shown that this test has higher power than other tests in its class. Thus, we conduct the unit root test in this study using the IPS unit root test.

The IPS unit root test begins with a separate Augmented Dickey-Fuller (ADF) regression for each cross section (country) specified in equation 10.1 as:

$$\Delta y_{it} = \alpha_i + \beta_i y_{it-1} + \sum_{j=1}^{p_i} \rho_{ij} \Delta y_{it-j} + \varepsilon_{it} \qquad (10.1)$$

In equation 10.1, y_{it} is the series of country i over period t, pi is the number of lags in the ADF regression and the error terms ε_{it} are assumed to be independent and normally distributed random variables for all i's and t's with zero means and finite heterogeneous variances. Δ refers to the change between two periods in the variable. In equation 10.1, βi and the lag order ρ are allowed to vary across the cross sections (countries). Hence, the null hypothesis to be tested is:

$$H_0: \beta_i = 0, \ \forall i$$ ----------(10.2)

$$H_1: \begin{cases} \beta_i = 0 \\ \beta_i \prec 0 \end{cases}$$ For some i's.
for at least one i. ---------- (10.3)

The null hypothesis stated in 10.2 implies that the series are non-stationary and thus needs to be differenced before using in any analysis. The alternative hypothesis, stated in 10.3, on the other hand, implies that some or all of the individual series are stationary. IPS developed two test statistics, the LM-bar and the t-bar tests, for testing the stationarity of the series. The t-bar statistics are calculated using the average t-statistics for β from the separate ADF regressions using equation 10.4:

$$\tilde{t}-bar_{NT} = \frac{\sum_{i=1}^{N} t_{i,T}(p_i)}{N} \quad \text{----------(10.4)}$$

Using Monte Carlo simulations, IPS shows that the t-bar test statistics are normally distributed under the null hypothesis and it outperforms LM-bar in small samples. Further, IPS used estimates of the means and variances of the variables to convert t-bar into a standard normal 'z-bar' statistic so that conventional critical values can be used to evaluate the significance of the variables.

The z-bar test statistic is defined in equation 10.5 as:

$$z_{\tilde{t}-bar} = \frac{\sqrt{N}\,(\tilde{t}-bar_{NT} - E[\tilde{t}_T \mid \rho_i = 0])}{\sqrt{\text{var}[\tilde{t}-bar_{NT} \mid \rho_i = 0]}} \rightarrow N(0,1) \qquad (10.5)$$

Where $\tilde{t}$ in equation 10.5 is the average t statistics developed by IPS (2003) with its expectations and variance specified in equations 10.6 and 10.7 as

$$E[\tilde{t}_T \mid \rho_i = 0] \quad \text{---------- 10.6}$$

$$\text{var}[\tilde{t}-bar_{NT} \mid \rho_i = 0] \quad \text{---------- (10.7)}$$

IPS (2003) provide exact critical values of the t-bar (NT) statistic for some N, T ranges and for the 1, 5 and10 percent confidence levels for the standard z tests.

ii. Heterogeneous Panel Co-integration

The second test after the unit root test is the test for co-integration among the series. Co-integration implies the existence of a long-run relationship among economic variables despite short-term disturbances (Granger, 1980). The principle of testing for co-integration is to test whether two or more integrated variables have a common relationship in the long run, despite their short run deviations from equilibrium. This means that if two or more series are co-integrated they may wander arbitrarily far away from each other in the short run, but return to equilibrium in the long run. Earlier tests of co-integration includes the simple two-step test by Engle and Granger (1987) and the Engle and Yoo (1987) 3-step procedure. One identified problem with these tests is their inability to deal with cases that involve more than one co-integrating relationship. Recognizing the shortcomings of traditional procedures, we utilise the Westerlund (2007) test that uses four test statistics to test for the presence of co-integration. This has been chosen over the Pedroni test for co-integration due to the flexibility in using Westerlund (2007), thus allowing for heterogeneity both in the cross sections and the panel as a whole.

The four statistics of Westerlund (2007) tests are based on the estimated residuals from the following long run model:

$$y_{it} = \alpha_i + \sum_{j=1}^{m} \beta_{ji} x_{jit} + \varepsilon_{it} \quad \text{---------- (10.8)}$$

$$\varepsilon_{it} = \rho_i \varepsilon_{i(t-1)} + w_{it} \quad \text{---------- (10.9)}$$

The null hypothesis tested is whether ρ_i unity is. The four statistics are normally distributed. The statistics can be compared to appropriate critical values and if critical values are exceeded, then the null hypothesis of no-co-integration is rejected implying

that a long run relationship between the variables does exist. Westerlund has four test statistics, G_a, G_t, P_a and P_t. The Ga and Gt test statistics test the hypothesis:

H_0: $a_i = 0$ for all cross sectional units (i)

H_1: $a_i < 0$ for at least one cross sectional unit (i).

These statistics start from a weighted average of the individually estimated a_i's and their t-ratio's respectively. Rejection of H_o is evidence of co-integration of at least one of the cross-sectional units (i).

The Pa and Pt test statistics, on the other hand, pool information over all the cross-sectional units to test

H_0: $a_i = 0$ for all cross sectional units (i)

H_1: $a_i < 0$ for all cross sectional units (i).

Rejection of H_0 is evidence of co-integration for the panel as a whole. The tests are very flexible and allow for an almost completely heterogeneous specification of both the long and short run parts of the error correction model. The series are allowed to be of unequal length. If the cross sectional units are suspected to be correlated, robust critical values can be obtained through bootstrapping. Westerlund (2007) co-integration tests the existence of long run relationships. The tests indicate the presence or absence of long run relationship among the variables, but do not indicate the direction of causality. Hence, once co-integration among the variables has been confirmed, we test for causality using the Panel Vector Autoregressive (PVAR) model

iii. Panel Vector Autoregressive (PVAR) Model

The literature suggests that when the variables are difference stationary and co-integrated, it is more appropriate to estimate the model using the differenced series

rather than the level variables. Thus, equations 8.9 to 8.11 are restated in equations 8.12 to 8.14 using the first differences of the variables. These equations will be estimated jointly using the System Generalised method of Moments estimator, specifically with the estimator developed by Love and Ziccino (2006) executable in Stata.

$$\Delta GDP_{it} = \beta_i^{GDP}\Delta GDP_{it-1} + \lambda_i^{GDP}\Delta M_{it-1} + \pi_i^{GDP}\Delta H_{it-1} + \mu_{it} \text{ ---------- (8.12)}$$

$$\Delta HEP_{it} = \beta_i^{HEP}\Delta GDP_{it-1} + \lambda_i^{HEP}\Delta M_{it-1} + \pi_i^{HEP}\Delta H_{it-1} + \mu_{it} \text{ ---------- (8.13)}$$

$$\Delta HEA_{it} = \beta_i^{HEA}\Delta GDP_{it-1} + \lambda_i^{HEA}\Delta M_{it-1} + \pi_i^{HEA}\Delta H_{it-1} + \mu_{it} \text{ ---------- (8.14)}$$

Further, we compute the impulse response and variance decompositions from the PVAR model. The impulse response functions can be used to produce the time path of the variables in the model, to shocks from all the other variables. If the system of equations is stable, any shock to the variables should decline to zero with time, an unstable system will, however, produce an explosive time path. Thus, the value is traced until the value of the variable either becomes zero (stable) or very large (unstable).

The Variance decomposition on the other hand, examines how much of the forecast error variance, for any of the variables in the system, is explained by innovations in the variable itself and any other variables in the entire system over a series of time horizons. Usually own series shocks explain most of the error variance, despite the shock from the other variables. It tells how much of a change in a variable is due to its own shocks and to shocks from other variables. In the short run most of the variation is due to own shock, but as the lagged variable's effect kicks in, the percentage of the effect of other shocks increases over time.

4.5 Data and Variable Description

The study uses a panel data set of 40 SSA countries[12] from 1995 to 2011 from the World Bank's World Development Indicators (2012). This period is chosen due to the availability of data on health expenditure in the World Bank's World Development Indicators (WDI) for SSA for periods 1995-2011. For periods before 1995 and after 2011, we do not have access to data. The dependent variables are Life Expectancy at Birth (LEB), Infant (IMR) and Under-five (UMR) mortality rates for the health outcomes function. Then the growth rate of GDP per capita is used as the proxy for economic growth. Finally, in estimating the interrelationships among the variables, health expenditure per capita, health outcomes (LEB) and GDP per capita are used. A summary of the variables and the a priori expectation are presented in Table 6.

In the health outcome equation, the explanatory variables are per capita health expenditure. This is further decomposed into public and private health expenditure. Other variables include per capita GDP as a proxy for income, measles and DPT immunisation rates to account for the use of preventive health care services, the availability of clean water for drinking and proper sanitation to account for the effect of the environment on the health of the person, and the rate of urbanisation and population structure is used to control for the pressure on health care services and the demographic structure of the nation. Similarly, in the economic growth equation, Gross capital formation is used as a proxy for physical capital; Gross primary school

[12] Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central Africa Republic, Chad, Comoros, DR. Congo, Cote d'Ivoire, Equatorial Guinea, Eritrea, Ethiopia, Gabon, The Gambia, Ghana, Guinea, Guinea Bissau, Kenya, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, South Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia.

enrolment rate is used as a proxy for education. Openness captured by the ratio of trade to GDP is used to measure the rate of technological diffusion in the economy as suggested in the literature.

Life Expectancy at birth refers to the number of years a newborn infant is expected to live given that prevailing patterns of mortality at the time of birth were to stay the same throughout the individual's lifetime. It is a measure of how long an individual is expected to live if the mortality conditions at the time of birth of the person remain the same over the life cycle of the individual. It has been agreed in the literature to be a good measure of health outcomes. Life expectancy is the most commonly used measure to describe population health and reflects the overall mortality level of a population. Life expectancy measures how long, on average, a person is expected to live based on current age and sex-specific death rates. The most commonly used measure of life expectancy is Life expectancy at birth (LEB) which measures life expectancy at age zero.

Infant Mortality Rate (IMR) refers to the probability of dying before age one, per 1000 live births. It is measured as the number of infant deaths per 1000 live births per year. In other words, Infant mortality is the death of a child less than one year of age. It is measured as the number of deaths of children under one year of age per 1000 live births. The leading causes of infant mortality, as have been identified in the literature, are birth asphyxia, pneumonia, pre-term birth complications, diarrhoea, malaria, measles and malnutrition. Many factors contribute to infant mortality such as the mother's level of education, environmental conditions, and political and medical infrastructure. Improving sanitation, access to clean drinking water,

immunisation against infectious diseases, and other public health measures such as improved health care during delivery have been agreed as effective means of curbing the infant mortality rate.

Under-five Mortality Rate (UMR) measures the probability of dying between age one and age five per annum. Thus, it is the probability of dying between age one and exactly five years of age expressed per 1,000 live births. It is a measure of the effectiveness of health care systems. According to the WHO Global Health Observatory data (GHO, 2014), the risk of a child dying before completing five years of age is still highest in the WHO African Region (90 per 1000 live births), about 7 times higher than that in the WHO European Region (12 per 1000 live births). Further, it is noted that many countries still have very high under-five mortality – particularly those in WHO Africa Region, home to 11 of the 12 countries with an under-five mortality rate above 100 deaths per 1000 live births.

Health expenditure is a sum total of private and public health expenditure. This is used as an investment in population health outcomes. Public health expenditure consists of recurrent and capital spending from government (central and local) budgets, external borrowings and grants (including donations from international agencies and nongovernmental organizations); and social (or compulsory) health insurance fund (World Bank, 2012). It is measured as a percentage of GDP. It is an indicator of the volume of public resources that are channelled into health in the form of infrastructural development, payment of health workers' salaries, training health professionals, provision of essential drugs, and medical research among others. Private health expenditure on the other hand includes direct household (out-of-pocket)

spending, private insurance, charitable donations and direct service payments by private corporations (World Bank, 2012). It measures the amount of resources from the households and firms that go into health. The study postulates that, health expenditure, should have a significant effect on health outcomes.

GDP per capita, which is used as a proxy for income, is expected to improve health outcomes in the region. It is expected that, people with higher incomes eat well, live a healthy lifestyle and are able to afford basic health care services in the event of illness. There exists empirical evidence, which suggests that the population's health status improves as a nation's per capita incomes rises. Gupta et al. (1999) argue that a rise in per capita income results in improvement in the health status of the population. This is because a rise in income per capita increases the ability of governments, households and firms to supply more and better health care facilities and to improve access to health care through better infrastructure. Again, higher incomes have the tendency to lead to improved public health infrastructure such as improved water and sanitation, better nutrition, better housing and the ability to pay for health care[13].

Environmental factors such as air and water quality and sanitation among others, have an equally important impact on health outcomes. Environmental cleanliness reduces the outbreak and spread of communicable diseases, thereby reducing mortality. During the outbreak of communicable diseases, children and pregnant/lactating mothers are the most vulnerable. Hence improving environmental conditions, is expected to improve health outcomes. This study uses the percentage of the population with access to improved sanitation and clean water as proxies for

[13] Cutler et al., 2006; Anyanwu and Erhijakpor, 2007

environmental cleanliness. The proportion of the population with access to an improved water source refers to the percentage of the population using an improved drinking water source. The improved drinking water source, includes piped water on premises (piped household water connection located inside the user's dwelling, plot or yard), and other improved drinking water sources (public taps or standpipes, tube wells or boreholes, protected dug wells and protected springs).

The proportion of the population with access to improved sanitation facilities refers to the percentage of the population using improved sanitation facilities. Basic sanitation is defined as having access to excreta disposal facilities, such as a sewer or a septic tank, a pour-flush latrine, a simple pit latrine or a ventilated improved latrine. "Improved sanitation" facilities include flush toilets or pit latrines, if they are not shared between households and provide privacy. Water and sanitation are important in generating health outcomes as poor sanitation and water facilities contribute to poor health. The MDG goal 7 aims to halve the proportion of people living without access to an improved source of drinking water and basic sanitation by 2015. It is expected that a significant increase in the population with access to improved sanitation and clean water should lead to a significant improvement in health outcomes in SSA.

One factor that is suspected to have contributed to the poor health outcomes in most regions, especially the developing nations is the prevalence of diseases. These are suspected to cause a significant number of deaths, hence contributing to the high mortality rates. Malaria and HIV/AIDS, even though have received significant attention, still pose a problem for most of the countries in the region, hence worsening health outcomes. Indeed, it is one of the aims of the MDGs (goal 5) to reduce the

prevalence of diseases. Thus, in this study, it is expected that higher disease prevalence rates will lead to poorer health outcomes, thus reducing life expectancy at birth and increasing infant and under-five mortality rates. These two diseases are used in the study to proxy the prevalence of diseases in SSA.

Gross primary school enrolment rate is used in this study as a proxy for education. This is chosen due to the general attention it has received in the advent of the MDG's and in the era of the free Compulsory Universal Basic Education (fCUBE) programs that were implemented by most developing nations. The MDG goal 3 seeks to increase the proportion of children who receive basic education. This makes this variable a good proxy for education since it can easily be measured and there are readily data available to measure progress. Indeed, it is expected that an educated population will make informed decisions, which will lead to improvement in health outcomes in accordance with the Grossman's (1972) health capital model. In addition, studies have postulated that education, as a component of human capital leads to significant improvement in economic growth. This is because education enhances labour productivity by making labour more efficient in the use of resources. The justification for using primary education is based on the social rate of return. Studies have reported that the social rate of return is higher for primary education, followed by secondary and tertiary education (Psacharopoulos, 1994; World Bank, 1995).

Gross capital formation is used in the study as the proxy for physical capital. Gross capital formation, according to the World Bank (2012) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements (fences, ditches, drains, and so

on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Inventories are stock of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and "work in progress." We expect the gross physical capital formation to have a positive effect on economic growth in SSA.

The Openness Index is an economic metric calculated as the ratio of a country's total trade, the sum of exports and imports, to the country's gross domestic product. The interpretation of the Openness Index is the higher the index the larger the influence of trade on domestic activities. The literature postulates that Openness has a positive effect on economic growth through its influence on the diffusion of technology into the domestic economy. Thus, in this study, we postulate that openness of SSA countries should have a positive effect on economic growth in the region.

Table 6: Definition of variables

Variable	Variable description	Expected sign
Per Capita health expenditure (M)	Per capita health expenditure (M) is used to measure the level of investment in health outcomes.	Positive (+)
Gross Domestic Product per capita (GDP)	Per capita Gross Domestic Product (GDP) is used as a measure of income. It is expected to improve the person's health outcomes.	Positive (+)
Clean water (WAT)	The Proportion of the population with access to clean water. This is expected to improve health outcomes.	Positive (+)
Proper sanitation:	The Proportion of the population with access to proper sanitation, such as toilet facilities, etc. This is expected to improve health outcomes.	(+)
Preventive Health care	Immunisation against measles (MEA) and DPT. This is expected to improve health outcomes.	(+)
Disease prevalence	- Prevalence of HIV/AIDS and Malaria (MAL) are used to measure the percentage number of people who are suffering from HIV/AIDS or malaria.	Negative (-)
Rate of urbanisation (URB)	This is the number of people in the urban areas as a percentage of total population to measure the pressure on health facilities.	Uncertain
Education (EDU)	The gross primary school enrolment rate is used to measure the effect of education on health outcomes and on economic growth.	Positive (+)
Age structure (AGE	Number of people below or above a certain age group in the economy.	Uncertain
Capital (K)	Gross fixed capital formation to measure physical capital in the region.	Positive (+)
Openness (Open)	This is defined as the ratio of trade to GDP. It is a measure of the degree of technological diffusion in a country through openness to trade.	Positive (+)
Economic Growth	Economic growth is measured as the growth in the rate of GDP per capita. This is calculated as the ratio of the difference between the current and the previous year's GDP per capita to the previous year's GDP per capita.	
Life Expectancy at birth	The number of years a new-born infant is expected to live given that prevailing patterns of mortality at the time of birth were to stay the same throughout the individual's lifetime.	
Infant Mortality rates	Refers to the probability of dying before age one per 1000 live births. It is measured as the number of infant deaths per 1000 live births per year.	
Under-five mortality rates	Measures the probability of dying between age one and age five per annum. It is a measure of the effectiveness of health care systems.	

CHAPTER FIVE

EMPIRICAL RESULTS AND DISCUSSION OF RESULTS

5.1 Introduction

The chapter presents the data for the study and discusses the empirical results. First, we present the descriptive statistics of the variables in section 5.2. In sections 5.3, 5.4 and 5.5, we present and discuss the results from the empirical models on the effect of health expenditure on health outcomes, the contribution of health outcomes to economic growth and the causal relationship among health expenditure, health outcomes, and economic growth in the region. We conclude the chapter by discussing the policy implications of the findings in section 5.6.

5.2 Descriptive Statistics

We present the descriptive statistics of the variables in the study in Tables 7 and 8. The mean, standard deviation, minimum and the maximum values of the variables are presented. The mean is an indicator of the average value of the variable. The standard deviation shows the spread of the variable from the mean, thus it shows the volatility of the variable. In addition, we report the minimum and the maximum values of each of the variables within the study period. From Table 7, the mean per capita GDP growth in SSA over the period was 2.46 percent with a standard deviation of 7.24, indicating the volatility of growth in the region during this period. Liberia recorded both the lowest and the highest per capita GDP growth rates of -33.98 percent in 2003 and 91.67 percent in 1997 respectively, as the economy experienced a rebound at the end of the first civil war. Guinea Bissau followed this experience with a negative growth rate of 29 percent in 1998.

Table 7: Descriptive Statistics of Principal Variables

Variables	Mean	Standard deviation	Min	Max
Life Expectancy at Birth (LEB)	52.49	6.21	30.47	73.92
Infant Mortality Rate (IMR)	79.84	25.57	18.2	155.7
Under-five Mortality Rate (UMR)	129.32	47.52	21.3	275.1
Total Health Expenditure per capita (HEP)	61.78	110.34	0	1236.15
Public health expenditure per capita (pum)	2.41	1.15	0	6.58
Private health expenditure per capita prm)	3.17	2.27	0.57	19.33
Growth rate of GDP per capita (GDP)	2.46	7.24	-33.98	91.67
GDP per capita (GDP)	1261.2	2073.01	50.04	14901.35

Source: Author's computation from the World Development Indicators (WB, 2012)

Figure 6 presents the growth rate of GDP per capita for SSA countries in the study. It can be realised from Figure 6 that growth has been consistent in some countries, and more erratic in others. For instance, in South Africa, Swaziland, Uganda, Togo and Zambia, growth has been very stable, whereas in countries like Liberia, Equatorial Guinea, Chad, and Rwanda, growth has been quite unstable.

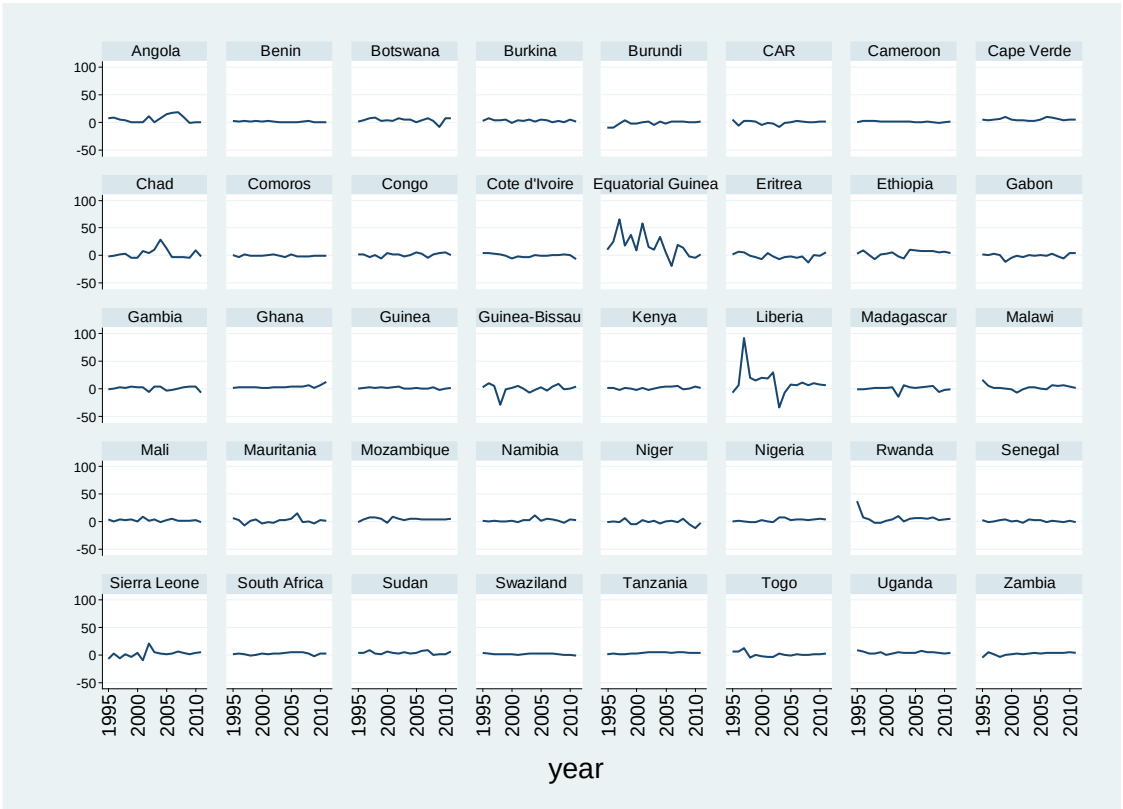

Figure 7: Growth rate of GDP per capita in SSA

Source: Author's plot from the World Development Indicators (WB, 2012)

Table 7 also has the statistics for health outcomes and health expenditure. The mean rates of the infant (IMR) and under-five mortality (UMR) per 1000 live births for the period were 79.84 and 129.32 respectively. Cape Verde recorded the lowest rates in IMR and UMR of 18.2 and 21.3 per 1000 live births respectively. This performance is quite incredible by regional standards. The highest rate of infant mortality (155.7) was recorded in Sierra Leone in 1995 and 1996. The highest rate of under-five mortality rate was recorded in Rwanda in 1995.

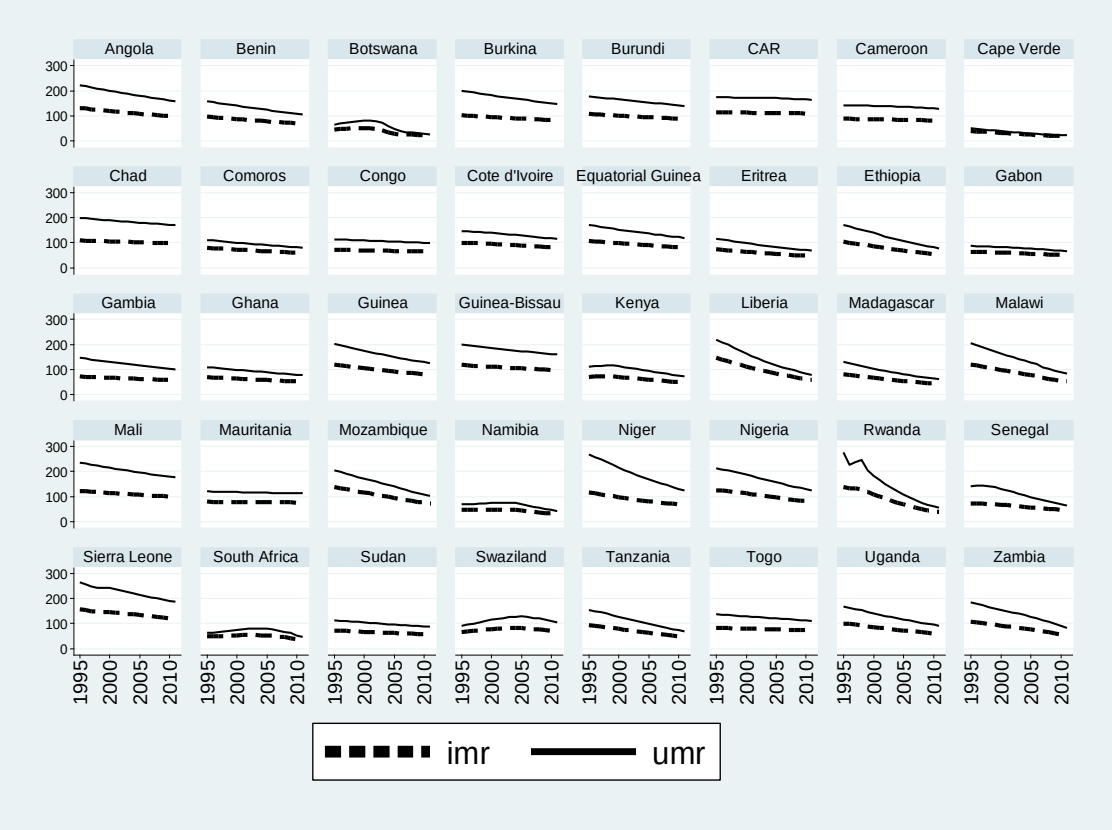

Figure 8: Infant Mortality Rate (IMR) and Under-five Mortality Rate (UMR)
Source: Author's plot from the World Development Indicators (WB, 2012)

Figure 7 shows the trend in IMR and UMR for SSA countries. The dashed lines refer to the trends in IMR while the thin lines refer to the trends in the UMR. From the graph, it can be realised that UMR and IMR have fallen in all the countries over the period. UMR has been very low in Cape Verde over the period while it has been high

in countries like Angola, Chad, Guinea Bissau and Sierra Leone. Generally, infant mortality rates are lower for SSA countries compared to UMR.

Also, the mean Life Expectancy at Birth (LEB) in SSA from Table 7 is 52.49 years with a standard deviation of 6.21 years. This value of LEB is quite low compared to the world average of almost 71 years. The maximum and minimum values of life expectancy at birth are 30.47 years and 73.92 years respectively. Hence, a child born today in SSA is expected to live for an average of 52.49 years, but might live for 30.47 years or 73.92 years depending on where the child is born. The maximum life expectancy at birth was recorded in Cape Verde (73.92 years). Figure 8 shows the trend in LEB for SSA countries. A critical look at Figure 8 shows that LEB has consistently been higher in Cape Verde over the years. The minimum was, however, recorded in Rwanda (30.47 years) in 1995.

Figure 9: Life Expectancy at Birth (LEB)
Source: Author's plot from the World Development Indicators (WB, 2012)

The average health expenditure in SSA (Table 7) was recorded as $61.78 per capita, with a standard deviation of $110.34 per capita within the period of study. This is a huge gap for the standard deviation for health expenditure signifying how variable health expenditure is within the region. Interesting, between 1995 and 1997, health expenditure in Liberia was reported to be zero. This might either be due to Liberia not spending on health within that period or unreported expenditure for the period. The maximum amount per capita spent within the study period was $1,236.15. This was recorded in Equatorial Guinea in 2011. This country has seen a consistent increase in health expenditure per capita over the years. These are depicted in Figure 9.

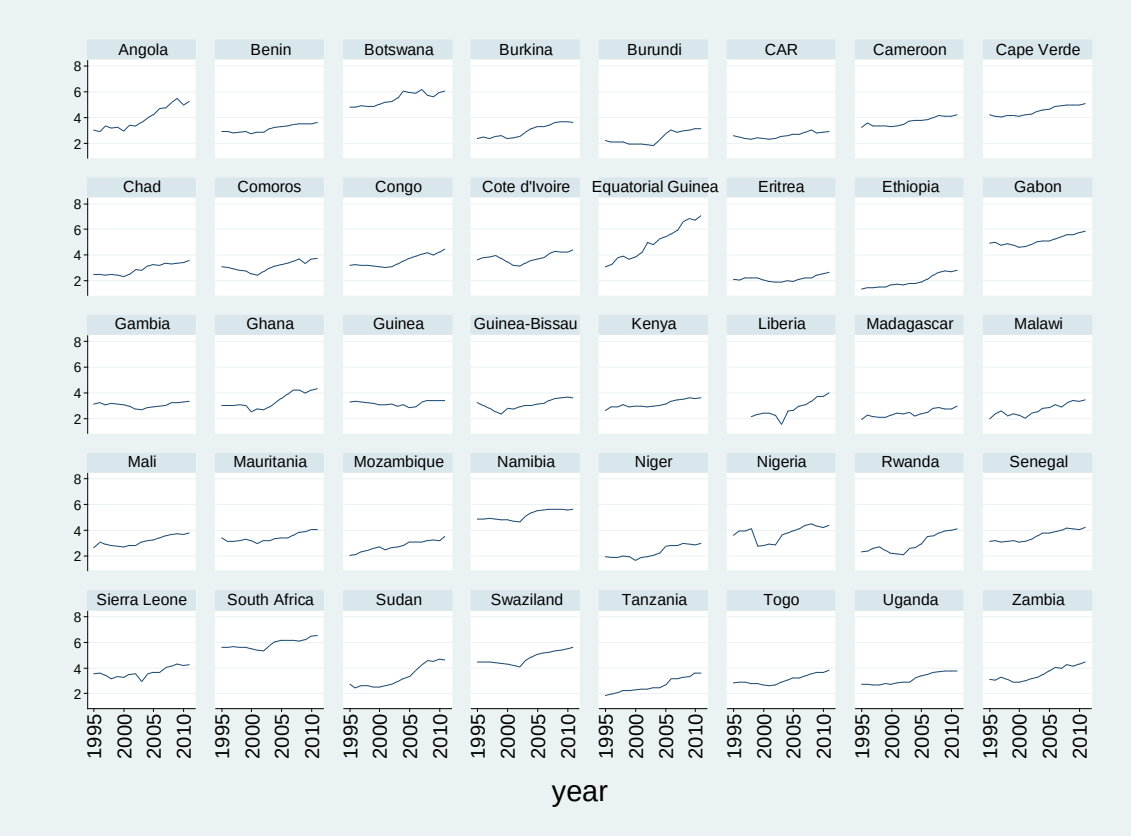

Figure 10: Log of total health expenditure per capita
Source: Author's plot from the World Development Indicators (WB, 2012)

Total health expenditure is further disaggregated into public and private health expenditure; this is presented in Figure 10. The results confirm the background review

presented that the proportion of private health expenditure is higher than public health expenditure in almost all the countries in the study. From Table 7, the mean of private health expenditure is $3.17 per capita compared to $2.41 per capita of public health expenditure in the region. The dominance of private health expenditure over public health expenditure is quite disturbing for a region with high poverty levels. It has been suggested that a greater proportion of private health expenditure in SSA is paid out-of-pocket (OOP).

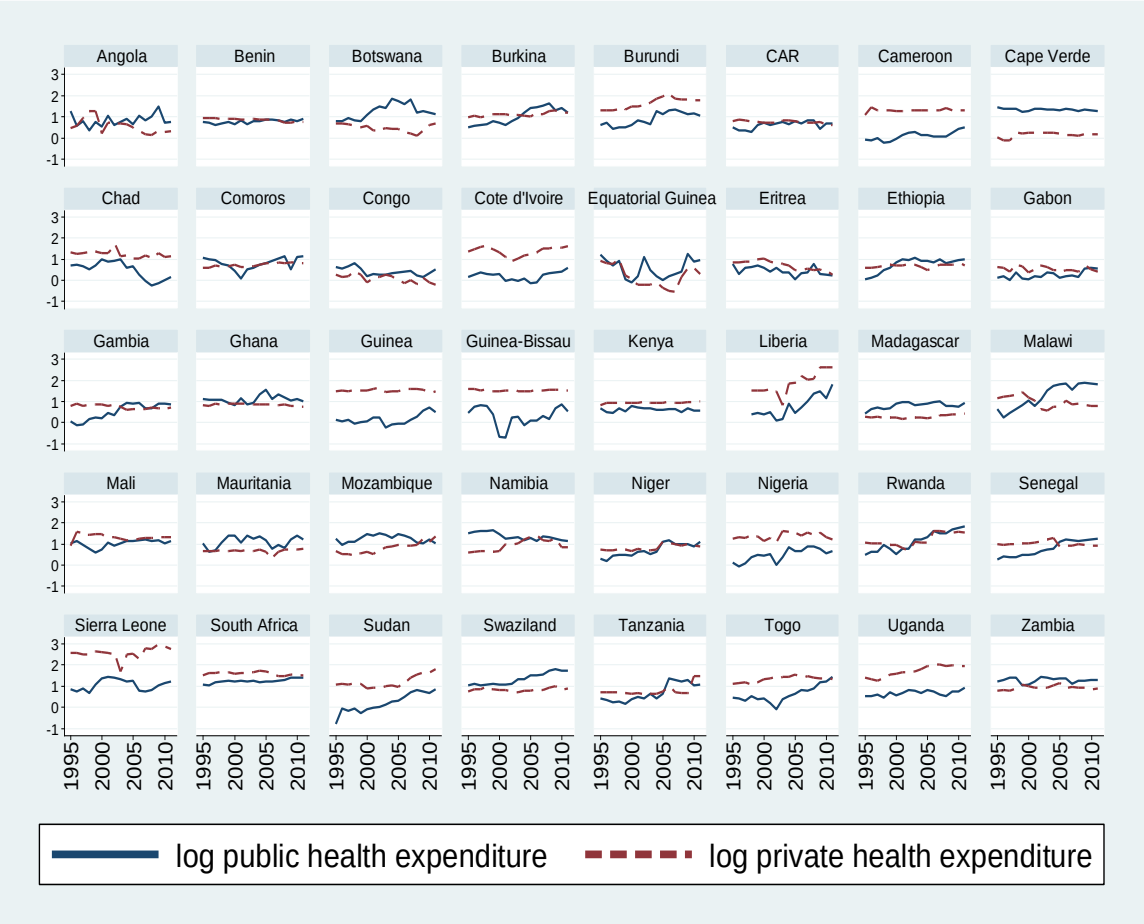

Figure 11: Log of Public and Private Health expenditure
Source: Author's plot from the World Development Indicators (WB, 2012)

Finally, a description of the other variables used in the study is worth appreciating. This is presented on Table 8. Within the period of study, the measles and DPT immunisation rates have been relatively high at 67.70 and 68.19 percent respectively

with about 18.13 and 20.61 percent variation within the sample. Some countries have achieved almost full immunisation while others have as low as 16 percent rates of immunisation for both measles and DPT in the region. Also, the primary school enrolment rate is very high in the sample, with a mean of 93.49 percent enrolment rate. The prevalence of malaria is, however, disturbing as it is still high despite significant efforts in the region to curb the incidence of malaria. However, access to clean water is high in the region, but proper sanitation is very low in the region as it is recorded to be below 50 percent.

Table 8: Descriptive Statistics of other Variables of Interest

Variables	**Mean**	**Standard deviation**	**Min.**	**Max.**
Measles Immunisation Rate (MIR)	67.70	18.13	16.00	99.00
DPT immunisation rate (DPT)	68.19	20.61	16.00	99.00
Primary School Enrolment rate (EDU)	93.49	27.38	28.80	181.70
Prevalence of Malaria (MAL)	953.27	1609.38	0.00	9736.33
Prevalence of HIV/AIDS (HIV)	5.06	5.88	0.10	27.00
Rate of Undernourishment (UND)	29.70	16.33	5.00	76.20
Population with proper Sanitation (SAN)	29.91	19.22	2.80	88.90
Population with access to clean water (WAT)	52.7515	17.84193	9.5	96.7
Gross fixed capital formation (K)	20.08	10.61203	-2.42	113.58
Age dependency ratio (ADR)	88.58	10.69	53.70	110.59
Urban population growth rate (URB)	3.94	1.72	-0.12	20.20
Population between 1 and 14 years (POP14)	43.66	3.54	29.60	49.92
Population between 15 and 64 years (POP64)	53.21	3.18	47.49	65.06
Population 65 and above (POP65)	3.13	0.72	1.66	5.93

Source: Author's computation from the World Development Indicators (WB, 2012)

Lastly, Table 8 also indicates that the rate of undernourishment is high in the region with a mean of 30 percent. In some countries, this is even recorded to be as high as 76.20 percent. This is far below the MDGs' target of reducing extreme poverty and hunger (goal 1). The highest rate of undernourishment was recorded in Eritrea for the study period, with the lowest being recorded in Ghana in the period 2010 and 2011.

The Age Dependency Ratio is also high in the region, suggesting a possible high fertility rate with reducing mortality rates. The majority of the people are within the working age group (53.2%), with 43.66 percent of the population in the region under the age of 14. Gross Fixed Capital Formation has an average of 20.08 percent and the Urban Population Growth Rate is reported to be 3.94 percent for the period of study.

5.3: Empirical Results

5.3.1 Effect of Health Expenditure on Health Outcomes

This study estimates the pooled least squares, the fixed effects, and the random effects models to investigate the effects of health expenditure on health outcomes. The Chow test, Lagrange Multiplier, and the Hausman test confirm the fixed effects model as appropriate compared to the pooled least squares and the random effects models. Hence, the results from the fixed effects model are reported on Tables 9, 10 and 11. The results were also corrected for heteroscedasticity, as the White (1980) test conducted confirmed the presence of heteroscedasticity[14]. Heteroscedasticity was corrected using robust standard errors. In the results, attention is paid to the interpretation of the coefficients of the variables. Some of the variables are expressed in logs, and these are indicated in the tables. The coefficients of the variables in logs are interpreted as percentage changes, while the ones in levels are multiplied by 100 converting them to percentages for easy interpretation.

The results from Tables 9, 10 and 11 indicate that about 75 percent of the variation in infant and under-five mortality, and life expectancy at birth are due to variations in the explanatory variables used in the study. The coefficients of the explanatory variables indicate the change in health outcomes due to a percentage change in any of the explanatory variables, holding the other variables constant. The "t" statistics indicates whether the variable is significant or not at 1, 5, and 10 percent levels of significance. Also, on Tables 9, 10 and 11, we present the model statistics, which includes the R-square, the F test of overall model significance, and the correlation between the unobserved heterogeneity and the explanatory variables (Corr (u_i, x_b)).

[14] See results for White's test for Heteroscedasticity in appendix.

The F test from the three models shows that the models are all statistically significant at the 1 percent level. In addition, the correlation coefficient between the heterogeneity and the explanatory variables in the models (Corr (u_i, x_b)) indicate that the errors (u_i) are correlated with the regressors in model, hence indicating the appropriateness of the fixed effects model for the study.

The results from Table 9 indicate that total health expenditure has a significant effect on health outcomes. They indicate a positive and significant coefficient for life expectancy at birth, and negative and significant coefficients for the infant and under-five mortality rates. These suggest an improvement in life expectancy at birth and a reduction in infant and under-five mortality rates in SSA due to increases in total health expenditure. The results from Table 9 also suggest that measles immunisation rate, proper sanitation, and the availability of clean water have a negative and significant effect on infant and under-five mortality. These variables lead to a reduction in infant and under-five mortality rates in SSA.

In addition, clean water availability has a positive and significant effect on life expectancy at birth and, therefore, leads to an improvement in life expectancy at birth. The prevalence of HIV/AIDS and urban population growth rates have a positive and significant effect on mortality rates and a negative effect on life expectancy at birth. Thus, they lead to an increase in infant and under-five mortality rates and reduce life expectancy at birth. GDP per capita, DPT immunisation rate, the rate of undernourishment, the prevalence of malaria and primary school enrolment rates, contrary to expectation, do not have any significant effect on health outcomes as reported on Table 9.

Table 9: Total Health Expenditure and Health Outcomes

Explanatory Variables	LEB	UMR	IMR
(Log) GDP per capita (GDP)	-0.0200	-0.0360	-0.0706
	(-0.55)	(-0.25)	(-0.58)
(Log) Total Health expenditure (HEP)	0.0149**	-0.0793**	-0.0720**
	(2.15)	(-2.59)	(-2.70)
DPT immunisation rate (DPT)	0.0005	0.0007	0.0011
	(1.48)	(0.54)	(1.08)
Measles Immunisation Rate (MIR)	0.0003	-0.0029**	-0.0026**
	(0.97)	(-2.14)	(-2.39)
Proper sanitation (SAN)	0.0027	-0.0237**	-0.0195**
	(1.21)	(-2.52)	(-2.48)
Clean water (WAT)	0.0023***	-0.0059*	-0.0058**
	(3.38)	(-1.92)	(-2.06)
Population 14 and below (POP14)	0.0062	-0.0114	-0.0082
	(1.63)	(-0.83)	(-0.71)
Population 65 and above (POP65)	-0.0061	-0.0620	-0.0780
	(-0.37)	(-0.79)	(-1.17)
Urban population growth rate (URB)	-0.0026	0.0266**	0.0260***
	(-0.64)	(2.67)	(3.26)
HIV prevalence rate (HIV)	-0.0145***	0.0380***	0.0283***
	(-6.83)	(4.36)	(3.92)
Undernourishment (UND)	-0.0005	0.0018	0.0001
	(-0.50)	(0.54)	(0.03)
(Log) Malaria prevalence (MAL)	-0.0015	0.0081	0.0041
	(-1.39)	(1.25)	(0.82)
(Log) Primary school enrolment rate(EDU)	0.0344	-0.0445	-0.0368
	(1.67)	(-0.58)	(-0.54)
Constant	3.4950***	6.841***	6.411***
	(12.46)	(5.76)	(6.17)
Number of observations	475	475	475
R-squared	0.753	0.748	0.754
F(13,38)	29.44***	13.47***	13.77***
Corr (u_i, X_b)	-0.5096	-0.6762	-0.7170

"t" statistics in parentheses **** p<0.01, ** p<0.05, * p<0.1*

The results presented on Table 10 indicate that public health expenditure has a positive and significant effect on infant and under-five mortality rates, thus reducing mortality. It, however, has no significant effect on life expectancy at birth, even though it has the expected positive coefficient. Private health expenditure, on the other hand, has a positive and significant effect on life expectancy at birth, and negative, but a weakly significant effect on infant and under-five mortality rates. This suggests that private health expenditure has a strong effect on life expectancy at birth and a weak effect on infant and under-five mortality rates. In addition to the variables

discussed from Table 9, we find that GDP per capita has a negative and significant effect on IMR when we disaggregate total health expenditure into public and private. This suggests that an increase in GDP per capita leads to a reduction in IMR. The prevalence of malaria (MAL) has a negative effect on life expectancy at birth and a positive effect on under-five mortality rates. A high rate of malaria prevalence reduces LEB and increases UMR. Lastly, primary school enrolment rate (EDU) has a positive effect on LEB, albeit weakly significant at 10 percent.

Table 10: Public and Private Health Expenditure and Health outcomes

Explanatory Variables	LEB	UMR	IMR
(Log) GDP per capita (GDP)	0.0011	-0.1640	-0.1860*
	(0.03)	(-1.36)	(-1.78)
(Log) Public health expenditure (PrM)	0.0113	-0.0917***	-0.0768***
	(1.47)	(-3.53)	(-3.13)
(Log) Private health expenditure (PuM)	0.0289**	-0.0877*	-0.0791*
	(2.54)	(-1.81)	(-1.82)
DPT immunisation rate (DPT)	0.0005	0.0007	0.0011
	(1.51)	(0.58)	(1.12)
Measles Immunisation Rate (MIR)	0.0004	-0.0033**	-0.0029**
	(1.16)	(-2.39)	(-2.63)
Proper sanitation (SAN)	0.0028	-0.0222**	-0.0184**
	(1.30)	(-2.57)	(-2.56)
Clean water (WAT)	0.0023***	-0.0056*	-0.0056**
	(3.42)	(-1.98)	(-2.09)
Population 14 and below (POP14)	0.0057	-0.0079	-0.0052
	(1.54)	(-0.58)	(-0.45)
Population 65 and above (POP65)	-0.0011	-0.0776	-0.0928
	(-0.07)	(-1.10)	(-1.58)
Urban population growth rate (URB)	-0.0016	0.0232***	0.0231***
	(-0.45)	(2.89)	(3.51)
HIV prevalence rate (HIV)	-0.0151***	0.0407***	0.0308***
	(-7.69)	(5.11)	(4.67)
Undernourishment (UND)	-0.0007	0.0026	0.0008
	(-0.75)	(0.75)	(0.27)
(Log) Malaria prevalence (MAL)	-0.0019**	0.0105*	0.0064
	(-2.24)	(1.76)	(1.38)
(Log) Primary school enrolment rate (EDU)	0.0321*	-0.0355	-0.0306
	(1.70)	(-0.56)	(-0.49)
Constant	3.3950***	7.3210***	6.8580***
	(11.77)	(6.32)	(6.74)
Number of observations	475	475	475
R-squared	0.763	0.762	0.767
F(14,38)	33.37***	13.78***	13.96***
Corr (u_i, Xb)	-0.5270	-0.6919	-0.7413
t statistics in parentheses	*** p<0.01, ** p<0.05, * p<0.1		

Lastly, the results from Table 11 indicate that the interaction of public and private health expenditure has a significant effect on health outcomes in SSA. The coefficient is positive in model LEB and negative in models IMR and UMR at the 5 percent level of significance. We, however, find no significant effect of immunisation against DPT, and undernourishment on health outcomes in SSA. Also, POP65 is negative and weakly significant in model IMR and insignificant in the other two models of UMR and LEB. POP14 is not significant in any of the three models.

Table 11: Complimentary Health spending and Health outcomes

Explanatory Variable	LEB	UMR	IMR
Log GDP per capita (GDP)	0.0031	-0.1590	-0.1820*
	(0.10)	(-1.30)	(-1.72)
Log complimentary spending (M)	0.0153***	-0.0740***	-0.0630***
	(3.37)	(-3.41)	(-3.32)
DPT immunisation rate (DPT)	0.0005	0.0008	0.0012
	(1.43)	(0.63)	(1.17)
Measles Immunisation Rate (MIR)	0.0004	-0.0034**	-0.0030***
	(1.25)	(-2.46)	(-2.71)
Proper sanitation (SAN)	0.0026	-0.0233**	-0.0192**
	(1.22)	(-2.68)	(-2.63)
Clean water (WAT)	0.0023***	-0.0057*	-0.0057**
	(3.54)	(-1.94)	(-2.07)
Population 14 and below (POP14)	0.0060	-0.0099	-0.0069
	(1.58)	(-0.72)	(-0.59)
Population 65 and above (POP65)	-0.0004	-0.0907	-0.1030*
	(-0.03)	(-1.26)	(-1.70)
Urban population growth rate (URB)	-0.0018	0.0230***	0.0231***
	(-0.50)	(2.73)	(3.43)
HIV prevalence rate (HIV)	-0.0150***	0.0405***	0.0307***
	(-7.72)	(5.16)	(4.65)
Undernourishment (UND)	-0.0006	0.0026	0.0008
	(-0.67)	(0.75)	(0.25)
(Log) Malaria prevalence (MAL)	-0.0020**	0.0108*	0.00666
	(-2.38)	(1.79)	(1.42)
(Log) Primary school enrolment (EDU)	0.0341*	-0.0463	-0.0402
	(1.71)	(-0.62)	(-0.62)
Constant	3.3940***	7.394***	6.919***
	(11.68)	(6.40)	(6.82)
Number of observations	475	475	475
R-squared	0.761	0.756	0.761
F(13,38)	32.64***	14.19***	14.09***
Corr (u_i, Xb)	-0.4853	-0.7079	-0.7535

"t" statistics in parentheses *** p<0.01, ** p<0.05, * p<0.1

Discussion of Results

i. Effect of Health Expenditure on Health Outcomes

The results from Table 9 indicate that total health expenditure per capita (HEP) has significant effects on life expectancy at birth (LEB) and infant (IMR) and under-five mortality (UMR). The coefficient of total health expenditure is positive and significant in the model for life expectancy at birth, and it is negative and significant in the models of infant and under-five mortality. The significance of the coefficients suggest that total health expenditure leads to a reduction in mortality rates and an improvement in life expectancy at birth. Specifically, the results imply that a 1 percent rise in total health expenditure per capita, from Table 9, leads to a reduction in infant and under-five mortality rates by 0.079 and 0.072 percent respectively, and improves life expectancy by 0.015 percent. In other words, the elasticities of health outcomes with respect to health expenditure are 0.079, 0.072 and 0.015 respectively, for the infant and under-five mortality rates and life expectancy at birth. These are all significant at 5 percent. Thus, health expenditure has an inelastic effect on health outcomes in SSA. Hence, significant improvement in health outcomes in SSA only results from higher levels of health expenditure.

The further disaggregation of total health expenditure into public (pum) and private (prm) health expenditure, as presented in Table 10, indicates that public health expenditure has a significant effect on mortality rates in SSA, while private health expenditure has a significant effect on life expectancy at birth. The coefficients of public health expenditure on IMR and UMR are negative and significant at 1 percent. Specifically, a 1 percent rise in public health expenditure results in a 0.077 and 0.092 percent reduction in infant and under-five mortality rates respectively. Thus, the

elasticities of public health expenditure with respect to infant and under-five mortality rates are 0.077 and 0.092, indicating that public health expenditure has an inelastic effect on infant and under-five mortality. The results, however, indicate that public health expenditure has no direct effect on life expectancy at birth. This result, of the significant effect of public health expenditure on mortality rates, corroborates the findings of Gupta et al. (2003), Issa and Outtara (2005) and Baldacci et al. (2003) who also reported a significant effect of public health spending on mortality rates.

In addition, the results indicate that private health expenditure leads to a significant improvement in life expectancy at birth and a weak effect on infant and under-five mortality rates. The coefficients are negative for the infant and under-five mortality rates and positive for life expectancy at birth. Specifically, a 1 percent rise in private health expenditure results in a 0.029 percent improvement in life expectancy at birth, significant at 5 percent. In addition, a 1 percent rise in private health expenditure leads to a 0.079 and 0.088 percent reduction in infant and under-five mortality rates respectively and are weakly significant at 10 percent. Hence, the elasticity of health expenditure with respect to life expectancy at birth is slightly higher compared to the effect when total health expenditure is used, indicating the importance of individual efforts to the health production process.

The interaction effect generated to measure the complementary relationship between public and private health expenditure, as reported on Table 11, is highly significant on all the health outcomes. It shows that public and private health expenditure serve to complement each other in improving health outcomes. The coefficients are highly significant at the 1 percent level in all the models reported on Table 11. Specifically, a

1 percent rise in the mix of public and private health expenditure results in a 0.15 percent improvement in life expectancy at birth and reduces both infant and under-five mortality rates by 0.63 and 0.74 percent respectively. Given the importance of the mix of public and private health expenditure, it may be important to harmonise public and private health expenditure in the effort to improve health outcomes in the region. One of such means of harmonising health care expenditure is the introduction of health insurance schemes. Berger and Messer (2002) and Akanni (2012) have reported similar results in their studies where they argued that the mix of health care expenditure is also important in the effort to improve health outcomes. Berger and Messer (2002), in addition, argue that the type of health insurance coverage is also important.

Our findings indicate that health expenditure is significant in reducing mortality rates and improving life expectancy in the region. Given the high mortality rates, it is necessary for governments to invest in the provision of health care in the efforts to improve health outcomes in the region. Indeed, health investments should be encouraged across all countries and for individuals. Special attention should be paid to pregnant women for childbirth and to the health of infants and children. This will serve to reduce the incidence of child mortality in the region. It has been documented that a high percentage of infant mortality occurs at birth or right after birth. Thus, enhancing technology to detect and resolve such occurrences will be very necessary and such will require government spending to improve health systems in the various countries in the region and individuals engaging in healthy life practices and investing appropriately in health care to achieve the desired outcomes.

Our results also indicate that public health expenditure is more significant in influencing mortality rates in SSA, whereas private health expenditure is significant in influencing life expectancy at birth. The significant effect of public health expenditure on mortality rates might be because the region invests more in mortality reducing technology, or probably the investment made by the public sector is more efficient in reducing mortality than improving life expectancy. Indeed, this is not surprising as life expectancy is also affected by environmental factors, disease morbidity, and individual lifestyle. Hence, as the government invests in health, there is the need to also improve environmental conditions to reduce disease morbidity and hence improve health outcomes. Thus, it is not surprising that private health expenditure influences life expectancy significantly. Finally, the mix of expenditure is important in influencing health outcomes as have been suggested. It is important to understand that given the inelastic nature of health expenditure, desired outcomes might only be noticed at high expenditure levels, going by standard demand theory, hence, the need to make conscious efforts in increasing health expenditure to achieve the desired health outcomes.

These findings support the Grossman (1972) model, which postulates that investment in health improves health outcomes, thus leaving the individual better off. Empirically, these findings are in agreement with other studies that have reported a significant effect of health expenditure on health outcomes. These include the studies by Gupta et al. (2001), Baldacci et al. (2003), Nixon and Ulman (2006), Oluyele and Afeikhena (2008), Kamiya (2010), Issa and Ouattara (2005), Anyanwu and Erhijakpor (2007), Novignon et al. (2012), and Akanni (2012). This finding is however in contrast to the findings from studies that have reported a negative or no

effect of health expenditure on health outcomes (Musgrove, 1996; Fimer and Prichett, 1997: 1999; Fayissa and Gutema, 2008, and Gupta et al. (2002). Thus, this study concludes that health expenditure has a significant effect on health outcomes.

ii. Socioeconomic Determinants of Health Outcomes

In addition to the health-improving effects of health expenditure, the measles immunisation rate has also been found to have a significant effect on health outcomes in the region. The results from Table 9 indicate that the coefficients of measles immunisation rate are negative and significant at the 5 percent level. This suggests that a higher rate of measles immunisation is associated with a lower rate of infant and under-five mortality rates. Specifically, a 1 percent rise in the measles immunisation rate leads to a 0.286 and 0.255 percent reduction in the rate of infant mortality and under-five mortality, respectively. The measles immunisation rate was used in this study as a proxy to measure the effect of the use of preventive health care services on health outcomes.

It is well known that the use of preventive health care is a means of improving and possibly correcting some infirmities that could have otherwise been difficult to deal with in later stages if allowed to develop. Indeed, this goes to support the saying that "prevention is better than cure". Thus, in the quest to improve health outcomes, there is the need to provide and utilise preventive health care services. This result is in consonance with the findings of Kamiya (2010) and Akanni (2012). Immunisation against diseases is a preventive health care service, which is mostly carried out when there is an outbreak of some communicable diseases and for known childhood diseases like measles, polio, and DPT.

The provision and utilisation of preventive health care services is an important and effective means of improving health outcomes. It has been reported that the significant reduction in mortality rates that has been achieved over time in the region, has been due to the provision of immunisation services, which has been agreed to be a cost-effective means of improving the health of children and controlling the effects of disease outbreaks. Immunisation against some of the known childhood diseases has been on the increase in SSA, either through government finances or by donors and other Non-Governmental Institutions (NGOs). Hence, it may be very important for the region to make efforts to increase the rate of immunization, not only for measles but also for other known diseases, as part of the effort to improve health outcomes. The MDG goal 4 seeks to increase the proportion of 1-year olds immunised against measles. Thus, efforts should be made to extend and encourage the use of preventive health care services in the region, like the culture of health check-up, which is hardly in existence in the region. What is mostly observed is that people use health care services when they are sick. Educating people about the importance of preventive health care use will be an effective means to improve health outcomes in the region.

Also of importance is the urban population growth rate, which was used as a measure of the pressure on health services, particularly in the urban centres. The results show that an increase in the urban population growth rate results in an increase in the infant and under-five mortality rates. Specifically, a 1 percent increase in the urban population growth rate results in an increase in the infant and under-five mortality rates by approximately 2.6 percent. These are significant at 5 and 1 percent respectively in the infant and Under-five mortality rate models. The urban population

growth rate has an insignificant effect on life expectancy at birth. This suggests that pressure on health facilities in the urban areas, which is characteristic of many developing regions, results in a rise in mortality rates. Thus, urban population growth is found to contribute to the poor health outcomes in the region.

As suggested by Akanni (2012), a high rate of urbanisation puts pressure on urban health facilities compared to the rural facilities, which are mostly underutilized either due to the unavailability of modern health facilities and health personnel in the rural health centres, or the preference of people for health facilities in the urban areas. This, therefore, has to be addressed in the region. Thus, health facilities in the urban centres should be expanded to accommodate the growing population and support the high utilisation, especially in SSA with the high urban migration rate. SSA, like most developing regions, experiences a high movement of people from the rural areas to the urban areas, mostly in search of jobs and to enjoy the perceived better social amenities, hence the pressure on health facilities in urban centres. Also, rural health centres should be improved to encourage utilisation, and to encourage health personnel to accept posting to rural areas as a means of reducing the pressure on urban health facilities.

This study also finds evidence in the significant effect of environmental factors on population health outcomes, as postulated. The results indicate that a 1 percent rise in the proportion of the population with proper sanitation leads to a reduction in the infant and under- five mortality rates by 1.95 and 2.37 percent respectively, significant at the 5 percent level. In addition, an increase in the population with access to clean water is associated with an increase in life expectancy at birth by 0.234

percent, significant at 1 percent and a reduction in infant and under-five mortality rates of about 0.5 percent, significant at 5 and 1 percent respectively. Indeed, as discussed earlier, environmental factors are known to contribute to the spread of most communicable diseases, and hence contribute to poor health outcomes.

As the saying goes, “cleanliness is next to godliness”. This means that sanitation has a significant effect on health outcomes. Proper sanitation improves health outcomes. Hence, in the quest to improve health outcomes in the region, it is important to address environmental concerns. SSA is one of the regions with poor drinking water facilities, which is worsened by drought, and the pollution of water bodies. Such water-related problems are mostly the major cause of the outbreak of diseases such as cholera, diarrhoea, and guinea worm that is prevalent in some parts of the region. Poor sanitation is also a cause for diseases such as malaria and cholera which are endemic in SSA. Thus, there is the need to address these problems to improve health outcomes. Indeed, these are part of the MDG (goal 7), which seeks to halve the proportion of the population without sustainable access to safe drinking water and basic sanitation to ensure environmental sustainability.

Also of importance to health outcomes is the prevalence of HIV/AIDS in SSA. The results have indicated that the prevalence of HIV/AIDS in the region significantly reduces life expectancy at birth and worsens mortality rates. The results imply that a 1 percent rise in the prevalence of HIV/AIDS is associated with approximately 1.45 percent fall in life expectancy at birth, and an increase in infant and under-five mortality rates by about 2.8 and 3.8 percent respectively. The coefficients are significant at the 1 percent level. The results confirm the findings of Novignon et al.

(2012) who has also reported that the prevalence of HIV/AIDS contributes to the poor health outcomes in the SSA region.

This is a known fact across the world, of the worsening effect of the prevalence of diseases on health outcomes and economic growth. Thus, the prevalence of diseases should be addressed in the quest to improve health outcomes in the region. The fight against HIV/AIDS and indeed other prevalent diseases in the region should be intensified, and efforts should be made in curbing the prevalence of these and other diseases. It is known that these diseases also impose costs on the growth of many economies as it incapacitates the victims and hence leads to productivity loss and the associated income loss to the individuals. Indeed, this is one of the targets of the Millennium Development Goals (goal 6), to combat HIV/AIDS, malaria, and other prevalent diseases. Thus, steps in achieving a significant reduction in the prevalence of diseases will be very vital to improving health outcomes in the SSA region.

In addition, the results reported on Table 10 indicate a significant effect of per capita GDP on infant mortality rates signifying the importance of income, particularly on the health of the infant. This is, however, weakly significant at the 10 percent level. This result suggests that increases in GDP per capita allow governments to allocate resources to the health sector, and help households to be able to afford essential health services, especially child health care, leading to the reduction in infant mortality rates. Specifically, a 1 percent rise in GDP per capita leads to, approximately, 0.186 percent fall in infant mortality rates in SSA. This finding is consistent with the findings of Musgrove (1996), Filmer and Pritchett (1997, 1999), Gupta et al. (2001, 2002), Buor and Bream (2004), Issa and Ouattara (2005), Imam and Koch (2004) and Alvarez et

al. (2009). Thus, an increase in income (GDP per capita) has an influence on health outcomes because it offers governments the ability to invest in healthcare. It also offers individuals the purchasing power to buy essential health services. The result of the positive effect of income on infant mortality rates, however, contradicts the findings of Anyanwu and Erhijakpor (2007), and Acemoglu and Johnson (2006) who reported a weak and insignificant relationship between per capita income and mortality rates.

The rate of primary school enrolment is significant in improving life expectancy at birth. The coefficient is weakly significant at 10 percent. Our results imply that a 1 percent rise in the primary school enrolment rate is associated with a 0.032 percent improvement in life expectancy at birth. Thus, it is important to pursue policies that will lead to a higher level of education if the region has to achieve a considerable improvement in life expectancy at birth. The positive relationship between gross primary school enrolment and life expectancy is an indication that improving education will serve as a means of improving health outcomes in SSA. This result is in conformity to the theory of the demand for health by Grossman (1972) which argues that improvements in education will lead to improvement in health outcomes since people become efficient in the use of health care resources and take good care of their health by seeking appropriate care and engaging in healthy life practices. This result is in consonance with the findings of Fayissa and Gutema (2008), Filmer and Prichett (1999). Specifically, Fayissa and Gutema (2008) conclude that education creates awareness about people's health status and what preventive measures to take to improve health outcomes. Moreover, an improvement in the primary school

enrolment rate will serve as an important step in the achievement of the MDG goal 2 of achieving universal primary education.

The prevalence of malaria increases the rate of under-five mortality and reduces life expectancy at birth. The coefficient of malaria in the life expectancy model is negative and significant at 5 percent, while that on under-five mortality rate is positive and weakly significant at the 10 percent level. The result goes to confirm the significant effect of malaria on under-five mortality in SSA. Specifically, a 1 percent increase in the rate of malaria leads to a fall in life expectancy at birth by 0.019 percent and increases under-five mortality rate by 0.105 percent in the region. It is known that malaria is a leading cause of mortality, especially, under-five mortality in the region. This, therefore, needs to be addressed to achieve the desired improvement in health outcomes.

5.3.2: Effect of Health Outcomes on Economic Growth

We investigated the effect of health outcomes on economic growth using dynamic panel data methods. In estimating this model, we used the lag of the dependent variable, GDP per capita growth, as an instrument to correct for the possible endogeneity in the model. We also included the second lag of GDP per capita growth in our estimations. The results of the effect of health outcomes on economic growth are presented on Table 12. The first, second and last columns of Table 12 present the results from the growth model using Life Expectancy at Birth (Model LEB), infant mortality rate (Model IMR) and under-five mortality rate (Model UMR) respectively as proxies for health outcomes.

The Hansen test of over-identifying restrictions does not reject the null of instrument validity. Furthermore, the test for first order serial correlation was rejected, indicating the presence of first-order autocorrelation in the model. This is however expected due to the introduction of the lag terms into the model. However, the test for the presence of second-order serial correlation was rejected. Attention should be paid to the interpretation of the results presented on Table 12. Since the dependent variable is not in logs, we divide the coefficients by 100 before interpreting them.

The results presented on Table 12 indicate the significance of health outcomes in all the measures used in the analysis. Life expectancy at birth in model LEB is weakly significant at the 10 percent level, while infant (IMR) and under-five (UMR) mortality rates are highly significant at the 1 percent level. Furthermore, our measure for the degree of openness (Open) is significant in all the three models. Physical capital accumulation (K) is also positive and significant in the three models. The

study reports a significant contribution of education (EDU) to economic growth. The coefficients of education are positive and significant in the infant and under-five mortality models at 5 percent. It is also positive in the life expectancy model, but insignificant. Lastly, the Age Dependency Ratio (ADR) has a negative, but weakly significant effect on economic growth in the UMR model but insignificant in the IMR and LEB models.

Table 12: Health Outcomes and Economic Growth in SSA

VARIABLES	Model LEB	Model IMR	Model UMR
GDP per capita growth (lag 1)	-0.073***	-0.152***	-0.123***
	(-3.68)	(-3.47)	(-3.77)
GDP per capita growth (lag 2)	-0.189***	-0.239***	-0.223***
	(-10.02)	(-7.40)	(-8.35)
Gross Physical Capital Formation (K)	3.634***	3.216***	3.177***
	(7.01)	(8.11)	(9.22)
Openness (Open)	1.559*	14.500***	15.300***
	(1.88)	(8.42)	(10.11)
Primary School Enrolment rate (EDU)	1.018	3.309**	3.964**
	(0.44)	(2.12)	(2.21)
Age Dependency Ratio (ADR)	9.436	2.639	-10.390*
	(1.57)	(0.26)	(-1.82)
Life Expectancy at Birth (LEB)	**15.190***		
	(1.85)		
Infant Mortality Rate (IMR)		**-14.63*****	
		(-7.04)	
Under-five Mortality Rate (UMR)			**-10.40*****
			(2.711)
Observations	542	542	542
F(7, 39)	62.78***	102.05***	47.55
First order autocorrelation (p-value)	-2.46(0.014)	-2.51(0.012)	-2.43(0.015)
Second order autocorrelation (p-value)	-0.20(0.840)	-0.29(0.770)	-0.33(0.738)
Sargan test (p-value)	82.37(0.019)	57.61(0.098)	51.27(0.241)
Hansen test (p-value)	34.84(0.993)	34.11(0.882)	34.40(0.874)

t statistics in parentheses *** p<0.01, ** p<0.05, * p<0.1

Discussion of results

The results in Table 12 indicate that the effect of health outcomes on economic growth is significant in the three models estimated. Specifically, the results indicate that an improvement in Life Expectancy at Birth (LEB) by 1 percent leads to an

increase in the rate of growth by 0.15 percent. The coefficient of Life Expectancy at Birth is weakly significant at 10 percent. The size of the coefficient is smaller than has been predicted in the earlier empirical models of growth. It is also less than the prediction by the World Bank of the growth of 3.5 percent per year due to improvement in Life Expectancy at Birth. Also, the negative coefficients of UMR and IMR suggest that a significant reduction in IMR and UMR contributes significantly to economic growth. Specifically, a 1 percent rise in infant and under-five mortality leads to a 0.146 and 0.104 percent decrease in the growth rate of GDP per capita respectively. Our findings, however, indicate that the significant contribution of health outcomes to Economic growth was significantly driven more by reductions in mortality rates than by the improvement in life expectancy at birth.

The results confirm the findings of Gymah-Brempong and Wilson (2003) that health outcomes have a significant effect on Economic growth in SSA, but do not agree with the findings of Ogunleye (2011), and Frimpong and Adu (2014) who report an insignificant effect of health outcomes on Economic growth in SSA. Our results also confirm the findings of previous studies by Arora (2001), Bloom et al. (2004), Barro (1991, 1997), He (2009), Aghion et al. (2010) and Kirigia et al. (2005). In addition, studies by Barro and Lee, (1994), Barro and Sala-I-Martin (1995), Bhargava et al. (2001), Knowles and Owen (1997) and Weil (2001) have also reported a positive and significant contribution of health outcomes to Economic growth. This result of a positive influence of health outcomes on economic growth is however in contrast to the results of Acemoglu and Johnson (2007).

This study provides evidence of the significant effect of health outcomes on economic growth and thus concludes that as the nations within SSA strive to attain economic growth, efforts should be made to improve health outcomes in the region as this promises significant economic returns. This can be done by investing in the health sector, through appropriate interventions such as reducing the rate of disease prevalence and other interventions in our quest to improve health outcomes and achieve the desired rate of growth in the region. These results imply that countries that desire higher per capita income should endeavour to increase their stocks of health human capital.

The results also confirm the importance of education in economic growth. Education is positive and significant in two of the three models, infant mortality and under-five mortality rates. In the third model (model LEB) it is positive, but, insignificant contrary to expectation. The positive and significant coefficients imply a positive effect of education on growth. Specifically, a 1 percent increase in the rate of primary school enrolment suggests a 0.033 to 0.040 percent increase in the growth rate of GDP per capita in SSA. This result is consistent with the findings from Kirigia et al. (2005), Barro (1991), Barro and Lee (1994) and Bloom et al. (2004) who also reported a positive effect of education on economic growth. This indeed confirms Grossman's proposition that education enhances the productive capabilities of people and hence contributes significantly to economic growth. Thus, the importance of education cannot be understated in the growth process.

In addition, the importance of physical capital to economic growth cannot be ignored in the region. The study confirms a positive effect of physical capital on economic

growth in SSA. This finding is in line with the neoclassical model of growth. Specifically, a 1 percent rise in the gross physical capital formation increases the growth rate of GDP per capita by about 0.032 to 0.036 percent. These coefficients are highly significant at the 1 percent level in all the three models. The positive and significant coefficient of capital confirms the conclusions reached by earlier researchers such as Barro (1991), Barro and Sala-I-Martin (1995), Gyimah-Brempong and Wilson (2003) and Mankiw et al. (1992). This has an important implication for the region. There is the need to invest in physical capital, and possibly also attract investment into the region to supplement what is already in existence. This would also help in contributing to the desired growth rate of the region. This result is not surprising as it has been the basic prediction of the neoclassical model of growth, that economic growth is driven by growth in the physical capital accumulation.

Furthermore, the results confirm the importance of trade in economic growth. Specifically, the openness variable is positive and significant, suggesting that countries that are open to trade are more likely to attract new technology that are developed in other nations they trade with, as postulated by the theory. This openness enhances the growth rate of GDP per capita in the region. Specifically, a 1 percent rise in the openness of the region to trade leads to a 0.01, 0.14 and 0.15 percent rise in the growth rate of GDP per capita in the three models of life expectancy, infant mortality and under-five mortality rates respectively. These are significant at the one percent, and ten percent levels of significance as reported on Table 12. Our results confirm the hypothesis that countries that trade with the outside world tends to grow faster than those that do not. This result is in consonance with the findings of Bloom et al. (2004). These results imply that it will be an advantage for countries to have an

open trading environment, but this notwithstanding; countries ought to develop their industries to take advantage of the trading benefit thereof from an open environment.

Our results also indicate the deleterious effect of the Age Dependency Ratio (ADR) on economic growth in the region. The results from Table 12 indicate that the age dependency ratio has a drag on economic growth. The coefficient is negative and significant in model UMR. Its significance is a caution for the region. The age dependency ratio, as suggested in the literature, drags economic growth when the population growth rate is higher than the growth rate of GDP. This is likely to occur when there is a significant fall in mortality rates, but a high fertility rate in a nation. In this result, the findings indicate that a 1 percent rise in the age dependency ratio leads to a fall in the growth rate of GDP per capita by 0.104 percent, but weakly significant at the 10 percent level. In the models for life expectancy and infant mortality, the coefficients of age dependency ratio are wrongly signed and insignificant. Nevertheless, there is the need to address the age dependency ratio in the region.

A significant reduction in the mortality rate, with a high fertility rate as observed in SSA, implies an increase in the non-working population relative to the working population. This increases the burden on the working population, thus dragging the rate of saving which in turn affects the investment rate and drags the rate of economic growth. An increase in the age dependency ratio also means an increase in the population size relative to the growth in GDP, thus dragging the rate of growth of GDP per capita as alluded to by Acemoglu and Johnson (2006). One means of addressing this problem is to address the rate of population growth through

appropriate fertility interventions as efforts are made to reduce the rate of under-five mortality. This will greatly support the growth rate of GDP per capita in the region.

Finally, the significance of the coefficient of the lag of the growth rate of GDP per capita needs to be understood in this context. In all the estimates, the coefficients on the initial value of GDP per capita have the expected negative signs and are significant, providing evidence in support of the conditional convergence hypothesis. The negative sign of the coefficients, according to the conditional convergence hypothesis, implies that a lower starting value of GDP per capita tends to generate a higher growth rate, which ultimately leads to convergence of income in the long run. In addition, it implies that countries starting at a lower value of GDP per capita would grow faster than those that start at a higher value of GDP per capita. Thus, if two countries with the same rate of investment and the same level of efficiency, start with different initial levels of income, the poorer one will grow more quickly for a transitional period than the richer one until both countries converge at some point (He, 2009). The coefficient is negative and significantly different from zero at the one percent level of significance. The coefficient sizes suggest convergence rates of about 0.073 to 0.152 percent per annum. This finding is in consonance with the findings of Islam (1995), Lee et al. (1997) and He (2009).

5.3.3 Causality: Health Expenditure, Health Outcomes, and Economic Growth

The third objective, the causality among the variables, was analysed using the Panel Vector Autoregressive (PVAR) model. In testing for the causal association among these economic variables while avoiding any spurious correlation, we followed the three-step procedure for PVAR causality. First, the test for non-stationarity in the variables of GDP per capita, health expenditure per capita and health outcomes was conducted. The Im, Pesaran and Shin (IPS) panel unit root test was conducted on the variables in their logs. Secondly, the test for co-integration was carried out using Westerlund (2007) panel co-integration test. Finally, having confirmed that the variables were co-integrated despite their unit roots, we analysed the causal relationship among the variables using the System's Generalised Method of Moments estimator (by using the program written by Love and Ziccino, 2006). The impulse response functions and the variance decompositions were then obtained to investigate the time path of the variables.

i. Panel Unit root and Co-integration test

The unit root test was carried out using Im, Pesaran and Shin (IPS) unit root test. The results from the IPS unit root tests presented on Table 13 indicates that health expenditure per capita and GDP per capita are difference stationary. Life expectancy at birth is, however, stationary both at levels and at first difference.

Table 13: Im, Pesaran and Shin (IPS) Panel unit root test

Variable	Variable at levels	First difference	Conclusion
GDP per capita	0.4886	-4.0068**	Difference stationary
Health expenditure	-0.8969	-2.9236**	Difference stationary
Life expectancy at birth	-2.8484**	-5.1985**	Stationary at levels

** indicates the variable is stationary

Source: Author's computation

We further examined the existence of co-integration among health expenditure, health outcomes and GDP per capita, since they are difference stationary. The test for co-integration among the variables in this study relied on the Westerlund (2007) test for panel co-integration.

Table 14: Westerlund (2007) Panel co-integration test
Ho: No co-integration

Statistic	Value	Z-value	P-value	Robust P-value
Gt	-2.37	-5.89	0.000	0.000***
Ga	-0.751	5.794	1.000	0.630
Pt	-7.589	-1.307	0.096	0.010**
Pa	-1.257	1.582	0.943	0.040**

Variables: GDP per capita, Health expenditure per capita and Life expectancy at birth
***.**. * indicates significant at the 1, 5 and 10 percent levels respectively.
Source: Author's computation

The Ga and Gt statistics test for co-integration of at least one of the cross-sectional units, while the Pa and Pt statistics pool information over all the cross-sectional units to test for co-integration for the panel as a whole. The results from Table 14 have confirmed that there is a long run association among health expenditure, health outcomes and GDP per capita (income). Three out of the four statistics confirm the existence of co-integration in the series. The Gt, Pt and Pa statistics are significant at the 5 percent level, while the Ga statistic is not significant. The study proceeds to test for causality using the PVAR model.

ii. Causality: Health Expenditure, Health Outcomes and Economic growth

The Panel Vector Autoregressive (PVAR) model was estimated using a one period lag to avoid the loss of large degrees of freedom. The PVAR was estimated using the first differences of the variables in the system. This is due to the short time span of the data. The system Generalised Method of Moments (GMM) estimator was employed

in estimating the PVAR model. Table 15 presents the results from the causal model. The first column represents the results for the variable GDP per capita, the second column represents results for life expectancy at birth and the third column represents causality results for health expenditure per capita.

Table 15: Causality

VARIABLES	$dLnGDP_{t-1}$	$dLnLEB_{t-1}$	$dLnHEP_{t-1}$
Log GDP per capita (GDP)	0.3104**	0.4302**	0.0523**
	(3.964)	(2.089)	(3.110)
Log Life expectancy at birth (LEB)	0.0032**	0.9123**	0.0018**
	(2.082)	(46.277)	(2.972)
Log Health Expenditure Per capita (HEP)	0.2294	2.6173**	0.1176
	(0.878)	(2.737)	(1.923)

*** indicates significant at 5 percent*
"t" statistics in parentheses
Source: Author's computation

The results indicate that, from the GDP equation, causality runs from both health outcomes and health expenditure to GDP per capita. These are significant at the 5 percent level. In addition, from the health outcome equation, the results indicate that causality runs from GDP per capita and health expenditure per capita to health outcomes. These are also significant at the 5 percent level. Lastly, in the health expenditure equation, causality runs from LEB to health expenditure per capita. The study, therefore, confirms a bidirectional causality between health expenditure and health outcomes, between health outcomes and economic growth, and unidirectional causality from health expenditure per capita to economic growth.

The discussion above implies that there is a bidirectional causality between GDP per capita (income) and health outcomes, implying a significant mutual relationship between the two economic variables. Improvement in health outcomes contributes significantly to income, whereas income also affects improvement in health

outcomes. Indeed, this confirms the health is wealth hypothesis. Income affords the person a basic standard of living and an enhanced environment, which also contributes to improvement in health outcomes. This in turn reduces lost time due to illness and enables the person to work efficiently, thereby enhancing economic growth. This suggests that any efforts to improve the wealth of nations should also focus on improving health outcomes.

In addition, the bidirectional causality between health expenditure and health outcomes implies that even though health expenditure has a significant effect on health outcomes, any improvement in health outcomes requires an increasing level of expenditure, perhaps to maintain such improvement, hence the bidirectional relationship. Newhouse (1992) has alluded to this. According to him, improvements in health outcomes are related to improvement in medical technology, which causes health expenditure to also increase. However, given the constant improvement in health technology, the improvement in health will require an increase in health investment in maintaining such improvements. This supports the findings of bidirectional causality between health expenditure and health outcomes. It makes sense in the context of health being a capital good and hence experiencing diminishing returns to capital.

Furthermore, the study confirms a unidirectional causality from health expenditure to GDP per capita, and confirms the existence of the health led growth hypothesis, that health expenditure leads to economic growth as postulated in the literature by Muskin (1962). The significant impact of health spending on economic growth justifies the necessity of government intervention aimed at improving health outcomes by

implementing policies to encourage health spending required to build up a healthier and productive society to support economic growth and development in SSA. Also, it has been argued that health is a capital good, thus in this sense, any investment in health, like any other capital good, should have an effect on economic growth through the generation of interest. Our findings support the findings of Balaji (2011) who reported a short run causality running from health expenditure to economic growth. These findings are however in contrast to the findings of Tang (2011), Elmi and Sadeghi (2012), Mehrara and Musai (2011) and Amiri and Ventelou (2010).

iii. Impulse response functions and variance decompositions

Finally, the impulse response functions and variance decompositions were generated from the results. The impulse-response functions describe the reaction of one variable to the innovations in another variable in the system, while holding all other shocks equal to zero. The Monte Carlo simulations, with the 5 percent error bands, were used to generate the impulse response functions. Figure 11 reports graphs of the impulse response functions. The first, second and third columns in Figure 11 represent the response of life expectancy at birth (lnleb), GDP per capita (lngdp) and health expenditure per capita (lnhep) to shocks.

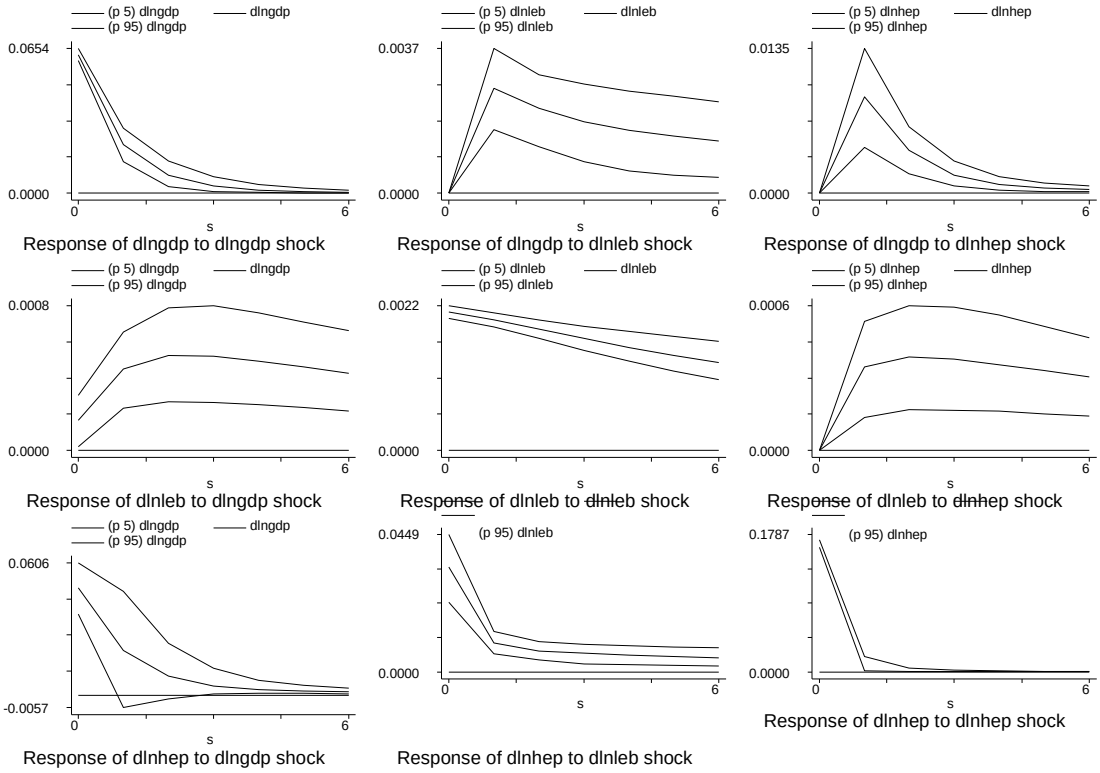

Figure 12: Impulse response functions
Source: Author's computation

The impulse response functions indicate that shocks from any of the variables to life expectancy at birth has a profound effect as depicted in the graphs of the second column. Thus, a shock to life expectancy at birth will have a lasting effect on health outcomes. The graphs in Figure 11 show that shocks from GDP itself and from health expenditure per capita ward off with time, with GDP returning to its normal level in the long run as the line returns to zero. However, shocks from LEB has a profound effect on GDP and takes quite a long time for it to settle. These are represented in the first column of Figure 11. In addition, the second column represents the response of health outcomes to shocks from itself and the other variables. It can be realised that, shocks from GDP to life expectancy takes a while to ward off in the long run, but of interest is the shock of life expectancy at birth on itself which is seen to take a downward trend. Indeed, shocks to health, as postulated by Grossman can have a

deteriorating effect on the individual, which can take a lifetime. However, shocks from health expenditure to life expectancy ward off with time, with life expectancy taking a new pattern parallel to the zero line. The third column represents the response of health expenditure to shocks. Shocks from life expectancy in particular to health expenditure causes it to take a new pattern as illustrated on the graph.

Furthermore, the variance decomposition, which shows the percent of the variation in one variable that is explained by the shock of another variable in the system, accumulated over time is examined. In this framework, the variance decomposition investigating the shock of the variables, GDP per capita, life expectancy at birth and health expenditure per capita, on each other was examined. The variance decomposition shows the magnitude of the total effect of the shock on the variable that is attributable to innovations from the other variables in the study. In this analysis, we considered 10 and 20 periods ahead. These are represented on Table 16. The results presented show the percent of the variation in the row variable explained by column variable.

Table 16: Variance decomposition

Rows/Columns	s	Log GDP	Log LEB	Log HEP
Log GDP	10	0.972722	0.005601	0.021676
Log LEB	10	0.063136	0.907094	0.02977
Log HEP	10	0.086392	0.042947	0.870661
Log GDP	20	0.971622	0.006679	0.021699
Log LEB	20	0.067034	0.901477	0.031489
Log HEP	20	0.086391	0.044667	0.868942

Source: Author's computation

The variance decomposition on Table 16 shows that GDP per capita explains about 97 percent of the variation in itself, with 2.17 and 0.56 percent being explained by

variations in health expenditure and health outcomes (Life expectancy at birth) respectively. Thus, the explanatory power of health expenditure in the variations in health outcomes, though small, is much higher than health outcomes itself. The effects remain virtually the same when the 20 periods are considered.

Further, considering the variation in life expectancy at birth, the study confirms that life expectancy at birth explains about 90.7 percent of its own variation with 6.3 and 3.0 percent of the variation due to GDP per capita and health expenditure per capita respectively. This, therefore, suggests that variations in income have a much higher effect on health outcomes than the shocks from health expenditure per capita in SSA. In the 20 periods, the study reports that the effect of GDP per capita and health expenditure per capita increases marginally with that of health expenditure gaining a marginal increase in the 20th period. This is accompanied by a marginal fall in the variations due to LEB on itself. This supports the claim by Grossman (1972) that health depreciates with time.

Finally, health expenditure per capita explains approximately 87 percent of the variation in itself, with GDP and life expectancy at birth explaining about 8.6 and 4.3 percent of the variation. The variation due to health outcomes improves marginally in the 20 periods, with that of GDP remaining constant over that period. Thus, the effect of GDP per capita on health expenditure remains constant from the 10 periods to the 20 periods, but the variation due to health outcomes increases marginally, with that of health expenditure on itself falling marginally after the 10^{th} period.

5.4 Summary of Findings

The first objective of the study has been to investigate the effect of health expenditure on health outcomes. The results indicate that total health expenditure has a significant, but inelastic effect on health outcomes in SSA. It leads to an improvement in life expectancy at birth and contributes to the reduction in infant and under-five mortality rates. Our findings further indicate that public health expenditure has a significant effect on infant and under-five mortality rates, while private health expenditure significantly influences life expectancy at birth. Finally, the interaction effect suggests a complementary relationship between public and private health expenditure in the region.

The second objective of the study has been to investigate the contribution of health outcomes to Economic growth. The results from the study imply that health outcomes contribute significantly to economic growth. Our findings, however, suggest that the significant effect of health outcomes on economic growth is driven more by mortality reductions than by improvements in life expectancy at birth in the region. Particularly, infant and under-five mortality rates have a significant effect on economic growth rates in SSA than life expectancy from our estimates.

The third objective of the study investigates the causal relationship among health expenditure, health outcomes and economic growth in SSA. The results confirm bidirectional causality between health expenditure and health outcomes, between health outcomes and Economic growth, and unidirectional causality running from health expenditure to economic growth in SSA. The bidirectional relationship between health outcomes and economic growth confirms the health is wealth

hypothesis while the unidirectional causality from health expenditure to economic growth confirms the existence of the health-led growth hypothesis in SSA. The impulse response functions indicate that shocks to life expectancy at birth have a prolonged effect which takes a much longer time to adjust to equilibrium compared to shocks from health expenditure and economic growth.

Our findings suggest that variables such as GDP per capita, urban population growth rate, the prevalence of HIV/AIDS and malaria, the proportion of the population with access to clean water and proper sanitation, and the rate of primary school enrolment have significant effects on health outcomes. Measles immunisation rates and proper sanitation improve health outcomes by reducing infant and under-five mortality rates. The urban population growth rate worsens mortality rates. Clean water availability improves health outcomes, while HIV/AIDS prevalence worsens health outcomes. The variables DPT immunisation rate and undernourishment were found to be insignificant in affecting health outcomes, contrary to the expectation of the study.

Finally, our findings from the growth model suggest that gross primary school enrolment, physical capital accumulation, openness to trade, and the age dependency ratio have a significant effect on economic growth. Gross primary school enrolment rate and physical capital accumulation have a positive effect on economic growth, while the age dependency ratio has a negative, but a weak effect on economic growth. Openness to trade, which is a measure of technological diffusion, has a positive effect on economic growth. In addition, the hypothesis of conditional convergence is confirmed to exist in SSA owing to the negative sign of the coefficient of the lag of the growth rate of GDP per capita.

5.5 Policy Implication of Findings

First, the findings indicate a significant, but inelastic effect of health expenditure on health outcomes. This presupposes that significant improvement in health outcomes in the region will only be observed at higher expenditure levels. We, therefore, suggest that health expenditure is increased significantly in the region to improve health outcomes. Indeed, this will also have a trickle-down effect on economic growth due to the health-led growth that has been established in this study. Indeed, health investments have growth effects presenting us with a policy alternative to improving health outcomes and achieving sustained economic growth in SSA. However, given that private health expenditure is higher in SSA than that of the public, we recommend that prepayment schemes should be instituted to enable people to save towards ill health.

In addition, given the complementary relationship between public health expenditure and private health expenditure, it is necessary to harmonise the private components of health expenditure to derive the maximum benefit from health investment. These private expenditures are almost entirely out-of-pocket at the point of service. It has been argued in the literature that out-of-pocket payments are an inequitable and inefficient way to mobilize resources for health services. Hence, introducing and sustaining health insurance schemes that aim to pool resources together and hedge the individual against financial difficulties in times of illness become important in this context. This will also help to avoid the likely occurrence of high out-of-pocket payments that might prevent people from the use of formal health care services.

Health expenditure can be a heavy weight on individuals, especially since one cannot predict when illness occurs. Health insurance, however, cushions individuals against sickness and serves to maintain income in the event of illness. It also serves as an important tool for government to boost the pool of health resources. Thus, this will help individuals save towards the purchase of health care in the event of illness. It is known that some avoidable deaths occur because individuals do not seek appropriate care, or only seek care when they perceive the situation to be critical, due to the high cost of care, which often occurs at the point of service. The introduction of health insurance schemes will, therefore, serve the additional benefit of encouraging the use of appropriate care in the event of illness.

These schemes should be mandatory to avoid issues of adverse selection, where those who value themselves to be much stronger and do not feel the need of an insurance policy and the rich who can afford the out-of-pocket expenditure may not register. Adverse selection can serve as a serious constraint on revenue generation for such funds and may eventually lead to a breakdown of the policy. Also, it may require a strengthening of the referral system in the region to check against moral hazard; the abuse of the system due to the possession of health insurance and hence the likelihood of people always heading for the higher facilities with ailments that could be treated at the primary health care centres.

In addition to the policy of introducing prepayment schemes, governments might also consider financing some aspects of care, such as maternal and child health, as being done already in some countries, as a means of support to the poor and vulnerable in society. This is in line with the conclusion that private health expenditure in SSA is

higher than public health expenditure. This situation is very peculiar to SSA and creates some concerns about the high poverty levels in the region. Most of the time, people who fall prey to the high cost of care also happen to be the poorest in the society at the point of service. Thus, this will also serve as a means of targeting the poor in the society and hence reducing the poverty and income inequality that might be due to the cost of health care. It is a known fact that a high cost at the point of service has the potential of deteriorating into the incidence of catastrophic health expenditure, where health expenditure takes a huge proportion of the household's income.

According to WHO, out-of-pocket payments for health can cause households to incur catastrophic expenditures, which in turn can push them into poverty, especially, those at the lower end of the income gap. The need to pay out-of-pocket can also mean that households do not seek care when they need it and this will have a worsening effect on health outcomes with a ripple impact on economic growth. Indeed, these are in the right direction of the prescriptions of the policy on Universal Health Coverage that is being championed by WHO. Some countries like Ghana, Nigeria, South Africa, Rwanda, and others are already using some of these policies, albeit with some difficulties. Thus, it is a wake-up call for the strengthening of such policies in countries that are already practicing them and for other countries to introduce such policies to help improve health outcomes. In addition, it might be necessary to provide support for the private sector to also function well and probably reduce their cost of operation so that people can purchase health care services from the private sectors without incurring the high cost of care. This can also encourage the private

health care providers to establish especially in areas that are highly under-served by the public sector.

Secondly, given the documented importance of health outcomes in enhancing economic growth, the study recommends that greater attention should be given to improving health outcomes in the region to achieve the desired rate of growth. Our results have indicated the importance of health outcomes to economic growth. Indeed, a healthy person works for long hours, saves more out of his/her income, which provides more resources for investment and strives to attain a higher level of education, which enhances productivity. All these contribute to economic growth and to poverty reduction in the region.

The very nature of health issues requires certain aspects of health infrastructure to be treated as public goods. Indeed, the bidirectional causality between health outcomes and economic growth, confirming the hypothesis that health is wealth, and the unidirectional causality from health expenditure to economic growth, confirming the health led growth hypothesis are important considerations for the region and policy makers to focus on health investments, particularly from the public sector. This indeed is in confirmation of the Abuja Declaration. An increase in the composition of public health expenditure will help the health sector in acquiring recent and up-to-date equipment that are effective in health care delivery, to train more health service personnel, build health care facilities, improve existing ones and extend health services to areas that currently have little or no access to health care services. These will then contribute significantly to achieving improved health outcomes and the desired economic growth rate in the region.

Again, the effects of disease prevalence and environmental factors on health outcomes need to be attended to. Even though considerable efforts have been made in fighting against these diseases, much effort should additionally be made to further reduce these diseases, specifically, the incidence of HIV/AIDS and Malaria. These diseases have been found in this study to contribute to poor health outcomes. Indeed, it is one of the targets of the Millennium Development Goals (MDGs), to reduce the prevalence of diseases. Despite the considerable efforts made in reducing some of these diseases, some studies in the region still attest to the fact that the incidence and vectors of these diseases still remain high (Aigbodion and Anyiwe, 2005) and these have significant negative effects on growth (Anyiwe and Egbagbe, 2003). Hence, reducing the prevalence of these diseases will aid the region in making significant progress in achieving the goals set in the MDGs.

The results also suggest that access to clean water is a significant factor in the quest to achieve good health outcomes. Hence, governments in the region must make efforts to make clean water available to all and sundry, to also educate, and encourage citizens to use clean water. In addition, given the importance of education to economic growth and health outcomes, the region needs to make efforts to encourage school enrolment, not only at the primary level as reported in this study, but also to the higher levels. Indeed, the literature has argued that education improves the efficiency of labour, which enhances labour contribution to economic growth. Education also enables people to make efficient use of health care, according to Grossman (1972). Thus, policy should aim at encouraging educational attainment to boost health outcomes and economic growth in the region. This should not only be limited to high school enrolment rates, but also the quality of education should be improved.

CHAPTER SIX

SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION

6.1 Summary of Findings

The study has investigated the interrelationship among health expenditure, health outcomes, and economic growth in SSA. In line with the main objective, three specific objectives were formulated. The first objective investigated the effect of health expenditure on health outcomes in SSA using the Grossman (1972) demand for health model as the theoretical justification and was estimated using the fixed effects model. The second objective examined the effect of health outcomes on economic growth in SSA drawing insights from the augmented neoclassical growth model and was estimated with the Generalised Method of Moments estimator (GMM). The third objective analysed the causal relationship among health expenditure, health outcomes and economic growth in SSA using Panel unit roots, co-integration and PVAR. A total sample of 40 SSA countries, over a period of 17 years (1995 to 2011) was used.

The study reports the following major findings:

1. From the descriptive analysis, the study finds that private health expenditure dominates public health expenditure in SSA. This is what prevails in almost all the SSA countries. This is, however, only peculiar to SSA compared to other regions in the world. This is quite worrisome, considering the high levels of poverty in the region, and it can lead to an undesirable pattern where households spend a greater proportion of their income on health care. It can thus worsen health outcomes in the region if not addressed.

2. Examining the effects of health expenditure on health outcomes, the results suggest that health expenditure has a significant, but inelastic effect on health outcomes. Health expenditure has a positive effect on life expectancy at birth and a negative effect on infant and under-five mortality rates. Thus, health expenditure leads to an improvement in life expectancy at birth and a reduction in Infant and Under-five mortality rates in SSA. The improvement in life expectancy at birth is significantly driven by private health expenditure, whereas the reduction in Infant and under-five mortality rates are driven by public health expenditure. The results, however, suggest that significant improvement in health outcomes is only observed at higher levels of expenditure due to the inelastic effect of health expenditure on health outcomes. There is, however, a strong complementary relationship between public and private health expenditures in improving health outcomes in SSA.

3. Investigating the contribution of health outcomes to economic growth, the results indicate that health outcomes, measured by life expectancy at birth and infant and under-five mortality rates, have a significant effect on economic growth, measured by the growth rate of GDP per capita. The significant contribution of health outcomes to economic growth over the study period was, however, driven more by reductions in mortality rates than by improvement in life expectancy at birth. Thus, significant gains from improvement in life expectancy at birth appear not to have been harvested yet in SSA. This may also be due to the slow improvement in life expectancy at birth in SSA, compared to the significant reduction in mortality rates in the region.

4. Analysing the causal relationship among health expenditure, health outcomes and economic growth, the results indicate bidirectional causality between health expenditure and health outcomes, between health outcomes and economic growth, and unidirectional causality running from health expenditure to economic growth. The bidirectional causality between health expenditure and health outcomes means that improved health outcomes have to be sustained by health investments, while the bidirectional causality between health outcomes and economic growth confirms the "health is wealth" hypothesis in SSA. The unidirectional causality, on the other hand, running from health expenditure to economic growth confirms the health-led growth hypothesis, suggesting that health investments have growth effects in SSA.

Besides the major findings listed above, the following findings from the study are also worth noting, given their importance to the efforts of securing high growth rates and rapid economic development in SSA countries.

5. The prevalence of life-threatening diseases, such as HIV/AIDS and Malaria, was found to have significant negative effects on health outcomes. It leads to a reduction in life expectancy at birth and increase the infant and under-five mortality rates in SSA.
6. Access to clean water, proper sanitation facilities, and GDP per capita contributes to improving health outcomes in the region. These variables improve life expectancy at birth and reduce infant and under-five mortality rates in SSA.
7. The openness of a country to trade, which was measured as the ratio of trade to GDP, has a positive effect on the growth rate of per capita GDP. This confirms the hypothesis that trade among nations contributes significantly to economic

growth, suggesting the need for SSA countries to open up to trade in view of its beneficial effects on economic growth rates.

8. Education has a significant effect on health outcomes and economic growth. The effect of education on health outcomes is only significant in the model for life expectancy at birth. Our estimates suggest that education has a positive effect on life expectancy at birth. In the growth model, education contributes positively and significantly to economic growth rates, supporting the arguments for the significant effect of human capital on economic growth.

6.2 Recommendations

The study makes the following recommendations based on the findings:

1. Given the documented importance of health outcomes in enhancing economic growth, the study recommends that greater attention must be given to improving health outcomes in the region to achieve the desired rate of growth. The study thus recommends that the region should make conscious efforts to allocate more resources to the health sector as the improvement in health and the investment in health outcomes have significant growth effects. This will help the health sector in acquiring recent and up-to-date equipment that are effective in health care delivery, to be able to train more health service personnel, build and improve health care facilities, and extend health services to areas that currently have little or no access to health care services. These will contribute significantly to achieving improved health outcomes and the desired economic growth rate in the region.

2. Prepayment and health insurance schemes, which act as savings towards health expenditure, should be made operational in SSA. This is in recognition of the high level of private health expenditure over public health expenditure, which is not sustainable in a region with such high poverty levels. Such schemes will help protect individuals against ill health and cushion their income levels in the event of illness. However, such schemes must be mandatory to avoid adverse selection, which might end up crippling fund generation for the scheme. This will also require a strengthening of the referral system to avoid moral hazards. The governments can also fund some aspects of health care, such as maternal and childcare, through taxation. This can target the vulnerable in the society to cushion them in periods of ill health. These will ensure that people use the right health care services and ensure that health outcomes are improved.

3. The region must make efforts to reduce the incidence of diseases in the region, specifically, the incidence of HIV/AIDS and Malaria and improve the availability of clean water to the citizenry. The prevalence of diseases has been found in this study to contribute to poor health outcomes. Indeed, it is one of the targets of the Millennium Development Goals (MDGs) to reduce the prevalence of diseases. Hence, achieving this will aid the region in making significant progress in achieving the MDG goals. In addition, the availability of clean water to all and sundry will contribute significantly to achieving better health outcomes. Thus, governments in the region must put up policies to ensure access to clean water and also educate their citizens on the importance of using clean water.

4. Given the positive contribution of openness to economic growth, efforts must be made by all nations within the region to develop their markets and make them more accessible to trading partners. This might mean building up industries to be more competitive in the international market. This has a significant effect on economic growth and must thus be encouraged. Indeed, as was hypothesized in this study, an open trading environment attracts the needed knowledge, especially from the developed nations with more advanced technology. As nations trade with such countries, it permits the flow of knowledge and technology between the countries and it has a significant impact on the growth of the trading nations, especially the less developed.

6.3 Contribution to Knowledge

The study adds to the existing knowledge in the following aspects:

1. On the importance of health expenditure to health outcomes:
    a) The study adds to the existing knowledge on the relationship between health expenditure and health outcomes in the context of SSA, confirming that health expenditure leads to a significant reduction in infant and under-five mortality rates and an improvement in life expectancy at birth in SSA. Our findings, however, indicate that health expenditure has an inelastic effect on health outcomes in SSA.
    b) The study has obtained estimates of the differential effects of private and public health expenditures on health outcomes. This study is the first, to the best of our knowledge, to investigate these effects in the context of SSA. The results indicate that the significant reduction in mortality rates over the period was driven by public health expenditure, while improvement in life

expectancy at birth was driven by private health expenditure in SSA. Further, the study reports the existence of a strong complementary relationship between public and private health expenditures in improving health outcomes.

c) The study has found empirical evidence of the effect of HIV/AIDS, the prevalence of malaria and the use of preventive health care/immunisation on health outcomes in SSA. Previous studies that have been conducted do not account for these effects in totality, which can significantly bias the results of such studies.

2. On the contribution of health outcomes to Economic growth,

a) This study adds to the limited studies on health outcomes and economic growth, particularly in SSA. To the best of our knowledge, the only studies that have been conducted in SSA in this connection came up with differing conclusions. Gyimah-Brempong and Wilson (2003) report significant effect of health outcomes on economic growth, while Ogunleye (2011), and Frimpong and Adu (2014) report an insignificant effect. The findings of this study conform with the findings of Gyimah-Brempong and Wilson (2004) on the importance of health outcomes to Economic growth. However, our finding that the significant gains of economic growth from health outcomes have been due to reductions in mortality rates rather than improvement in life expectancy at birth in SSA appears novel and thus represents a contribution to knowledge. This possibly explains why known previous studies that used life expectancy at birth could not find any significant effect of health outcomes on economic growth in the literature.

b) In addition, this study has found the existence of the conditional convergence hypothesis of economic growth in the context of SSA. This hypothesis suggests that countries that start on a lower level of per capita GDP grow at a faster rate than those that start on a higher level, thereby converging to the same rate of growth in the long run on the growth trajectory.

c) Lastly, important variables of openness to trade and the age dependency ratio, which have not been accounted for in the known previous studies were incorporated into this study and have been found to be important factors that also affect economic growth in SSA.

3. Finally, on the causality analysis, this study has obtained empirical evidence showing the nature of the causal relationship among health expenditure, health outcomes, and economic growth in SSA. The results indicate the existence of bidirectional causality between health expenditure and health outcomes, between health outcomes and economic growth, and unidirectional causality running from health expenditure to economic growth. To the best of our knowledge, this appears to be the first study to investigate the relationship among these variables in SSA. Thus, the results from this study serve as a platform upon which other studies can improve to understand how these variables interact to inform policy in the region.

6.5 Conclusion

The study has investigated the interrelationship among health expenditure, health outcomes and economic growth in SSA. Three objectives were formulated in this study; to investigate the effect of health expenditure on health outcomes in SSA; to examine the effect of health outcomes on economic growth in SSA; and to test the causal relationship among health expenditure, health outcomes and economic growth in SSA. A total sample of 40 SSA countries, over a period of 17 years (1995 to 2011) was used in this study.

The study examined the effect of health expenditure on health outcomes using the Grossman (1972) demand for health model as the theoretical justification. The fixed effects model was estimated using the OLS estimator. This objective was investigated in three stages. Firstly, the effect of total health expenditure on health outcomes was examined. Total health expenditure was further disaggregated into public and private health expenditure in the second model to test the effect of these two basic types of health expenditure on health outcomes in SSA. Then we examined the effect of the interaction between public and private health expenditure on health outcomes. Secondly, the effect of health outcomes on economic growth was investigated drawing insights from the augmented Solow model and was estimated using GMM. Lastly, the causal relationship among health expenditure, health outcomes, and economic growth was analysed using the PVAR model. The IPS panel unit root and the Westerlund panel co-integration methods have also been employed in testing this relationship. The impulse response and the variance decomposition analysis have been examined.

The results confirm the significant effect of health expenditure on health outcomes in SSA. Health expenditure leads to a fall in IMR and UMR and improves LEB. Our estimates suggest, however, that health expenditure has an inelastic effect on health outcomes. Thus, significant improvements in health outcomes are only observed at higher expenditure levels. Also, the contribution of health outcomes to economic growth is positive. A significant reduction in infant and under-five mortality rates lead to a higher growth rate of GDP per capita, while an improvement in life expectancy at birth, even though weakly significant, also leads to a higher growth rate of GDP per capita in SSA. Finally, on the nature of the causality among health expenditure, health outcomes and economic growth, the study confirms bidirectional causality between health expenditure and health outcomes, and between health outcomes and economic growth. In addition, there is unidirectional causality running from health expenditure to economic growth. The impulse response functions and variance decompositions imply that a higher percent of the variation in each of the variables is explained by the variable itself, with marginal contributions from the other variables in the study.

Finally, factors such as disease prevalence, environmental factors and urban population growth rate are reported to have significant effects on health outcomes in the region. Education also leads to improvement in life expectancy at birth, while GDP per capita contributes to reductions in infant mortality. In the growth equation, education, gross capital formation, and openness are some of the factors reported to have significant effects on health outcomes in SSA. The age dependency ratio was reported to have a negative, but weakly significant effect on economic growth in the under-five mortality model. Factors such as DPT immunisation and undernourishment were found to have no effect on health outcomes for the period covered by the study.

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Appendix

Table 17: Summary of literature on Health expenditure and Health outcomes

Author(s)	Sample and method	Main Findings	Other covariates
Gupta et al. (2002)	50 developing countries, (1993-1994) OLS and 2SLS	Health spending is negatively related to IMR and U5MR	Adult literacy rate, urbanization, access to improved sanitation
Baldacci et al. (2003)	94 countries (1996-98) 2SLS and OLS	Government health expenditure reduces IMR and U5MR	GDP per capita, total fertility rate, spending per pupil and urbanization
Issa and Ouattara (2005)	160 countries (1980-2000) OLS, Fixed and Random Effects, GMM	Health expenditure leads to a fall in IMR	carbon dioxide emissions, female literacy, Real GDP
Anyanwu and Erhijakpor (2007)	47 countries in Africa, (1994-2004) OLS, 2SLS, Fixed effects	health expenditures are inversely related IMR and U5MR	Female literacy, GDP per capita, physicians
Novignon et al. (2012)	40 SSA countries 1995-2010 Fixed and Random effects	public HE leads to a fall in IMR, U5MR, Crude death rates and improves LEB	per capita GDP, HIV prevalence, hospital beds
Filmer and Pritchett (1997; 1999)	98 developing countries OLS, Median regression, 2SLS	Health expenditure not a determinant of mortality	Per capita income, distribution of income, female education, degree of ethnic fragmentation, Predominant religion.
Musgrove (1996)	OLS	No evidence that health reduces mortality	per capita income
Cremieux et al. (1999)	GLS	Health expenditure reduces IMR and improves LEB	physician per capita, per capita income
Gupta et al. (2002, 2003)	OLS, 2SLS	Health expenditure has positive but Weak effect on health outcomes.	adult literacy, GDP per capita, sanitation, urbanization rate
Berger and Messer (2002	GLS	publicly financed share of health expenditures increases in mortality	Female labour force participation, GDP per capita, post-secondary education, tobacco

		rates, total health expenditures reduces	consumption per capita.
Buor and Bream (2004)	Bivariate correlation and categorical cross tabulation	health expenditure per capita have strong negative association with maternal mortality	GNP per capita, female literacy and births attended by skilled health personnel.
Akanni (2012)	fixed effects, 2SLS	Public hE leads to a fall in IMR, U5MR, Crude death rates and improves LEB.	Income per capita, immunisation, external funding of health care, fertility rates.
Kamiya (2010)	GMM	Leads to a reduction in mortality	GDP per capita , access to improved sanitation, immunisation, skilled birth attendants, number of physicians per 1,000 people
Nixon and Ulmann (2006)	IMR	HE makes a marginal contribution to the reduction in IMR	for number of physicians per 10,000 population, pollution and nutrition,
Imam and Koch (2004)	IMR	Health expenditure reduces mortality	per capita GDP, female literacy rate, assisted delivery at birth, HIV/AIDS prevalence, immunization rate
Gottret and Scieber (2006)	IMR, UMR	Government health expenditure reduces UMR and MMR	education, roads, sanitation, GDP per capita and donor funding
Oluyele and Afeikhena (2008)	IMR, UMR GLS	Health expenditure leads to a fall in IMR and UMR	Availability of physicians, female literacy rate and immunisation, per capita.
Alvarez et al. (2009)	MMR	Health expenditure reduces MMR	prenatal care coverage, births assisted, improved water source, adult literacy rate, primary female enrolment rate, education index, Gross National Income per capita

Source: Author's compilation

Table 18: Summary of Literature on health outcomes and Economic growth

Author(s) and Year	Sample and method	Measure of growth	Main Findings	Other covariates
Acemoglu and Johnson (2007)	OLS, 2SLS	GDP	LEB increases the population growth, but reduces GDP, hence reducing GDP per capita	none
Aghion, Howitt, and Murtin (2010),	OLS, 2SLS	Per capita GDP growth	Positive effect of initial level and rate of improvement in LEB on growth	none
He (2009)	GMM	GDP per capita	Both the stock of health, and accumulation of health has positive effect on growth	
Kirigia, Oluwole, Germano, Gtwiri and Kainyu(2005)	Pooled OLS	GDP per capita	MMR has a negative impact on GDP.	Land, capital, exports, education, imports, labour
Bloom, Canning Sevilla (2004)	GLS fixed effects and random effects	GDP per capita	ASR has a positive effect on GDP	labour, technology, governance, land, Capital, schooling
Bhargava, Jamison and Murray (2001)	OLS	GDP per capita	ASR has a positive effect on GDP	Labour, capital, schooling
Barro (1997)	OLS	GDp per capita	LEB has a positive effect on real income per capita	Capital, labour, education
Barro and Sala-i-Martin (2004)	OLS	GDP per capita	LEB has a positive effect on real income per capita	
Gymah- Brempong and Wilson (2003)	GMM	GDP per capita	The stock of and investment health human capital affects the growth rate of per capita income in a quadratic way.	
Aurangzeb (2003)	Johansen cointegration analysis, and ECM	GDP	Significant and positive relationship between GDP and	

			Health Expenditure, both in the long- and short-run.	
Ogunleye (2011)	GMM	Per capita GDP growth	Health not an important determinant of growth in SSA.	
Knowles and Owen	OLS	Log difference of real GDP per working age person	Positive relationship between health and economic growth	

Source: Author's compilation

Table 19: Summary of Literature on Health expenditure, Health outcomes, and Economic growth

Author(s) and Year	Method	Main Findings
Balaji (2011)	Juselius co-integration and Granger causality	SR: HE→ Economic growth only in Pradesh LR: No long run evidence
Tang (2011)	multivariate co-integration and error-correction framework	SR: Relative price→ HE; Relative price→ income, LR: HE ↔ income
Day and Tousignant (2005)	Unit root and co-integration tests, with and without allowances for structural break(s)	Weak Triangular causality
Mehrara and Musai (2011)	panel unit root tests and co-integration analysis	SR: oil revenues and economic growth → HE, LR: No long run evidence
Mehrara and Musai (2011)	Gregory-Hansen (1996) co-integration technique and Granger causality	SR: GDP→ HE LR: no evidence
Hassan and Kalim, (2012)	Ng - Perron test for stationarity, ARDL bounds testing and Granger Causality test	SR: GDP↔ education expenditures LR: Triangular causality
Elmi and Sadeghi (2012)	Panel co-integration and causality in VECM framework	SR: GDP → HE LR: GDP ↔ HE
Amiri and Ventelou (2010)	Toda and Yamamoto (1995) causality test and VAR	HE ↔ GDP (1965 to 1984) HE → GDP (1975 to 1994) GDP → HE (1985 to 2004) HE ↔ GDP (1965 to 2004)
Erdil and Yetkiner (2004)	Granger causality approach	HE ↔ GDP for entire sample GDP → HE (LIC and MIC) HE → GDP (HIC)

Source: Author's compilation

Table 20: Modified Wald test for group wise heteroskedasticity

Null Hypothesis: H0: sigma(i)^2 = sigma^2 for all i	
Output for LEB (Model 1)	chi2 (39) = 11824.24 Prob>chi2 = 0.0000
Output for UMR (Model 2)	chi2 (39) = 42673.55 Prob>chi2 = 0.0000
Output for IMR (Model 3)	chi2 (39) = 11061.12 Prob>chi2 = 0.0000

Table 21: Hausman Test for random and fixed effects

Null Hypothesis: Difference in coefficients not systematic (Random Effects)	
Output for LEB (Model 1)	chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 49.53 Prob>chi2 = 0.0009
Output for UMR (Model2)	chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 72.63 Prob>chi2 = 0.000
Output for IMR (Model 3)	chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 66.63 Prob>chi2 = 0.0296

Table 22: Breusch and Pagan Lagrangian multiplier test for random effects

Model 1: LEB

```
lnleb[country4,t] = Xb + u[country4] + e[country4,t]

Estimated results:
                 |       Var     sd = sqrt(Var)
        ---------+------------------------------
           lnleb |   .0117634       .1084591
               e |   .0004806       .0219228
               u |   .0049502       .0703573

Test:   Var(u) = 0
                     chibar2(01) =  1248.26
                   Prob > chibar2 =   0.0000
```

Model 2: UMR

```
lnumr[country4,t] = Xb + u[country4] + e[country4,t]

Estimated results:
                 |       Var     sd = sqrt(Var)
        ---------+------------------------------
           lnumr |   .1780284       .4219341
               e |   .0081463       .0902568
               u |   .0586401       .2421572

Test:   Var(u) = 0
                     chibar2(01) =  1123.42
                   Prob > chibar2 =   0.0000
```

Model 3: IMR

```
lnumr[country4,t] = Xb + u[country4] + e[country4,t]

Estimated results:
                 |       Var     sd = sqrt(Var)
        ---------+------------------------------
           lnumr |   .1780284       .4219341
               e |   .0081463       .0902568
               u |   .0586401       .2421572

Test:   Var(u) = 0
                     chibar2(01) =  1123.42
                   Prob > chibar2 =   0.0000
```

Lis of Sub-Saharan African countries in the study: World Bank (2012):

Angola	Chad	The Gambia	Malawi	Tanzania
Benin	Comoros	Ghana	Mali	Togo
Botswana	DR Congo	Guinea	Mauritania	Uganda
Burkina Faso	Burundi	Guinea Bissau	Senegal	Zambia
Equatorial Guinea	Cote d'Ivoire	Kenya	Mozambique	Swaziland
Cameroon	Eritrea	Rwanda	Namibia	Sierra Leone
Cape Verde	Ethiopia	Liberia	Niger	South Africa
Central Africa Republic	Gabon	Madagascar	Nigeria	South Sudan