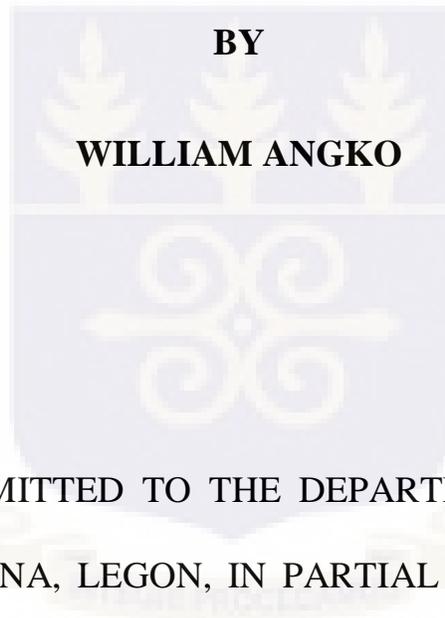


**THE DETERMINANTS OF HEALTHCARE EXPENDITURE IN
GHANA**



BY

WILLIAM ANGKO

THIS THESIS IS SUBMITTED TO THE DEPARTMENT OF ECONOMICS,
UNIVERSITY OF GHANA, LEGON, IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE AWARD OF A MASTER OF PHILOSOPHY
(M.PHIL) DEGREE IN ECONOMICS.

JULY, 2009

DECLARATION

I, **WILLIAM ANGKO**, do hereby declare that this thesis consists entirely of my own work and that no part of it has been presented by anyone for the award of a degree in the university or elsewhere for such purpose.

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DEDICATION

This thesis is dedicated to my beloved Mum, Madam Kuubiere Ursula, my siblings and my twin nieces Ana-Marine (Danyi) and Ana-Miriam (Napog).

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EBENEZER “This is how far the Lord has brought us”. First and foremost, I give praise to the Almighty God for bringing me this far in the pursuit of academic success. I further express my appreciation to my Mum, Madam Kuubiere Ursula, my Siblings and my uncle, Dr. Kuubiere Callistus for all their support.

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LIST OF ACRONYMS

AIDS	Acquired Immune Difficiency Syndrome
ARDL	Autoregressive Distributed Lag
ATH	Proportion of Population with Access to Basic Health Facilities
CBHIS	Community Based Health Insurance Scheme
CBR	Crude Birth Rate
CDR	Crude Death Rate
CHAG	Christians Health Association of Ghana
CHPS	Community Based Health Planning & Services
CL	Clinics
DACF	District Assembly Common Fund
DALY	Disability Adjusted Life Years
DH	District Hospitals
DMHIS	District Based Mutual Health Insurance Scheme
DOC	Number of Doctors/Physicians
DOTS	Direct Observed Treatment, Short Course
DPR	Domestic Private Revenue
DPT	Diphtheria, Pertussis and Titanus
ECM	Error Correction Model
EPI	Expanded Programme on Immunization
GDP	Gross Domestic Product

GHCE	Government Financed Healthcare Expenditure
GHS	Ghana Health Services
GoG	Government of Ghana
HC	Health Centres
HCE	Healthcare Expenditure
HIPC	Highly Indebted Poor Countries
HIV	Human Immune Virus
HS	Health Status
IMR	Infant Mortality Rate
LEB	Life Expectancy at Birth
MDGs	Millennium Development Goals
MH	Maternity Home
MoF	Ministry of Finance
MoH	Ministry of Health
MR<5	Under-Five Mortality Rate
NDPC	National Development Planning Commission
NGO	Non-Governmental Organization
NHIS	National Health Insurance Scheme
NMR	Neonatal Mortality Rate
OECD	Organisation for Economic Co-Operation and Development
OH	Other Hospitals

OLS	Ordinary Least Squares
PC	Polyclinics
PHCE	Privately Financed Healthcare Expenditure
POP15	Proportion of Population below 15 Years
POP65	Proportion of Population above 65years
POW	Programme of Work
PPME	Policy Planning Monitory and Evaluation
PUB	Publicly Financed Healthcare Expenditure as a Percentage of GDP
QALY	Quality Adjusted Life Years
RH	Regional Hospitals
SPH	Specialist Hospitals
SWAP	Sector-Wide Approach Programme
TB	Tuberculosis
TH	Teaching Hospitals
UN	United Nations
URB	Urbanization Rate
WHO	World Health Organization

ABSTRACT

This study is motivated by the conviction that previous studies on the determinants of per capita government healthcare expenditure are mostly based on international comparisons of healthcare expenditure. The study analyses the main demand side determinants of per capita government healthcare expenditure in Ghana from 1970 to 2006.

Using the Johansen cointegration test and an error correction model, the paper identified the key determinants of per capita government healthcare expenditure in the short run. These include; changes in per capita GDP, changes in the proportion of the population aged 65 years and above as well as changes in the proportion of the population with access to basic healthcare facilities. Of these, per capita GDP is the dominant determinant of per capita government healthcare expenditure in Ghana. It therefore suggests that in order to meet the minimum expenditure requirement for achieving the health related Millennium Development Goals, per capita GDP ought to be increased considerably.

Specifically, the coefficient of per capita GDP is found to be far below unity in the long run and above unity in the short run. One of the major implications of this result is that healthcare in Ghana is a necessity in the long run and a luxury in the short run. This could be an indication that healthcare delivery is one of the most important issues to Ghana's policymakers.

CHAPTER ONE

BACKGROUND INFORMATION

1.1 Introduction

Health related issues predominantly feature in three out of the eight Millennium Development Goals. The goals include; reduction in child malnutrition and mortality, improving maternal health and combating HIV/AIDS, malaria and other diseases. Although more money is needed to achieve the health related Millennium Development Goals, resources could be wasted without achieving the desired health targets. Achieving the health related Millennium Development Goals (MDGs) in Africa region will therefore require both mobilization of additional financial resources and better spending of scarce resources in the health sector. The World Health Organization (WHO) has indicated that the Millennium Development Goals (MDGs) on health cannot be achieved without fully functioning and equitable health systems in various countries.

An efficient healthcare system is therefore crucial in breaking the vicious cycle of poverty and poor health. Moreover, it is critical in meeting the Millennium Development Goal (MDG) of “marked improvements in the health of the poor by the year 2015.”

There are acute shortages of both human and financial resources in the health sector all over the African continent. Without adequate financing of the health sector, many countries in the region will not realize these goals given that the health systems are chronically under-funded, and health budgets remain far below what is seen as the minimum spending required to achieve the health related Millennium Development Goals (MDGs).

Identifying appropriate policies on how to finance and provide healthcare in Africa is a serious constraint on most governments. Healthcare financing policies are also essential for all countries as they determine who will have access to basic healthcare services, the quantity and quality of services to be offered and the mode of payments for healthcare services. A well functioning healthcare system is needed to provide the basic package of health services that is affordable, sustainable and is based on the ability of households to pay regardless of their need or risk.

Most growth theories argue that health is a key component of human capital and emphasize that investment in health has direct effect on productivity, and educational attainment per unit of time and consequently on economic growth. They also argue that health and economic growth are intertwined in that health can strongly affect growth and economic growth can also affect health. These arguments served as the basis for the Alma-Ata declaration of “universal health for all by the year 2000” in the former Kazat Soviet Republic in September 1978. This declaration provided the platform for adopting primary healthcare as the means for providing comprehensive, universal, equitable and affordable healthcare services for all countries .

In recent times, the growth and pattern of healthcare expenditure and its share of Gross Domestic Product (GDP) have become a phenomenon which is constantly the subject of discussion in many countries. This can be explained by the fact that all countries put similar interest in cost effectiveness and cost containment of healthcare interventions, yet economists have to date failed to reach consensus on what determine the healthcare expenditure growth of nations.

Many empirical studies on the subject are based on cross-country comparisons of healthcare expenditure. These studies emphasize the important role of GDP and other factors such as the price of medical care, urbanization rate, proportion of population above 65 years of age, share of publicly funded proportion of health expenditure and life expectancy at birth in explaining healthcare expenditure growth (see Abel Smith 1963, Newhouse 1972, 1977, Gerdtham 1992). Parkins et al, (1987) also found GDP to account for most of the variation in aggregate health expenditure and suggested that the influence of non-income factors were dependent upon the structure of the population and the health sector in particular.

Newhouse (1977) examined the determinants of healthcare expenditure by regressing healthcare expenditure on Gross Domestic Product and other factors. The study concluded that non-income factors such as price paid by the patient and the method of physician payment have only marginal significance on healthcare expenditure.

The study focused mainly on the demand side determinants of per capita government healthcare expenditure in Ghana. This study will however ignore the production, cost efficiency and equity in healthcare spending and considers only variables such as per capita GDP, life expectancy at birth, proportion of population ages 65 years and above, proportion of population below ages 15 years and urbanization rate using time series analyses. The dependent variable is the per capita government healthcare expenditure. Since this study is the first of its kind in Ghana, unavailability of healthcare data explains why this study will not consider the per capita healthcare expenditure in total and disaggregating it into the public-private per capita healthcare

expenditure mix. This was expected to help us measure the different responsiveness of the varying determinants of healthcare expenditure on the disaggregated total, public and private healthcare expenditure in Ghana.

1.2 Research Problem

Many empirical studies on the determinants of healthcare expenditure are inconclusive about the factors that actually determine the growth of per capita government healthcare expenditure in many countries. To our knowledge, there are very few studies on the determinants of per capita government healthcare expenditure. The few known studies on the subject are based on international comparisons with mixed evidence. This study constitutes the first attempt at estimating a model of per capita government healthcare expenditure determinants in Ghana.

Currently, the African continent is not on track in achieving the health related Millennium Development Goals since healthcare spending in the region is far below the minimum levels needed to achieve the health goals (World Bank 2006). In trying to predict how much per capita government healthcare expenditure could increase in the future and what policy can do about it in order to meet the minimum healthcare expenditure needed to achieve the health goals, more and better targeted spending as well as improved management of scarce resources will be instrumental in addressing the problem(s).

Although much is known about healthcare financing challenges in other regions the world over, robust analysis of the key issues and policy options remains scanty. In light of this, the need to

examine the main determinants of per capita government healthcare expenditure in Ghana is predominant.

Africa has severe budget constraints and the worst health outcomes the world over. Strategies that will have significant impact in terms of securing more fiscally sustainable source of financing, managing the financial vulnerability and ensuring greater benefits should be underpinned by robust analysis of the determinants of per capita government healthcare expenditure.

The main problem with studies in this direction has to do with unavailability of health data, the econometric and statistical method to adopt and the type of data to use. Lessons from countries that have implemented reform to tackle the acute problem of financing healthcare such as Ghana, Uganda and Zambia highlight the facts that reform are inherently political, and may not be sustained without a strong political will and legal framework (Bossert, 2000). Other problems associated with such reforms concern the resource intensiveness of sustaining and maintaining a reform process, the necessary improvements in managerial systems, institutional and capacity, the need for good data as a basis for justification for a reform process and structuring the reform within each country's financing capacity.

This study on the determinants of per capita government healthcare expenditure in Ghana is therefore crucial and can be looked at from two broad perspectives. On one hand, the benefits derived from that spending measured by proxies of population health status such as life

expectancy at birth. On the other hand, the additional spending may also impose a burden on the citizenry in the form of taxation.

1.3 Significance of the Study

There is a weak theoretical and statistical framework on healthcare expenditure determinants due to the inability to separate both demand and supply-induced influences on healthcare services utilization and cost of care. In order to tackle this problem, analysis of per capita government healthcare expenditure determinants should be based on all aspects of healthcare such as; demand side, production/supply side, cost efficiency and effectiveness as well as equity in the delivery of healthcare services.

Empirical studies on per capita healthcare expenditure determinants identified many factors affecting the growth of per capita total healthcare expenditure at both the OECD and African context and the evidence is inconclusive on the income elasticity of per capita healthcare expenditure. There have not yet been generally agreed models in the literature explaining the long-term growth of per capita government healthcare expenditure. To this extent, most of the international or cross country comparison of per capita healthcare expenditure provide inconclusive results. It is therefore necessary to specify a model and examine the role of the various factors influencing the growth of per capita healthcare expenditure at the national level.

The major justification of this study on the determinants of per capita government healthcare expenditure in Ghana is to identify the forces that drive the public spending on healthcare below the minimum level needed to achieve the health related MDGs. This will help us recommend

sustainable macroeconomics policies concerning healthcare spending in the future. Furthermore, this will enable policy makers make inference about the trends in the per capita government healthcare expenditure in Ghana.

In order to be able to inform policy and make recommendation on sustainable healthcare spending policies, the analysis of the determinants of per capita government healthcare expenditure in Ghana is extremely important for formulating policies and strategies for the health sector. An adequate knowledge about the extent, determinants, and elasticities of per capita government healthcare expenditure is essential for devising strategies to increase allocative efficiency of resources, to ensure proper utilization of the existing resources, and to improve the quality of services. Analysis of the determinants of per capita government healthcare expenditure is also crucial for designing strategies aimed at achieving financial sustainability of a programme.

Despite the general agreement among economists on the importance of the determinants of per total healthcare expenditure (public and private mix) and the availability of a large volume of literature on the theoretical aspects of demand for healthcare, only a few empirical studies on the shape of the function and elasticities of healthcare exist, especially for African countries. The question therefore is “what are the demand side determinants of per capita government healthcare expenditure in Ghana”. This and other questions are what the research seeks to answer.

1.4 Research Questions

The study will answer the following specific research questions;

- Is healthcare a luxury or a necessity?
- What demand factors explain the growth of per capita government healthcare expenditure in Ghana?
- How can these factors control healthcare spending in Ghana?

1.5 Objectives of the Study

Generally, the objective of the study is to find out what demand factors determine how much government spends on healthcare per person in Ghana.

Specifically, the study seeks the following objectives;

- To develop a model of both income and non-income determinants of per capita government healthcare expenditure in Ghana in order to measure both short run and long run linkage between per capita government healthcare expenditure and its determinants.
- To identify and predict the long-term growth of per capita government healthcare expenditures in Ghana.
- To estimate the income elasticity of per capita government healthcare expenditure and to determine whether healthcare is a luxury or a necessity.

1.6 Organization of the Study

The first chapter is an introductory one, the rest of the study is organized into five chapters. The next chapter undertakes a broad overview of the health system in Ghana and include the background of Ghana, objectives of the healthcare system, structure of the Ghana health system, disease profile, distribution of healthcare personnel, healthcare financing in Ghana, healthcare expenditure trends in Ghana, health status indicators and health sector reforms in Ghana. Chapter three examine the relevant literature on the subject. Chapter four deals with the methodology, data sources, choice of variables and the model specification. The actual estimation of the model and interpretation of results constitutes chapter five and ends with the summary, conclusion, recommendations and policy implications, area for future research and the limitation of the study in chapter six.

CHAPTER TWO

AN OVERVIEW OF THE GHANA HEALTH SYSTEM

2.1 Background of the Study Area

Ghana is a tropical country on the west coast of Africa. It is bordered to the south by the Gulf of Guinea, La Côte d'Ivoire to the west, Burkina Faso to the north and Togo to the east. Administratively, the republic of Ghana is divided into ten administrative regions and 138 decentralized districts. The population density varies from 897 per km² in Greater Accra Region to 31 per km² in the Northern Region. The government is one of a presidential democracy with an elected parliament and independent judiciary. The principal religions are Christianity, Islam and African traditional religion. Ghana's economy is predominantly agrarian (small scale peasant farming) absorbing about 60% of the adult labour force, a small capital intensive mining sector and a large and growing informal sector. Each of the 138 districts is further sub-zoned into sub-districts, with each district having at least one health management team (DHMT), (World Bank Statistics 2007 and www.ghanadistricts.com).

2.2 Objectives of the Healthcare System

A healthcare system is defined as all people and all activities whose primary purpose is to promote, restore or maintain health. It refers to a country's system of delivering services for the prevention and treatment of disease and for the promotion of the physical and mental well-being of its population. The ultimate goal of the health sector is to ensure a healthy and productive population that reproduces itself safely over time, to improve the health of the population they serve, to respond to the expectations of the population and to provide financial protection against

the costs of ill-health. The goal of the health sector will be achieved through pursuing five inter-related and mutually reinforcing objectives. These are:

- Improving health outcomes
- Ensuring equity in access to and payment for healthcare services
- Ensuring efficiency in healthcare delivery
- Overall control of expenditure (reduce escalating cost of healthcare)
- Ensuring quality (patients and provider satisfaction)

2.3 Structure of Ghana Healthcare System

A typical structure of the Ghana healthcare system can be classified into three distinctive categories based on the level of technological sophistication and complexity of healthcare services namely; Primary, secondary and tertiary services. The structure looks hierarchical and/or pyramidal.

At the apex of the pyramid are the central hospitals and at the bottom are the healthcare centres and health units. In between the two are the district healthcare facilities which serves as the first point of referrals from the broader base. The apex is the end of the referral chain in the pyramid which provides more sophisticated and specialised tertiary services. Clinical research education and training also take place at this level. They are usually located in the large urban areas. The relative proportions of the facilities and personnel depend on the pattern of diseases, structure of the population and density, the human resources availability in the health sector, education, communication and the level of socioeconomic development.

At the middle of the hierarchy are the first referral hospitals from the health centres. Such hospitals generally have between 100 and 400 beds capacity and served a population of about 50,000 to 250,000 people. They offer services such as inpatient care; obstetrics and gynaecology, pediatrics, dentistry, limited surgery, outpatients care; emergencies and referred cases.

At the base of the pyramid are the health posts, clinics and health centres. They provide services like maternal care, school healthcare services and few curative care services; malaria, TB, STD/AIDS and family planning.

For optimal behaviour in the provision and utilisation of healthcare services, it is recommended that healthcare provision should follow this pyramid. This pyramid suggests that, government should provide more of the primary healthcare facilities to make them available to patients (Clinic, healthcare centres, health posts e.t.c) than the secondary and tertiary services. This is because, it should be very cheaper and easier to have access to healthcare for easily curable and preventable diseases that would have costed so much if available at a tertiary unit. This means that patient can have easy access to cheap healthcare while the providers will not spend on any sophisticated machine and equipment. By implication, government tends to spend less in providing healthcare to majority of the population through the primary healthcare system than secondary and tertiary while patient also pay less for easily accessible healthcare at the primary units.

This structure shows the optimizing behaviour of both the providers and patients. It has a broader base where less costly and easily treatable illness like malaria can be handled. This also requires less qualified healthcare personnel. The top is the most narrowed and required highly specialized

personnel together with technically sophisticated, complex and expensive cost of treatment of complicated diseases.

This structure is showed in figure 2.1 below;

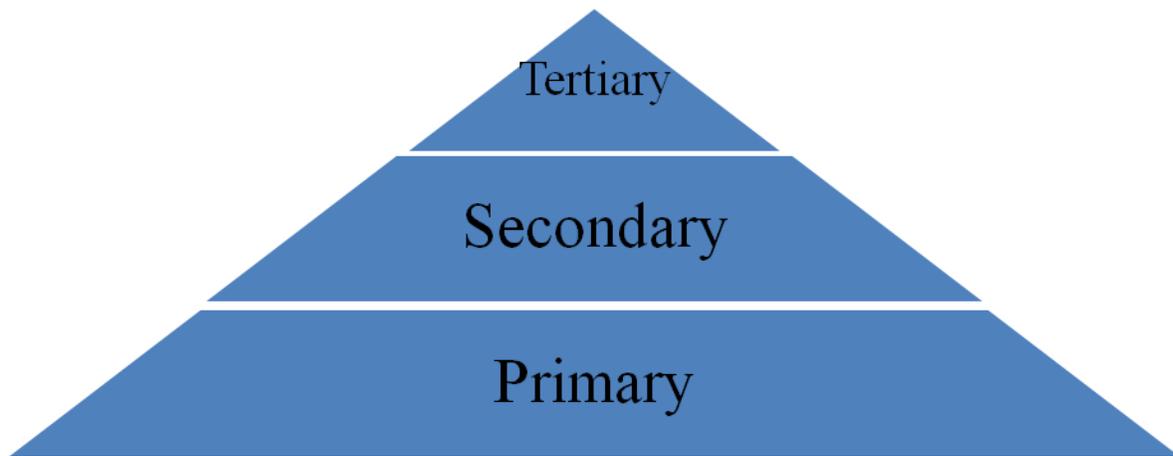


Figure 2.1: The Health System pyramid where healthcare is provided.

Source: drawn and modified by the author

Tertiary indicates specialised and teaching hospitals that provide complex and sophisticated health services, Secondary indicates Regional and District hospitals that provide secondary health services while the primary indicates Clinics, Health post, health centres and maternity homes that provide basic primary healthcare services.

2.4 Distribution of Healthcare Facilities within the Structure

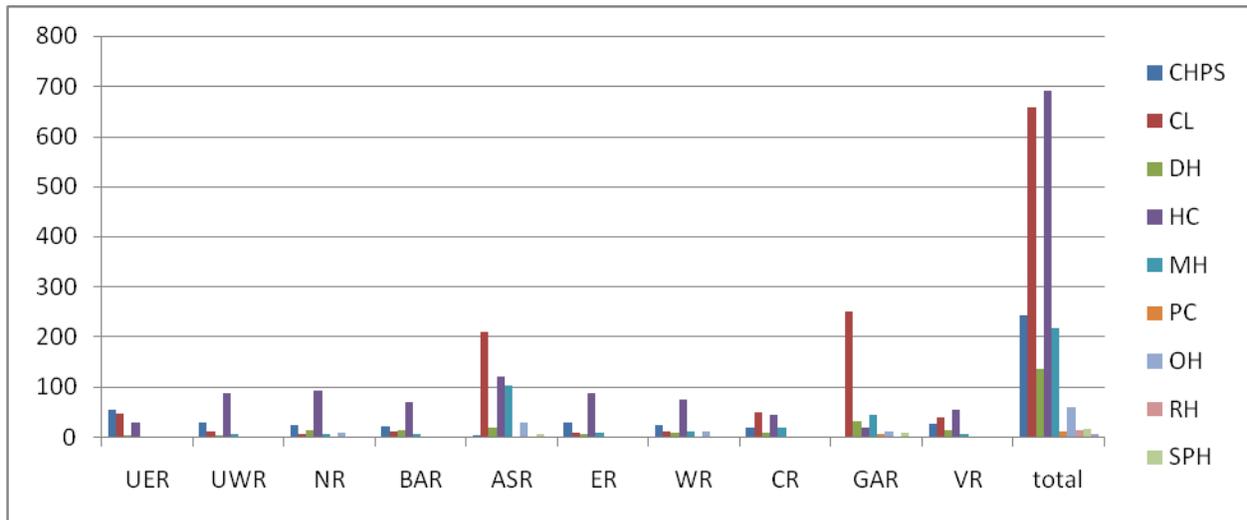
At the top of the pyramid are the few tertiary level healthcare facilities which are mainly concentrated in the two major cities in Ghana: Accra and Kumasi. These include the specialized as well as the teaching hospitals. The regional distribution of these facilities are skewed towards the urban areas of Ghana. There are 16 specialized hospitals out of which 8 are located in the capital town, Accra, 5 in Kumasi, the Ashanti regional capital, 2 in the Northern region and 1 in the Central region. Currently, there are 5 teaching hospitals in Ghana. 2 in Accra, 2 in Kumasi and 1 in Tamale, the Northern regional capital. These are established purposely for the training of healthcare personnel, to undertake health related research and handling highly complicated and high cost treatment of complex diseases and referral cases from the secondary level (Ghana Health Services, facts sheets 2006).

The secondary healthcare services are normally the first referral hospitals or centres from the primary level which are mostly situated in the district and regional capitals. These facilities are more advanced than the primary ones. They consist of district hospitals and polyclinics. Here, both in-patient as well as out-patient services are delivered. There are about 136 district hospitals, 10 polyclinics and 14 regional hospitals. There are also about 60 for-profit hospitals and religious based hospitals currently in Ghana (Ghana Health Services, facts sheet 2006).

At the broad base of the pyramid is the primary healthcare units that includes, the health posts, healthcare centres and clinics. Currently there are about 245 community health posts, 734 health centres, 671 clinics and 217 maternity homes in Ghana (Ghana Health Services, facts sheet

2006). These facilities serve as “gate keepers” where they undertake both preventive and curative care for some basic diseases like “common” headache, malaria, and stomach upsets. The facilities are mainly located in the small towns and selected villages. The distribution of the healthcare facilities on this structure is depicted in figure 2 below.

Figure 2.2: REGIONAL DISTRIBUTION OF HEALTHCARE FACILITES IN GHANA



(Source: Ministry of Health, Ghana and modified by the author)

NOTE:

- CHPS** Community Based Health Planning & Services
- CL** Clinics
- DH** District Hospitals
- HC** Health Centres
- MH** Maternity Home
- PC** Polyclinics
- OH** Other Hospitals
- RH** Regional Hospitals

SPH Specialist Hospitals

TH Teaching Hospitals

2.5 Mandate of the Ministry of Health and Its Agencies

The Ministry of Health (Mohr) controls and manages the health sector in Ghana and is responsible for policy development, planning, donor coordination and resource mobilization. There are also a variety of providers of healthcare services in the public, private and informal sectors. The Ghana Health Service (GHS) is the largest agency of the ministry and is responsible for service delivery organized at five key levels: national, regional, district, sub-district and community level.

There are other autonomous teaching hospitals, private providers accounting for 40% of patient care, a coalition of non-governmental organizations (NGOs) and the Christian Health Association of Ghana (CHAG) with hospitals and clinics. About 60% of the population has adequate access to healthcare facilities (within one hour travel) but increasing user fees deter the poor from access to healthcare. The government of Ghana in collaboration with the ministry of health implemented a National Health Insurance Scheme (NHIS) using the District-based Mutual Health Insurance Schemes (DMHIS) which was instituted in 2004 to reduce the financial barriers to healthcare caused by the user fee system (Ministry of Health / Ghana Health Service, 2001)

2.6 Disease Profile

In Ghana, Malaria accounts for about 40% of all outpatient attendances with a high mortality rate of (13%). Upper respiratory tract infections, tuberculosis, diarrhea (including cholera), yellow

fever and meningococcal meningitis are common. Tuberculosis is a major public health problem; in Ghana, not all districts are implementing the directly observed treatment, short-course (DOTS) strategy and case detection and treatment success remain very low.

According to data from the HIV Sentinel Survey, the national median prevalence has declined for a second time from 3.1% in 2004 to 2.7% in 2005. The commercial sex workers in Accra and Kumasi had respective rates of 76% and 82% in 2001, which reduced to 54% in 2002 in Accra. Guinea-worm disease particularly affects 15 districts particularly in the Northern, Brong-Arfo and Volta Regions and results in significant suffering (morbidity) and reduction in food production. Changes in environmental and lifestyle increasingly cause other non-communicable diseases: Hypertension, diabetes, chronic renal diseases, cancer and mental diseases are increasing and there is a rise in alcohol and tobacco use, and substance abuse (Ghana Demographic and Health Survey 1998, Ghana National Expanded Programme on Immunizations (EPI) Report 2001).

2.7 Health Status Indicators in Ghana

Available data on antenatal coverage on maternal and child mortalities still remains high since 1998 with the highest coverage of (96%) in the Ashanti Region and lowest (69%) in Upper West Region. There are still significant urban/rural variations in maternal and child mortalities in Ghana. On average, about only 44% of deliveries were supervised by medical staff; consequently, complications of pregnancy are common. Infant and under-five mortality remain high.

Malaria accounts for 22% mortality in children; only 9% of children and 8% of pregnant women use insecticide-treated nets. Access to sanitation remains low and diarrhea is a common cause of morbidity and mortality in children under five years. In 2001, overall immunization coverage was 91% with 76% for Diphtheria, Pertussis and Tetanus (DPT3) and 82% for measles but in some districts DPT3 coverage was below 50%. Road traffic accidents are now responsible for approximately 1300 deaths and 10,000 injuries per year (Ministry of Health / Ghana Health Service, 2001).

2.8 Linkage between the Economy and the Health Sector

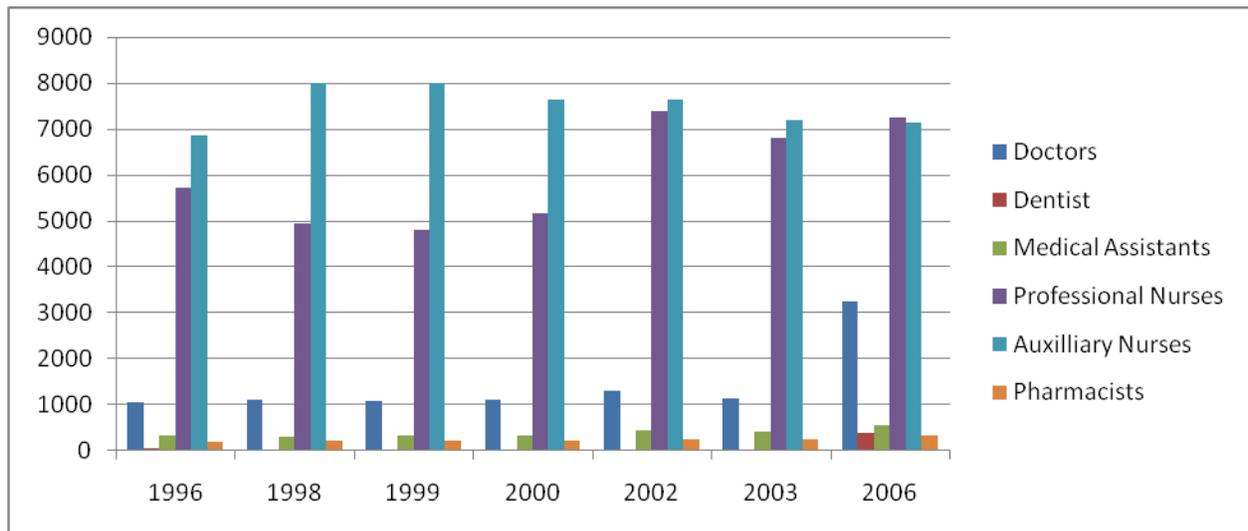
There is a strong linkage between the performance of an economy and all the other sectors of the economy including the health sector. The population living below the poverty level fell from around 54% in 1991-92 to below 40% in 1998-99. There are persistent inequalities across geographic areas and socioeconomic groups. User fees contributed to the widening health and income inequities in Ghana (Human Development Report 2005).

2.9 Distribution of Healthcare Personnel

In Ghana, the distribution of the human resources in the health sector has suffered from acute problems. The experience is that, a lot of the trained doctors and/or health workers do not accept postings to the rural and deprived areas where their services are most needed. The numbers and distribution of healthcare personnel is also affected drastically by the brain drain syndrome (mass exodus of health professionals abroad in search of greener pastures). This situation created an acute shortage of healthcare personnel in the country.

Statistical evidence from the human resource division of the Ghana health services (2005) indicates that, between 1996 and 2003, the total number of registered health professionals; Doctors, dentists, medical assistants and pharmacists, increased steadily from about 14,234 to a little below 16,000. There were also about 3,240 registered physicians in Ghana by 2006. These numbers were supplemented by a registered nurses and midwives population of 19,707. These numbers are quite high but inadequate to meet the demand of professionals in the health sector.

Most of the health facilities at the primary care levels are usually managed by the nurses and midwives. The human resource capacity for the health sector is not encouraging enough to achieve the set health goals of “earmarked health for all”. There are other health professionals within the health sector that provide supportive and essential services. Such professionals include, the Dentists and Laboratory Technicians, Environmental health workers, Community health workers and other staff (Human Resource Division, Ghana Health Services). The human resource capacity of health professionals in the health sector are shown in figure 3 below;

Figure 2.3: ANNUAL DISTRIBUTION OF HEALTHCARE PERSONNEL IN GHANA

(Source: Human Resource Division; Ghana Health Services database and modified by author)

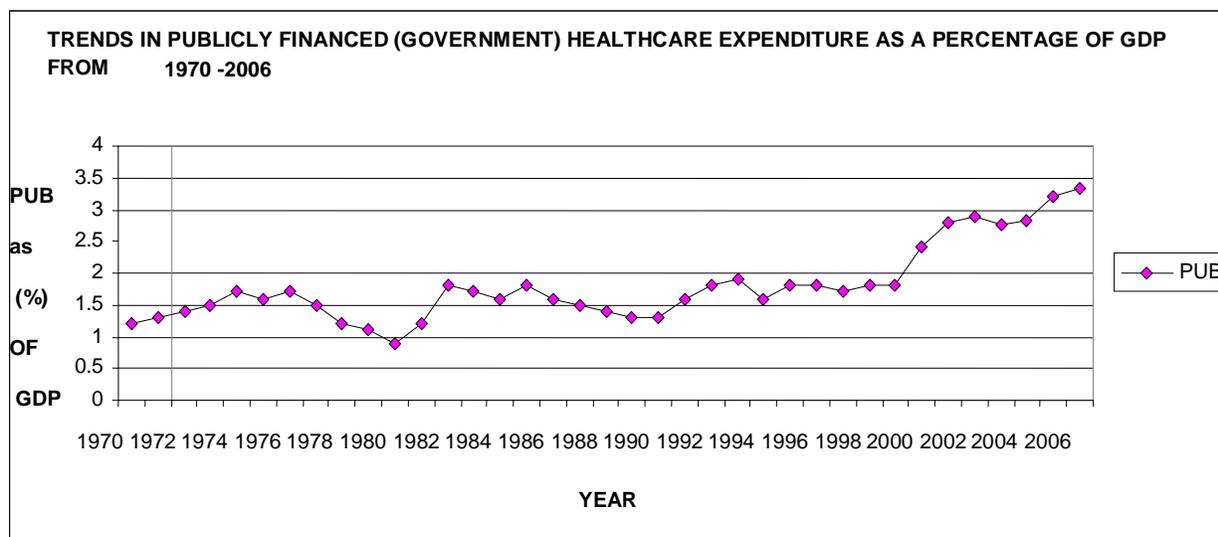
2.10 Healthcare Financing in Ghana

Healthcare financing in Ghana is related to revenue collection (donor funds aids, general taxation, private or voluntary insurance, community based financing), management of risks (insurance and subsidies) and strategic resource allocation and purchasing of priority health services. The government provides the bulk of the funds to the health sector. Healthcare in the country is funded from several sources such as; domestic public revenues (Central and sub-national), external public finance (bilateral and multilateral), Sector-wide approach programme (SWAP), debt relief from Highly Indebted Poor Countries initiatives (HIPC), national budget support, development loans and domestic private finance (User fees).

Between 1963 and 2003, Government of Ghana allocations to the health sector have enjoyed tremendous increases in nominal terms. Compared to total government spending, these allocations appeared to have stagnated over the years. Available data shows that government allocations to the health sector reached its peak of 9.13 % of total government spending in 1974 and between the early 1980's and the late 1990's took downward trends until 2003 when it rose to 9.8% of total government spending. (NDPC, Government of Ghana). Furthermore, the government of Ghana allocations to the health sector has undergone substantial changes over time in real terms. The share of health budget as a percentage of GDP has slightly, but remains below 1.5% in 2003.

The National health accounts estimates presented by WHO confirm government expenditure on health was relatively stagnated since 1998. The accounts however shown that privately financed healthcare expenditure in Ghana was above 50% of total healthcare expenditure in 2002. This trend in the composition of government healthcare expenditure in Ghana is shown on the figure below;

Figure 2.4: Trends in publicly financed(Government) healthcare expenditure in Ghana from 1970 to 2006



(Source: National health accounts, World Health Organization 2005, IFS 2007 and other issues)

NB:

PUB=Publicly financed healthcare (Government) expenditure as a percentage of GDP

Table 2.1: Proportion of health budget by sources

The major composition of finance to the Ghana health sector are shown in the table below;

Sources Finance	2001	2002	2003	2004	2005	2006
Government health Budget	51%	61%	62%	59%	59%	48%
Health Fund	13%	18%	15%	21%	n/a	13%
Earmarked fund from development partners	22%	8%	10%	6%	n/a	13%
Others(fees, Insurance)	14%	14%	14%	13%	14%	26%
Per capita expenditure on Health (US Dollars)	6.3	8.1	10.5	13.5	23.9	25.2

(Source: National health accounts estimates), Note: n/a indicates data not available for those years.

The European Union has in the past several years supported the health sector through national budget support. The Ministry of Health (MoH) also receives development loans from some of its partners to support health activities. However, external public financing sources are used for non-salary expenditure. The last source of funds to the health sector is from domestic private revenues (DPRs). The DPRs are charges derived from hospital fees. Hospital fees are composed of drugs (cost to be fully recovered) and hospital services. DPRs are collected and are wholly retained by the health facilities.

2.11 Health Sector Reforms in Ghana

Health sector reform is a problem-solving as well as a learning process and seeks solutions to major problems related to a country's healthcare system and policy. It can be defined as a sustained process of fundamental changes in national health policy and institutional arrangement, guided by government and designed to improve the functioning and performance of the health sector and ultimately, the health status of the population.

Health sector reforms in Ghana takes several dimensions involving major actors and/or stakeholders: Ministry of Health, Ghana Health Services, public and private healthcare providers, civil society organisations, in-country representatives of health sector donors and patients/population. These reforms are generally centred around specific areas: institutional reforms, reforms on mode of healthcare services delivery, financing of healthcare services, management, public-private partnership and management support systems.

In Ghana, the Ministry of Health (MoH) was reorganized by an act of parliament (Act 562) into a ministry-agency relationship. Subsequently, the MoH has been restructured along with its implementing agencies; the Ghana health service (GHS), tertiary institutions, specialized institutions, statutory and regulatory bodies. The ministry is responsible for policy formulation and coordination all activities within the health sector whilst the Ghana health services (GHS) was task with the implementation of policies for service delivery.

The major reasons for all reforms in Ghana are enormous; problems with resource misallocation, exploding cost of healthcare services (User fees), inefficiencies, inequity in health care delivery system, and the poor quality of services provision. In view of the above problems and several others, Ghana since independence has undergone some form of health reforms to address such problems with the objective of providing and improving the already deteriorating health outcomes and to manage the journey towards achieving the health related Millennium Development Goals.

Historically, all reforms in the Ghana health sector can be grouped into five phases; government led healthcare system in the early 1960's, the adoption of the Alma-Ata declaration in the 1970's, the era of economic restructuring in the 1980's, the adoption of the Sector-Wide Approach Programme (SWAP) in the mid 1990's and the lasting adoption of the National Health Insurance Scheme (NHIS) in 2005.

Soon after Ghana's independence in 1957, there was a strong enthusiasm by government to provide high-standard healthcare, education and many other services to the people. Government move to establish teaching hospitals and medical and nursing schools. These tertiary services consumed the largest proportion of the national budget. This government-led policy undermined the ability of the poor to have easy access to healthcare service. By the 1970's, the morbidity and mortality rates in the rural communities was further deteriorating in some places. Led by the World Health Organization (WHO), all its member countries including Ghana had to reform its health sector to adopt the Alma-Ata declaration of 1978 that formally adopted primary healthcare as a means of providing a comprehensive, universal, equitable and affordable healthcare services for all countries.

Between the late 1980's and 1990's, Ghana adopted the Structural Adjustment Programme (SAP) and the Economic Recovery Programme (ERP) that conditioned member countries to cut down on its public sector expenditure (fiscal austerity). This policy led to another reform of the health sector where user fees (Cash and Carry system), cost recovery and private health insurance was introduced as part of the reform process.

In addition to concerns with strategies for improving the performance of the health system in Ghana, the Sector-Wide Approach (SWAP) emerged in the mid 1990's where projects funds were contributed and directed to sector-specific umbrella and tied to defined sector policy under the government. The emphasis of the SWAP was to strengthen the management of the health sector

through adaptation of management tools, combined with strengthening of all institutional capacity.

The National Health Insurance Scheme (NHIS) was set up and implemented in 2005 to provide access to health services for all citizens, especially the poor and vulnerable. This reform was a follow-up to an earlier pilot community-based health insurance scheme (CBHIS). Currently, about 134 schemes are functional. The main purpose of this reform in the health sector is to reduce the financial burden of ill-health on the poor and to provide a pooled-fund for the health sector.

CHAPTER THREE

LITERATURE REVIEW

3.1 Introduction

Lack of theoretical guidance has been the center of debate for both econometric and statistical studies on healthcare expenditure determinants. To date, there have not yet been consensus in the literature on the particular econometrics and statistical method(s) to use and the type of health data to use for analyses (see Firat Bilgel 2003). While the debate is still ongoing, there is no conclusion concerning the magnitude of the income elasticity of healthcare expenditure. However, it is known that, in the presence of national health insurance, the individual income elasticity of healthcare expenditure is closer to zero but this income elasticity is likely to be greater than unity at the national level.

The chapter mainly covers considerable literature on the demand function for healthcare, the determinants of healthcare expenditure which will include studies on the public sector, individual healthcare as well as total healthcare expenditure determinants, income elasticity of healthcare expenditure.

3.2 Demand Function for Healthcare

Among theories and empirical studies on the demand function for healthcare highlights the relationship between health, healthcare and economic growth. The Demand for healthcare services is described within an orthodox static utility-maximizing framework originally pioneered by Grossman (1972). In this framework, individuals are assumed to consume

healthcare not because they value healthcare per se, but because it improves their stock of health, which is used as a productive resource. Cropper (1977) extended Grossman's model to account for the disutility that illness may impose on individuals, and to examine differences in the demand for preventive and curative care, and the dynamics of demand for healthcare over the life cycle.

Recognized firmly in human capital theory, these models value healthcare services in terms of their potential to improve productivity. While this is clearly one outcome of better health, the consumption value of improved health status would suggest that such measures are lower bounds. Health was to be viewed as a dimension of human capital, similar but not identical to education.

We can represent a simple preference function for healthcare within a standard utility-maximizing framework based on the formulation by (Cropper, M.L. 1977): he assumes individuals use their available resources to acquire health. In order to admit a substantive choice, individuals must have alternative uses for their resources. He bundle all of these alternative uses into a consumption good, denoted C . Utility is then represented as a function $U(C,H)$, where H is the level of health and not the quantity of healthcare services consumed but rather the level of health that the individual enjoys after consuming healthcare. We assume that greater health and higher levels of other consumption make the individual better-off, and that an increase in one coupled with a decrease in the other (of a particular magnitude) leaves the individual's well-being unchanged.

In the neo-classical theories of economic growth, Solow (1956) predicted a positive relationship between investment in healthcare, health and GDP. Solow concluded that increases healthcare is expected to increase health status of individuals which will intend increase productivity, educational attainment per unit of time and consequently reduce poverty by increasing incomes. Later models of endogenous growth also identified technological progress as a factor influencing growth and healthcare spending (Romar 1990).

Folland (1997) also concluded that technological changes in the healthcare industry raised the economic question about the effects these changes will have on the cost of healthcare. The study further predicted that technological changes may reduce the cost of care when it improves the productivity of the healthcare resources and may also increase cost of care when it improves the quality of healthcare. Technological improvements through innovation in the presence of health insurance may also result in a cost inflation effect in the healthcare industry since people will have demand for highly technological and economically costly services.

Healthcare is fundamentally a production process and shares many of its economic concepts with production generally. Several studies offer insights into the contribution of healthcare to health. On one hand, evidence suggests that lifestyle and environment expenditure could provide more marginal benefits per dollar cost of health than healthcare. On the other hand, healthcare is seen as a major contributor to health.

Economists and policymakers are so much concern about the price and income elasticities of the demand for healthcare. This is because; they determine the effects of various pricing and

distributional policies on healthcare demand. If there is no responsiveness of demand to price, then prices play little role in determining the allocation of healthcare resources among individuals. In the absence of financing constraints, free provision of healthcare might be warranted. But, if healthcare is responsive to price, some user fees should probably be charged to discourage overuse. These charges should however, not be so high as to force individuals into imprudent decisions about whether to seek medical attention. Similarly, if income has a large, with direct effect on demand or on the price responsiveness of demand, some form of targeting of subsidized healthcare services may be desirable.

3.3 Empirical Literature on the determinants of healthcare expenditure

This section basically reviews literature on the various factors that determines how much is spent on healthcare by the public (government), private and the mixed total healthcare expenditure. The study will also review literature on the econometric methodologies used in these studies.

Previous studies on the subject emphasize the importance of national income (GDP) in explaining the growth of total (a mixed of public and private) healthcare expenditure. These studies however considered a number of non-income factors as influencing total healthcare expenditure. Some of the non-income factors identified in the literature mentioned in the literature are; the relative price of health care (proxy by the ratio of medical CPI to GDP price index), the proportion of the population over the age of 65, urbanization rate and the publicly funded proportion of healthcare expenditure. While GDP accounts for most of the variation in total health care expenditure (see Parkin et al. (1987), the significance of non-income variables

were identified to depend on the structure of the population in general and the health sector in particular.

Pioneering the body of knowledge on the determinants of healthcare expenditure, Newhouse (1977) tried to answer the question “what determines the amount of resources a country devotes to healthcare?” Newhouse answered this question by using a sample of 13 countries within the United Nations, he regressed per capita total healthcare expenditure on per capita income. He estimated an income elasticity greater than one, which suggests that healthcare is a luxury good. Newhouse therefore suggested that the estimated income elasticities decrease as the income level rises.

A number of interesting empirical studies employed time-series data in analyzing the determinants of healthcare expenditure. Particularly, many of such studies were conducted using data from the OECD countries. In his study, Roberts (1999) employed techniques to analyze the properties of non-stationary variables over the period 1960-1993. The study adopted the Autoregressive Distributed lag (ARDL) model to capture the heterogeneity across the OECD countries. She regressed per capita total healthcare on per capita income, proportion of the population over the age of 65, relative price of health care, the proportion of publicly funded health spending and a time trend which captures technological change. She found income, the proportion of publicly funded health spending and the relative price of health care to have long run significant effects of total healthcare spending. The study estimated the long-run income elasticity to be above unity.

In a related study, Roberts (2000) addressed the problem of spurious regression in Hitiris' 1997 article. She acknowledged that regression of non-stationary variables may yield misleading results arising from the common trends in the data rather than the true economic relationship. Applying cointegration techniques using Hitiris (1997) dataset, Roberts (2000) estimated the short-run income elasticity of healthcare to be significantly below unity whereas Hitiris (1997) found income elasticity above unity. However, the existence of any long-run relationship between health spending and its determinants was unclear.

Getzen (2000) argued that healthcare is an individual necessity and a national luxury in the sense that the magnitude of income elasticity depends on the level of analysis. Getzen identified that, at the individual level, budget constraints do not provide sufficient information about how much to spend on healthcare as long as there is a system of pooling resources which removes those individual constraints. However, at the national level analysis, budget constraints still limits the amount of funds a country can devote to healthcare. Getzen therefore concluded that the analysis of the determinants of healthcare expenditure should be based on the units of observation at which decisions are being made.

In another interesting study, Okunade and Karakus (2001) employed ADF test for Unit Roots, Engle-Granger and Johansen cointegration analysis for real per capita health expenditure. They examined the determinants of total healthcare expenditure using data on real per capita GDP and relative price of health care¹⁹ OECD countries between 1960-1997. They estimated the income elasticity of healthcare expenditure to be above one. They concluded that their findings were consistent with the previous estimates. Clemente et al. (2002) examined the stability of HE

models in the OECD countries by adopting a cointegration approach. They criticized the stability assumption in the healthcare expenditure- income relationship and argued that there exist structural breaks which may bias the long-run relationship. They further conducted their analysis by disaggregating total expenditure as public and private health expenditure. The results suggested that the inclusion of structural breaks does not change income elasticity of health care spending being greater than one.

Estimating a demand function by using panel data for 18 OECD countries, Bac and Le Pen (2002) adopted a cointegration approach using a model where per capita total health expenditure depends on per capita GDP and the relative price of health care. They have found strong evidence on the cointegration of these variables. They used a various models including OLS, fully modified OLS (FMOLS) and dynamic OLS (DOLS) to enable them account for variations in results due to methodological differences. The latter two techniques accounted for endogeneity and serial correlation. Interestingly, the results confirmed that the income elasticity of health care spending exceeds unity.

There exist other empirical studies specially based on the OECD countries examining the cointegrating relationships and unit root problem. The first of such studies was evidence in the work by McCoskey and Selden (1998). Using a sample 20 OECD countries, they employed country-by-country ADF tests on a model where per capita total healthcare expenditure depended. They found that the variable contain no unit roots hence they rejected the null hypothesis of unit root. This led to the obvious conclusion by McCoskey and Selden (1998) that one need not be concerned about the existence of unit root in the OECD data.

In a contradictory study by Gerdtham and Löthgren (2002), they employed panel data for 25 OECD countries for the period 1960-1997. They examined the relationship between per capita total healthcare expenditure and income. They found that the unit roots tests indicated that both per capita healthcare expenditure and GDP are difference stationary series. They also found that in 12 countries out of 25 countries in the sample, per capita total healthcare expenditure and GDP were cointegrated. Presenting evidence on the stationarity and the presence of structural breaks in per capita healthcare expenditure and GDP covering 38 annual observations for 20 OECD countries, Jewell et al. (2003) suggested on the contrary that both per capita total healthcare expenditure and GDP are stationary if they allow for structural break(s).

Others studies also presented interesting and supporting findings. Di Matteo and Di Matteo (1998,) focused on the determinants of Canadian provincial government health expenditures within time-series framework for the period 1965-1991. The determinants of provincial government health expenditures were examined to be the real per capita provincial income, the share of senior population in total population and real provincial per capita federal transfers. The limitation of such is studies is that, the issue of stationarity (Unit roots) was not fully addressed, yet, they found that the income elasticity of government health care spending is 0.77. In a related study, Di Matteo (2000) decomposed total healthcare expenditure into the public-private mix. This allowed the examination of the public and private Canadian healthcare expenditures over the period 1975-1996.

The studies also examined the major determinants of public-private mix as per capita income, the share of individual income (at the individual level analysis) and federal health transfers. Health

expenditures are examined at another level as aggregates and categorized into sub-expenditures such as hospital, physician and drug spending. The empirical evidence suggested that increases in per capita income are associated with more private healthcare spending relative to public spending. In other words, increases in per capita national income leads to more of private spending than public healthcare expenditure.

In a modified study, Di Matteo (2003) employed data for the U.S states, the Canadian provinces and the OECD countries. He argued that estimates of the income elasticity of health expenditure and its magnitude is highly dependent on the level of analysis. Estimating data at the international level lead to the conclusion that the income elasticity of healthcare expenditure in total is greater than one. Di Matteo also provided evidence that the income elasticity of healthcare expenditure is higher at low-income levels and lower at high-income levels. Ariste and Carr (2001), also used provincial data on real per capita income, the proportion of the population over the age of 65 and the ratio of the deficit/surplus to GDP to explain the real per capita government health expenditures. They examined the non-stationarity of the variables, the cointegrating relationships and found that variables, both individually and collectively, are non-stationary and possibly non-cointegrated. They identified income, the ratio of the deficit/surplus to GDP, the share of senior population and a time trend capturing technological progress as the main the determinants of government health expenditures. They found an insignificant coefficient for the share of senior population. They also concluded that all the variables are non-stationary and non-cointegrated. They also estimated that the income elasticity of government health spending is 0.88.

Some of the studies in the early 1990s considered cross-section analysis. Gbesemete and Gerdtham (1992) applied cross-sectional data for 30 African countries to measure the effects of socioeconomic and demographic variables on per capita total healthcare expenditure. The regress per capita total healthcare expenditure on per capita GDP, percentage of the population under 15 years of age, crude birth rates and per capita foreign aid percentage of births attended by health staff, urbanization rate. They found that only per capita GDP, percentage of births and per capita foreign aid were positive and statistically significant. The income elasticity of healthcare expenditure was estimated to be below unity.

Gerdtham et al. (1992) also investigated a similar relationship for 19 OECD countries using cross-section data. They estimated a model of per capita healthcare determinants to depend on income, the relative price of health care, age structure and urbanization. The results estimated the income elasticity to be greater than one. In a closely related study, Gerdtham et al. (1994) incorporated other socioeconomic and demographic factors such as alcohol and tobacco consumption, income, age structure of the population, and female labor force participation ratio as well as various institutional factors in 22 OECD countries. They found that income elasticity is significantly below unity.

There are also a number of interesting empirical analyses based on panel data methodologies. Popular among them is the work presented by Hitiris and Posnett (1992). Using 560 panel observations for 20 OECD countries, they analyzed the determinants of per capita total healthcare expenditure. With an estimated income elasticity of less than unity, the results support

that GDP is the most important determinant of per capita total healthcare expenditure. They however found that the effects of non-income variables are important but very small.

Kanavos and Mossialos (1996) emphasized that the inclusion of national income does not reflect the society's ability to pay and argued that GDP may not be effective at all in explaining the growth of healthcare expenditure among countries such as Germany, Greece and the Netherlands.

Moore et al. (1992) specified a model of per capita healthcare expenditure to depend on per capita income, per capita number of physicians, nurses and beds, and the ratio of public expenditures to total health care expenditures. The results indicated that the number of per capita beds has a negative effect on health care spending. They also found that health is a necessity in the short-run while a luxury in the long-run.

Hansen and King (1996) while concerned about the nature of the model specification postulated that the per capita healthcare expenditure-income relationship is spurious if the variables are not stationary. Blomqvist and Carter (1997) used panel data for 18 OECD countries for the period 1960-1991 to check the common finding that health is a luxury good. They found out that both real per capita total health expenditure and income are non-stationary and cointegrated for most of the countries. The study found the income elasticity to be close to unity.

Casasnovas and Saez (1998) examined the determinants of per capita total healthcare expenditure using data for eight OECD countries in 1997. They found very significant country-

specific effects. They analyzed a model where log of per capita health expenditure depends on log of per capita income, share of public health spending and the share of population over the age of 65. The results confirmed that the income elasticity is far less than one. They also found that increases in the share of population over the age of 65 are associated with increases in healthcare expenditure.

3.4 Categories of determinants of healthcare expenditure determinants

The analysis of healthcare expenditure determinants has been based on a standard demand theory linking healthcare expenditure and GDP. Most of the studies that focused on the econometric models of healthcare expenditure determinants agree upon the view that the income elasticity of healthcare expenditure varies with the unit of observation and statistical method used in the analyses (Hitiris and Posnett 1992, Gerdtham et al 1992).

Empirical studies on healthcare expenditure determinants can be grouped into three generational studies based on the econometric models and type of data used (Atella and Marini 2002). The first generation studies are based on international comparison of healthcare expenditure linking healthcare expenditure and GDP (Newhouse 1977, Parkins 1987, Gerdtham et al 1992,). The second generational studies are based on panel data analyses of healthcare expenditure determinants. Panel data analyses enable us to test for the country-specific and time-specific effects (Gerdtham 1992, Hitiris and Posnett 1992).

Advancement in econometric and statistical methods led to extension in the empirical literature on healthcare expenditure determinants. Most of the third generation studies were based on the

OECD countries using cointegration and unit roots (Hansen and King 1996, Mckoskey and Selden 1998, Jewell et al 2003).

Table 3.1: Summary of literature

Author	Year	Type of analysis	Methodology	Countries of study	Sample size	Determinants	Income Elasticity
Grossman	1972,1999	Demand for health	Demand function	theory	General	Healthcare, all other goods	..
Cropper	1977	Healthcare demand	Extension of Grossman model	theory	General	Disutility of ill health	..
Solow	1956	Demand for health	Growth model	Theory/ practice	..	GDP, healthcare	..
Folland	1997	Demand for healthcare	..	theory	General	Technological progress	..
Newhouse	1977	Cross section	Linear , log-linear	UN	13	GDP	>1
Newhouse	1992, 1999	Cross section	Linear	Technological progress	..
Gerdtham et al	1992	Cross section	Log functional form	OECD	19	GDP, Price of healthcare, Urb, Pub, pop65	>1
Gbesemete and Gerdtham	1992	Cross section	Log functional form	African Countries	30	GDP, Aid, birth rate,urb, pop below 15	Around 1
Gerdtham et al	1994	Time series /cross section	Cointegration	OECD	22	GDP, FLPR,ATC, Age and demographic factors	>1
Blompvist and Carter	1997	Panel data	Cointegration	OECD	744	GDP, pop 65	>1
Casasnovas and Saez	1998	Panel data	Random Effects	OECD	880	GDP, Pop 65, Pub	<1
Di Matteo and Di Matteo	1998	Panel data	Fixed Effects	Canada	270	GDP, Federal transfers, Pop 65	<1
Roberts	1999	Panel data	Non-Stationarity	OECD	660	GDP, Pub, price of healthcare	Around 1
Hitiris and Posnett	1992	Panel data	cointegration	OECD	20	GDP, pop65	>1
Hitiris	1999	Panel data	Fixed Effect, linear form	G7	217	GDP, Pop65, Pub	Around 1
Okunade and Karakus	2001	Panel data	Cointegration	OECD	722	GDP, Price of healthcare	>1
Ariste and Carr	2001	Panel data	Coimtegration	Canada	330	GDP, Pop65, Ratio of Deficit to GDP	<1
Clemente et al	2002	Panel data	Cointegration	EU and OECD	185	GDP	>1
Bac and Le Pen	2002	Panel data	Cointegration	OECD	432	GDP, Price of health	>1
Moore et al	1992	Cross sectional	Log linear function	GDP, DOC, PUB	..

CHAPTER FOUR

METHODOLOGY

4.1 Introduction

Previous studies on the determinants of healthcare expenditure are characterized by lack of dynamics in the specification. The failure to include certain key variables as determinants to capture both the income and price effects of healthcare spending will lead to specification errors and incorrect estimates. It is often asserted that the structure of a country's health spending adjustment process is not well known. In most cases, income have both permanent and transitory component and incomes earned in a particular year may not be fully spent in the same period but rather spent over time. To avoid misleading and biased conclusions thereafter, one should therefore expect lags of some variables in the specification (Getzen 2000).

The model specification in this study will be based on times series and the nature of the data will determined the specific model to adopt. Proxies are used for certain variables in the study due to unavailability of health data. Identifying a model of healthcare expenditure determinants in Ghana will constitute the first step in an attempt to inform policy to predict the long term growth of healthcare expenditure and to justify the particular area of healthcare, resources should be diverted in order to produce the most in terms of health outcomes. In order to quantitatively examine the determinants of per capita government healthcare expenditure in Ghana, a time series modeling technique is employed using data for Ghana over the period 1970 to 2006.

The exact functional specification of the model is therefore dependent on the nature of the data. A test for unit roots (stationarity) and therefore, a test for cointegration of the variables will justify the validity or otherwise of the use of an Error Correction Model (ECM).

4.2 Methodological Issues

On the economic frontier of healthcare expenditure determinants, there has not yet been a formal theory that predicts the per capita healthcare expenditure growth of nations. Following from Parkins, McGuire and Yule(1987), formidable problems exist when researchers attempt to specify a formal model of health expenditure determinants through the spending behaviour of the economy.

The main methodological issue on the determinants of healthcare expenditure is the absence of a formal theory. Most studies on this subject are based on pre-existing modeling. The literature mainly consist of international panel studies based on cross-country comparison of healthcare expenditure determinants, allowing for greater size of the samples. However, working with times series data will bring a lot restrictions regards to the sample size and the accuracy of the asymptotic test. The model should therefore be treated with the greatest caution.

4.3 Model Specification

Following empirical studies on the determinants of healthcare expenditure, several factors have been identified. The study is basically designed to use time series approach in modeling the determinants of healthcare expenditure in Ghana. The dependent variable shall be per capita government expenditure on healthcare.

Several studies on the determinants of healthcare expenditure argued that income (GDP) is the main determinant of healthcare expenditure (see Newhouse 1987, Gerdtham et al 1992, Hitiris and Posnett 1992). This assertion is based on the underlying economic principle that the ability to spend depends to a large extent on income level. It is expected that as GDP increases, healthcare expenditure will continually increase over time at the national level.

In the context of traditional macroeconomics, a country's ability to spend depends mainly on its income level, however, in the area of healthcare industry, healthcare expenditure cannot be said to be solely dependent on a country's ability to pay (income) but also depend on several other variables such as; the proportion of publicly funded healthcare expenditure (as a percentage of GDP), the relative price of healthcare/medical care (price effect since individuals spend in response to the system of healthcare payment), proportion of population ages 65 years and above, life expectancy at birth (measure of population health status), urbanization rate, educational levels and technological progress.

The study employs the dynamic model based on Firat Bilgel (2003) formulation in analyzing the demand approach to healthcare expenditure determinants in Turkey for the period (1927 - 1996). The dependent variable is the per capita government healthcare expenditure in Ghana which is considered in the following model with some modification by the researcher based on the availability of health data.

$$HCE = f(GDP, POP65, POP15, LEB, URB, ATH) \dots \dots \dots (1)$$

Where,

HCE is per capita government healthcare expenditure

GDP is per capita GDP

POP65 is the proportion of population ages 65 years and above

POP15 is the proportion of the population below the ages 15 years

LEB is life expectancy at birth (measure of population health status)

URB is urbanisation rate (proportion of population living in towns with more than 5,000 inhabitants)

ATH is the proportion of population (as percentage of total population) with access to basic health facilities

4.4 Structural Model

The motivation for this study is to model the determinants of healthcare expenditure in Ghana. To achieve this objective, we can express a standard empirical model for per capita government healthcare expenditure determinants in a linear specification as below;

$$HCE_i = \beta_0 + \beta_1 GDP_i + \beta_2 POP65_i + \beta_3 POP15 + \beta_4 LEB_i + \beta_5 URB_i + \beta_6 ATH + \varepsilon_i \dots \dots \dots (2)$$

Where;

HCE is per capita government healthcare expenditure.

GDP is per capita GDP (in national currency units at current market prices)

ε is an identical and independently distributed error term (White noise)

β_0 is the constant

β_i is vector of parameters (estimated coefficients)

i is time (1, 2, 3, . . . , T)

Following the specification from Bewley (1979) formulation, we can transform the linear specification to a natural log-linear form. The advantage of writing the model in log-linear form with respect to the explanatory variables is that the elasticities can be evaluated at a point. This transformation can be written in such form that the estimated parameters are direct long-run elasticities or effects. The specification can thus be expressed as follows;

$$\ln(HCE_i) = \alpha_0 + \beta_1 \ln(GDP_i) + \beta_2 \ln(POP65_i) + \beta_3 \ln(POP15_i) + \beta_4 \ln(LEB_i) + \beta_5 \ln(URB_i) + \beta_6 \ln(ATH_i) + \varepsilon_i \dots \dots \dots (3)$$

We can modify this model by replacing the initial equation above by a first-order autoregressive, AR(1) model in which per capita government healthcare expenditure depends on a one period lagged value of HCE. The inclusion of this lagged value of the dependent variable is purely intuitive by the fact that the budget of the current year is prepared year earlier and government will usually consider this lagged relation when deciding on how much to spend on health in the current year.

Finally, the following modified model is considered;

$$LHCE_i = \beta_0 + \beta_1 LHCE_{i-1} + \beta_2 LGDP_i + \beta_3 LLEB_i + \beta_4 LPOP15_i + \beta_5 LPOP65_i + \beta_6 LURB_i + \beta_7 LATH_i + \varepsilon_i \dots \dots \dots (4)$$

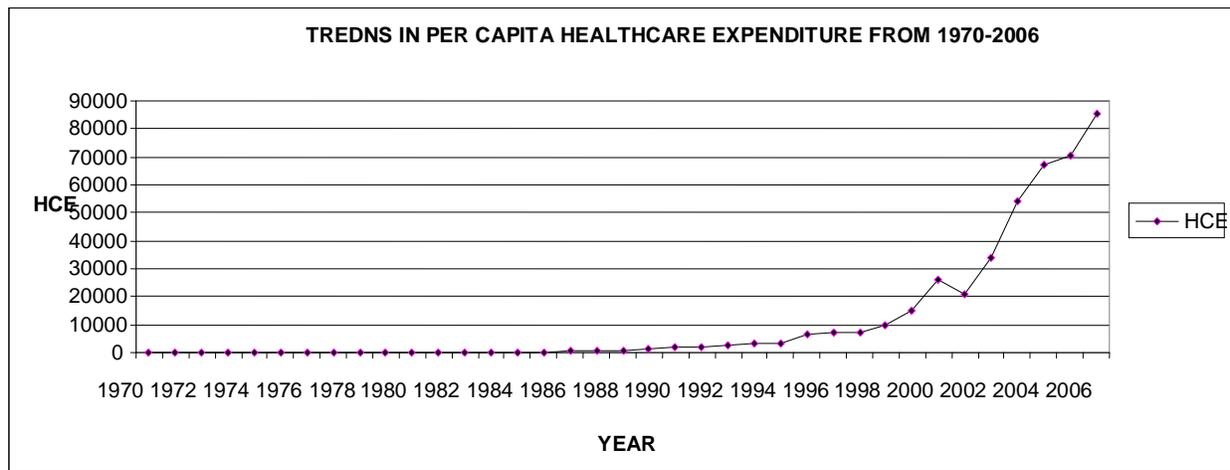
4.5 Definition of the Variables

4.5.1 Per capita publicly financed(Government) healthcare expenditure

A common measure of healthcare expenditure is the amount of expenditure devoted solely to the health sector with the main objective of improving health. This consists of the sum of all expenditure made by central government for hospitals, clinics and public health affairs and services; for medical, dental and paramedical practitioners; for medications, prosthesis, medical equipment and appliances; for applied research and experimental development and for health

affairs. This includes both recurrent and capital (development) expenditure allocation by the central government to the health sector in Ghana. This figures will be divided by the total population for each corresponding year in order to expressed them in per capita terms.

Figure 4.1: Trends in per capita public (government) healthcare expenditure in Ghana from 1970 to 2006.



Source: Ghana Statistics, Quarterly Digest of Statistics (1960-2007) and with modification by the author

NB

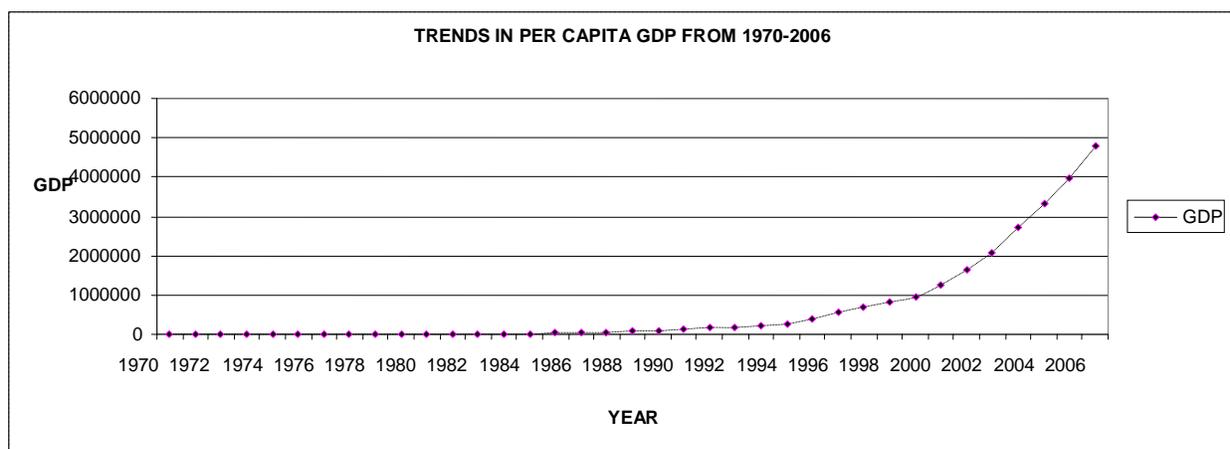
HCE=per capita government (publicly financed) healthcare expenditure.

4.5.2 Per capita Gross Domestic Product (GDP)

This measures the income level of a country. A country’s ability to spend on healthcare depends to an extent on its income level measured in terms of GDP per capita. Both economic theory and practice posit per capita GDP to be positively correlated with per capita healthcare expenditure. Empirical studies on the determinants of healthcare expenditure suggest income as the major determinant of healthcare expenditure. Economic theory also argues that other things being

equal, the amount of government will spent on healthcare should depend on its income level measured in terms of GDP per capita. Therefore as the income level of a country increases, its share of healthcare allocation increases as well, holding all other factors constant. Empirical evidence therefore suggests a positive income coefficient with inconclusive results on the magnitude of the coefficient.

Figure 4.2: Trends in per capita Gross Domestic Product in Ghana from 1970 to 2006.



Source: African Development Indicators and World Development indicators 2007 with modification by author

NB

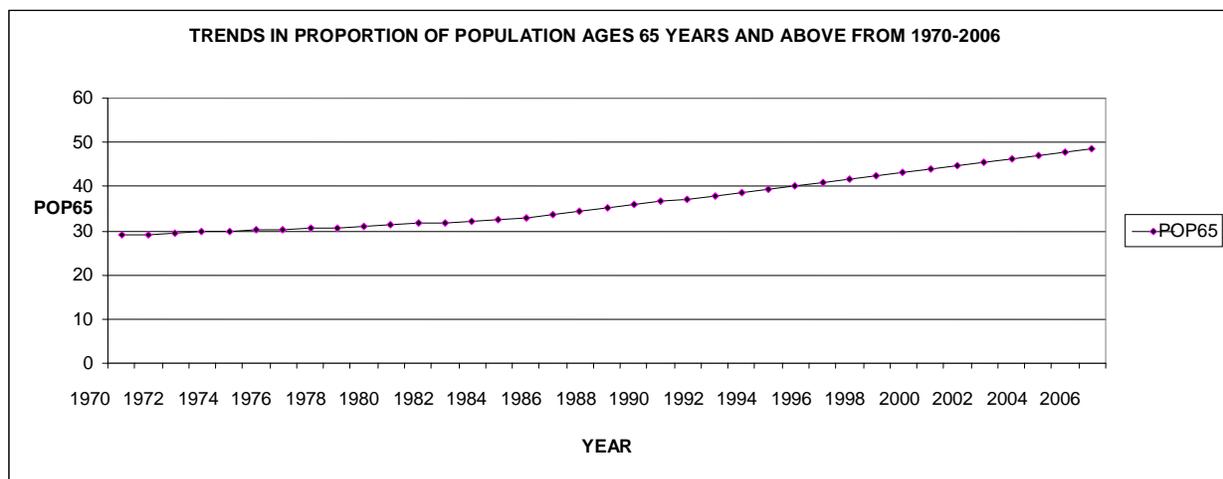
GDP=Per capita Gross Domestic Product

4.5.3 Proportion (in percentage) of total population aged 65years and above, (POP65)

This measures the proportion of the population age 65 and above (as percentage of total population). It is used as a measure of a population human capital. According to Grossman (1972, 1999), the population health stock depreciates over time. The elderly populations tends to have higher rates of depreciation in their health stock (depreciation in the population health stock is an increasing function of age). Governemnt must continually invest on the health of the aged

(persons aged 65years and above) by providing them with more healthcare than persons below that age group. Treatment of the aged also involves prolonged, hardly curable, higher cost, complex illness requiring technical knowledge and equipment that increases the cost of healthcare. One will therefore expect a positive relationship between the proportion of population aged 65years and above and healthcare expenditure.

Figure 4.3: Trends in proportion (as percentage) of population age 65years and above from 1970 to 2006



Source: African Development Indicators, World Development Indicators 2007 with modification by author

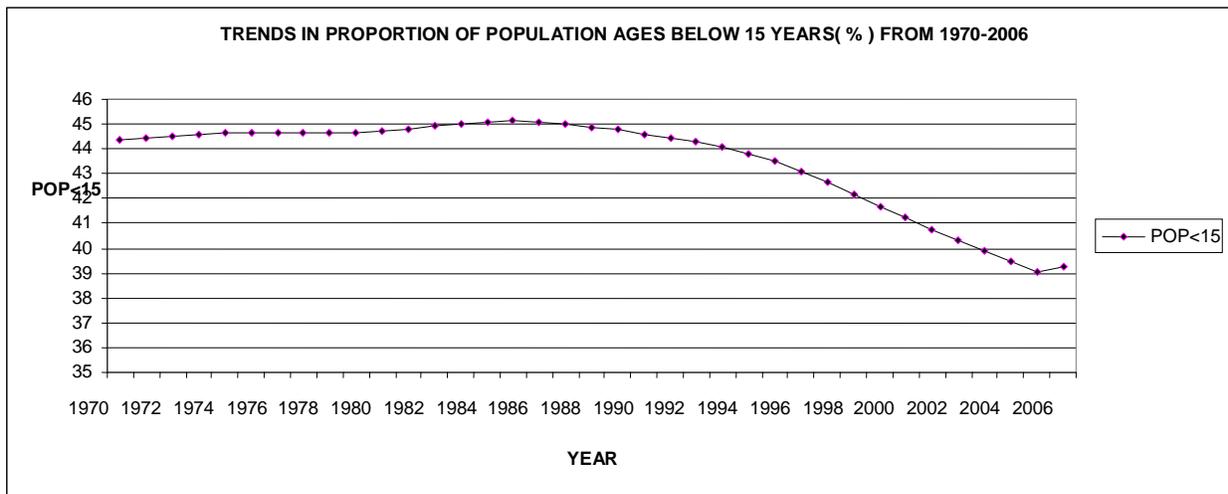
NB

POP65=proportion of population ages 65years and above

4.5.4 Proportion (in percentage) of total Population below 15 years (POP15)

This measures the proportion of the total population below the ages 15 years expressed as a percentage. Statistical data on Ghana indicates that the proportion of population that is below the age of 15 years recorded an average of 45.3% of the total population in 2005 and an average of 39.20% of the total population in the 1970's. Since the population structure of Ghana is mainly composed of the minor population, the inclusion of the variable is necessary in order to capture the influence of the young/minor on the long term cost of healthcare. Theoretically, younger population also tends to consume more healthcare than the adult and active population of between ages 15 and 64 years. We will therefore expect a positive association between the proportion (in percentage) of the population below 15 years and healthcare expenditure.

Figure 4.4: Trends in proportion (as a percentage) of the population below 15years from 1970 to 2006



Source: African Development Indicators, World Development Indicators 2007 with modification by author

NB

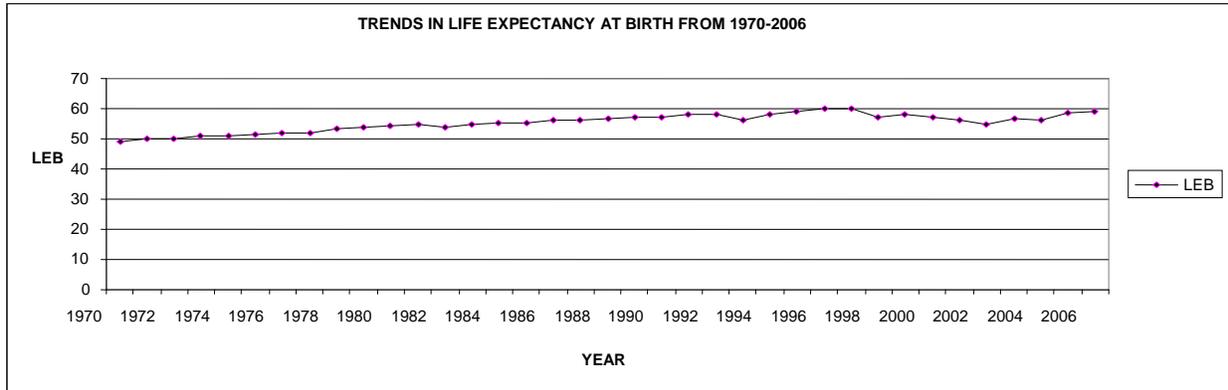
POP<15=proportion of population ages below 15years

4.5.5 Health status of the population measured by Life expectancy at birth (LEB)

Currently, the widely recognised measure of aggregate population health status are the Quality Adjusted Life years (QALYs) and the Disability Adjusted Life years (DALYs). Due to data unavailability, this study will use the life expectancy at birth as a proxy for the population health status. The shortcoming of using life expectancy at birth is that, it measures quantity of life rather than quality of life years. The relationship between healthcare expenditure and health status is very controversial.

Theoretically, increasing life expectancy is associated with long-term cost of healthcare and the sign of this effect is ambiguous. We will expect a positive effect if marginal increases in health status leads to an increase in healthcare expenditure. This implies that the cost of maintaining higher health status increases. Hence, we will need to spend more on healthcare in order to make people live longer. Otherwise, we expect the effect to be negative if marginal increases in health status decreases health expenditure implying that cost of maintaining previous levels of health decreases as the health condition improves. This situation leads to less need for healthcare and thus less expenditure on healthcare.

Figure 4.5: Trends in life expectancy in Ghana from 1970 to 2006



Source: African Development Indicators, World Development Indicators 2007 with modification by author

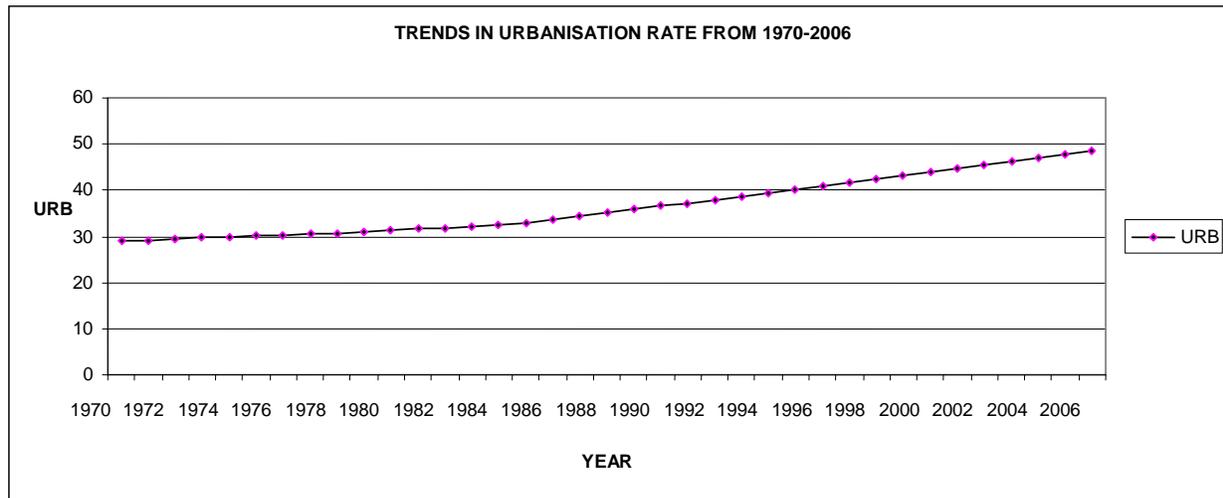
Where, LEB=Life expectancy at birth

4.5.6 Urbanization rate (URB)

This variable is used to capture the fraction of the population living in towns with more than 5,000 inhabitants (Ghana Statistical Service: 1980, 2000 Population and Housing Census, Special Report on Urban Localities, 2002). The inclusion of this variable in the model is to enable us measure the degree to which per capita healthcare expenditure could increase with changes in the proportion of population living in urban areas. The main justification for the inclusion of these variable in the study is that, most urban areas are associated with higher risks of contagious diseases, they can easily access healthcare facilities , they have lower travel time and cost to healthcare facilities. This implies that more people will tend to use healthcare facilities in the urban areas than rural dwellers who may not even have

access to a proper healthcare facility. We will expect a positive correlation between urbanisation rate and per capita government healthcare expenditure.

Figure 4.6: Trends in Urbanization rate in Ghana from 1970 to 2006



Source: African Development Indicators, World Development Indicators 2007 with modification by the author.

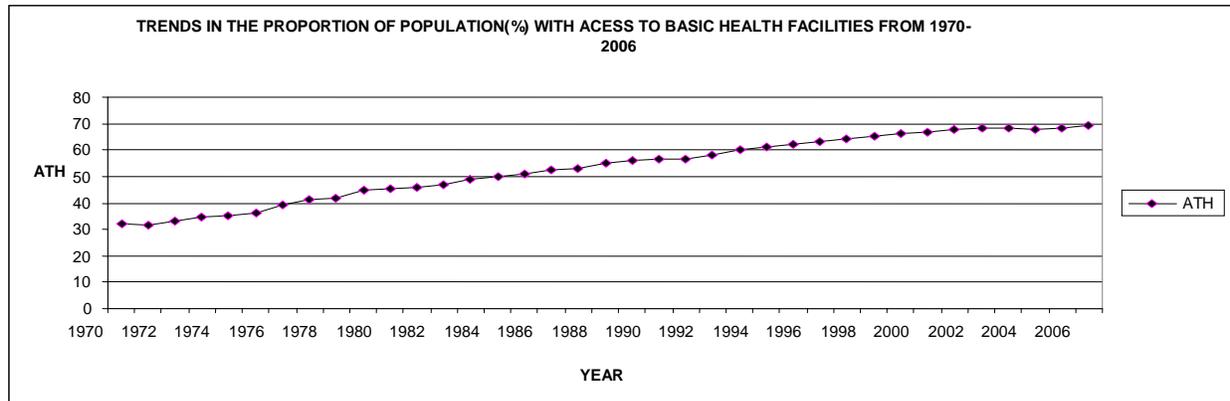
Where URB= Urbanization rate

4.5.7 Proportion of the population with access to basic healthcare facilities (ATH)

This measures the proportion of the population (as percentage) of total population with access to basic healthcare facilities such healthcare centres, clinics and hospitals. It is often maintained however that, the availability of healthcare facilities does not necessarily guarantee accessibility to healthcare. Economic theory does not help us with expectations to the sign of this effect. Several economic and epidemiological factors have been identified as possible determinants of per capita government healthcare expenditure. Nonetheless, there is no evidence in the literature on the relative importance of such factors. The inclusion of this variable implies that, those who have easy access to healthcare facilities are more likely to use healthcare than their counter parts

that do not have access to such facilities, all other things being equal. We may thus expect the positive correlation between the variable and healthcare expenditure.

Figure 4.7: Trends in the proportion of the population (%) with access to basic health facilities from 1970-2006.



Source: African Development Indicators, World Development Indicators 2007 with modification by author

Where ATH= proportion of the population with access to basic health facilities

4.6 Data Sources

All data used for this study are annual secondary data covering the period 1970 -2006. The sources of data were extracted from various issues. Data on the dependent variable; per capita government healthcare expenditure data are extracted from the Ghana Statistical Service, Quarterly Digest of Statistics and international financial statistics year book. By definition, it consists of the sum of all expenditure made by central government for hospitals, clinics and public health affairs and services; for medical, dental and paramedical practitioners; for medications, prosthesis, medical equipment and appliances; for applied research and

experimental development and for health affairs. This definition includes both recurrent and development expenditure made by the central government.

Other variables that are of interest to the study are per capita GDP, proportion of population ages 65 years and above, proportion of population below 15 years, Urbanisation rate, and the proportion of population with access to basic healthcare facilities. GDP is used to measure the income level of the country. Life expectancy is used to crude proxy populations health status, proportion of the population below 15years, 65years and above are used to proxy the age structure of the population. Urbanization rate measures the composition of the population in terms of number of people living in the urban areas. The proportion of population with access to healthcare facilities captures proximity to healthcare facility.

All these data were drawn from are drawn from various issues of World development indicators (WDI-2007), African Development Indicators (ADI 2007), Global Development Indicators(GDI 2007), Ministry of Finance (MoF), Ministry of Health (MoH), Ghana Health Services (GHS), International Financial Statistics (IFS 2005, 2007), United Nations Development Programme (U.N.D.P) and the World Health Organisation (WHO).

Inconsistency in data is the main limitation of this study since the data were extracted from different sources.

4.7 Procedure of Estimation

Most researchers using time series data have limited knowledge about the economic process which generates the observed data. Models involving such data are transformed by economic and statistical theory and tested using econometric techniques. Therefore, it is necessary to consider also the process that generates the time series variables. In econometric modeling, we assume that the data are stationary at their levels but it has been shown that models containing non-stationary variables will often result in the common problem of spurious regression. In this case, the results will show statistically significant relationship between the variables in the model when infact they are obtained from contemporaneous correlations rather than meaningful economic relations.

4.7.1 Testing for Unit roots

If appropriate tests are not employed in econometric modeling, the presence of unit roots may result in a common trending between the variables rather than meaningful economic relationship (see Engle and Granger ,1974). A model should be treated over stationary forms of the variables. A common problem in time series is the existence of unit root. Regression on non-stationary variables results in spurious correlation, commonly called “seemingly good” regression. Therefore this study will consider the Augmented Dickey-Fuller (ADF) unit root test proposed by Dickey and Fuller (1979) under the null of unit root.

The first problem that appears in unit root testing is whether to include a time trend. On one hand, Hansen and King (1998) claimed that Augmented Dickey- Fuller (ADF) regression should

include a linear trend. On the other hand, McKoskey and Selden (1998) argued that it should not include a time trend. It has however been observed that most macroeconomic variables have the tendency to increase over time; therefore it is appropriate to include a deterministic component into unit root testing. However, some variables may not evolve around a trend component at all, yet may appear stationary. Economic theory does not help as to whether to include a linear trend or not, but for the purpose of this study, we will include a time trend since we can observe some trends either downwards or upwards in the variables above.

4.7.2 Cointegration

Most time series variables are classified as being integrated of order d , denoted as $I(d)$, that is, if the series must be differenced d times in order to become stationary then it contains d unit roots. The economic interpretation of cointegration is that, two or more series are linked to form a long run equilibrium even though they may be non-stationary (they may contain stochastic trends). If the variables are non-stationary then they will never move closer to each other over time and the difference between them will be stationary (stable). Cointegration in econometric modeling is used to mimic the existence of this long run equilibrium to which these economic variables converge over time.

When two or more series have unit roots (non-stationary), they may also be cointegrated. In the presence of unit roots, we test for cointegration of these variables to capture the long run equilibrium relationship between the variables. Otherwise, no equilibrium exists. If the series are cointegrated, then we have information about their long run behaviour of the variables and the coefficients are interpreted as the long run multipliers. We can then estimate the short run

parameters by an Error Correction model. Otherwise, we estimate an Autoregressive Distributed Lag (ARDL) model when the series have unit roots and are not cointegrated.

4.7.3 Error Correction Model (ECM)

The use of an error correction model in this study will be necessary if the variables have unit root and are cointegrated. The preliminary test for the existence of cointegration is done through inspection of the order of integration of the variables. If the variables are integrated of the same order, then the test for cointegration and the use of an Error Correction Model becomes appropriate and the number of cointegrating vectors will be determined. An Error Correction Model represents the disequilibrium relationship between the short run and long run parameters. The absence of an error correction model in this case will lead to loss of the short run parameters in the model.

4.7.4 Autoregressive Distributed Lag Model (ARDL)

After testing for the presence of unit roots in the variables, if the variables contain unit roots and are not cointegrated, then we cannot apply an Error Correction Model. In this case, it becomes necessary to employ the popular econometric model using the Autoregressive Distributed Lag (ARDL) modeling to capture both the short run and long run influence of these variables. The regressors may include lagged values of the dependent variable and current and lagged values of one or more explanatory variables. This model allows us to determine what the effects are of a change in a policy variable.

The choice of an Error Correction Model (ECM) or an Autoregressive Distributed Lag Model (ARDL) will depend on the nature of the available health data.

CHAPTER FIVE

MODEL ESTIMATION AND INTERPRETATION OF RESULTS

5.1 Introduction

In this chapter, we conduct a rigorous test for unit roots (test for stationarity of the variables) as propounded by Dickey and Fuller (1979) and Philip and Perron (1988) and the test for cointegration of the variables (based on the Johansen cointegration test procedure). This precedes the final estimation of the true long run and short run static models of the determinants of healthcare expenditure. The study then estimated the final logarithmic model in order to interpret the results based on economic theory and statistical significance of the explanatory variables.

5.2 Estimation and Diagnostic Tests of Long Run Model

Table A1 in the appendix shows the summary descriptive statistics of the variables used for the study. The study employed 37 times series observation on available health data in Ghana from 1970 to 2006. The Jarque-Bera statistics for normality shows that the log of all the variables are not randomly distributed. In other words, the variables are normally distributed at 5% level of significance. The variables used for the study includes;

HCE= per capita healthcare expenditure

GDP=per capita gross domestic product

LEB= life expectancy at birth

POP15=proportion of the population below 15 years

POP65=proportion of the population ages 65 years and above

URB= urbanisation rate

ATH = proportion of the population with access to the basic healthcare facilities

The study considered the Augmented Dickey-Fuller test and the Philip Perron test for unit roots. Under both tests statistics, a variable is stationary (contains no unit roots) if the ADF test statistic or the Philip Perron tests statistic is less than the conventional 5% critical value. Otherwise, we compared the t-prob with the significance level of 5%.

5.2.1 Results of Units roots test and graphical representation

To model the determinants of healthcare expenditure, it is useful to first determine the order of integration of the considered variables. The results of the unit roots test based on both the Augmented Dickey-Fuller and Philip Perron test statistics with the inclusion of only a constant and with a constant and linear trend are displayed in the table 5.1 below. All analysis are carried out using Eviews 5.0 statistical package.

The results shows that all the variables contain unit roots (non-stationarity) at their level at both 1% and 5% significance level. The results however confirms that all the variables are stationary at their first difference. In other words, all the variables are integrated of the same order I(1). The graph showing the stationarity of the variables are to be found in figures A1 and A2 in the appendix. The results are shown in table 5.1 below;

Table 5.1 : Results of Unit Roots test

Variable	ADF		Philip Perron		Order of integration
	Constant	Contant and Trend	Constant	Constant and Trend	
LHCE	-0.3078	-2.6053	-0.1773	-2.2314	I(1)
DLHCE	-6.3192***	-6.2423***	-6.4549***	-6.3826***	
LGDP	-1.0195	-0.4356	-0.8775	-0.9938	I(1)
DLGDP	-4.5470***	-4.7282***	-4.5919***	-4.7021***	
LLEB	-1.9029	-2.1044	-1.9207	-2.1044	I(1)
DLLEB	-6.8535***	-6.8961***	-6.8535***	-6.8680***	
LPOP15	-1.2125	-1.6645	2.1482	-0.4828	I(1)
DLPOP15	-3.9712***	-3.9986***	-3.3900**	-3.5055***	
LPOP65	2.4364	2.5838	2.6039	1.7989	I(1)
DLPOP65	3.6356***	-3.7882***	-3.1673**	-4.7472***	
LURB	0.5653	-2.5851	2.6109	-2.3384	I(1)
DLURB	3.6802***	-4.0096***	-3.8059***	-3.8349***	
LATH	-2.2021	-1.0894	-2.2959	-0.1721	I(1)
DLATH	-4.8485***	-3.5293**	-5.1204***	-8.6901***	

Source: Computed; Note: D represents the difference operator of the variables and L represents the logarithm of the variables. The ADF and PP Critical Values are provided below, **ADF test** : - **3.6268**, **-2.9458** and **-2.6115** for 1%, 5% and 10% respectively. **The Philip Perron (PP) test**; - **3.6268**, **-2.9458** and **-2.6115** for 1%, 5% and 10% respectively. ***, ** (*) means significance at 1%, 5% and 10% respectively. We start with a maximum lag length of 2 and pare it down as per the Akaike Information Criterion.

There is no general rule on how to choose the maximum lag to start with. Researchers usually employ a rule of thumb which is the cube root of the number of observation. The advantage of testing for unit roots is to remove any spurious results that arise from contemporaneous relationship rather than meaningful economics relations. Another advantage of testing for unit roots in the variables is to capture the short run dynamics of per capita healthcare expenditure as well as the long-run effects. An Error Correction Model (ECM) for the model are estimated to capture both the long-run and short-run relationship between the variables.

There are however, problems associated with unit roots test. This is due to the facts that unit roots test can sometimes be biased. Said and Dickey (1984) and Philip and Perron (1988) have shown that the power of the Dickey-Fuller test is very low and may not be able to distinguish between a unit root and a near unit root process. This becomes a limitation to this study since the test does not clearly distinguish between trend stationary and a drifting process. For these reasons, the low power of the unit roots test may not give very accurate stationary results. We rectify this problem by comparing the values of the Augmented Dickey-Fuller test with the Philip Perron unit roots test procedure.

5.2.2 Testing for Cointegration and Modelling Error Correction

The study applied the Johansen (1991) test procedure to capture the long run relationship between healthcare expenditure and its determinants. This procedure is the maximum likelihood for vector error correction and is easily calculated using eviews. The choice of this method is not just because it is a VAR. The model is simple in modelling time series variables. The procedure also performs better than the single equation and/or multivariate regression methods.

We applied an error correction model to capture both the short and long run relationship. The intuition behind error correction model is that, we need to recover information lost from differencing the variables to get stationarity. This problem is rectified by introducing an error correction term. The error correction term is derived in this model from the long run equation based on the basic economic theory to measure the speed of adjustment of healthcare expenditure

to its long run equilibrium value after a disequilibrium.. The results of the cointegration test are reported in the table 5.2 below;

Table 5.2 : Johansen Hypothesised cointegration relations

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.871941	71.93421	45.28	51.57
At most 1 **	0.750349	48.56916	39.37	45.10
At most 2 **	0.723738	45.02414	33.46	38.77
At most 3	0.489746	23.54966	27.07	32.24
At most 4	0.431395	19.75991	20.97	25.52
At most 5 *	0.334966	14.27709	14.07	18.63
At most 6	0.042718	1.527994	3.76	6.65

Max-eigenvalue test indicates 3 cointegrating equation(s) at both 5% and 1% levels

*(**) denotes rejection of the hypothesis at the 5%(1%) level

NB

CE=cointegrating equation(s)

The result from the Max-Eigenvalue test shows that there are three (3) cointegrating equations in the analysis. The result of the normalized unrestricted cointegrating coefficients (PT-matrix) of the betas from the Johansen cointegration test and preferred cointegrating relationship are displayed in table A2a and A2b of the appendix. Using the statistical significance and signs of the coefficient based on the underlying economic theory, the first cointegration relation is chosen. The normalized cointegration equation is shown below;

Table 5.3: Normalized cointegration coefficients

Normalized cointegrating coefficients(standard error in parentheses)						
LHCE	LATH	LGDP	LLEB	LPOP15	LPOP65	LURB
1.000000	-3.662429	-0.210964	-1.877214	-9.258544	-12.10928	-11.87153
	(1.35020)	(0.11173)	(1.41808)	(10.7569)	(9.98941)	(1.72141)

The normalized cointegration equation above expresses the long run relationship between healthcare expenditure and its determinants in a form as written below;

$$\text{ECM} = \text{LHCE} + 0.210964\text{LGDP} + 3.662429\text{LATH} + 1.877214\text{LLEB} + 9.258544\text{LPOP15} + 12.10928\text{LPOP65} + 11.872153\text{LURB}$$

The results also show that, in the per capita government healthcare expenditure equation, which normalized the coefficient of the logarithm of per capita government healthcare expenditure, the coefficients are statistically significant and provide meaningful explanation for changes in per capita healthcare expenditure. As shown in table A2b in the appendix, from the normalized cointegrating coefficients, all the coefficients of the log of; per capita GDP, life expectancy at birth, urbanization rate, proportion of the population with access to basic health facilities, proportion of the population below ages 15 years, the proportion of population age 65 years and above are shown to be significant in explaining changes in per capita government healthcare expenditure. The result therefore indicates that per capita GDP, life expectancy at birth, urbanisation rate, proportion of population below 15 year, proportion of population ages 65 years and above and the proportion of the population with access to basic healthcare facilities positively influence the growth of per capita government healthcare expenditure in Ghana.

Having ascertained that all the variables are non-stationary at their levels but stationary after differencing them once and that they cointegrated, the phase is thus set to formulate the final error correction model. This intuition behind such a model is to recover the long run information lost during differencing the variables. The error correction model rectifies this problem by introducing an error correction term.

5.2.3 Preliminary Results and Discussion

The study proceeds after the testing for unit roots and the number of cointegrating relationship to estimate both the over-parameterized error correction and the parsimonious error correction models. The result found that, the variables are not stationary at level but are stationary after differencing them once. The variables are also found to exhibit a cointegrating relationship. Hence, we estimated a vector error correction model. This is necessary in order to enable us capture the long run relationship between the variables. This is done simply by introducing the error correction factors to reconcile both the short run and long run relationship. This factor measures the speed to which healthcare expenditure adjust to its long run equilibrium after a disequilibrium. This then provides us with information about the proportion of disequilibrium error accumulated in the previous period that are corrected in the current period. The error correction results are shown in the table 5.3 below.

5.2.4 Results from the Error Correction Model (Parsimonious Error Correction Model)

Having estimated the general or over-parameterized Error Correction Model as shown table A3 of the appendix, the results from the unrestricted coefficients also help us to include a lag length of two based on the Akaike information Criterion (AIC) and the Schwarz information Criterion (SIC) as shown in appendix A4. A maximum lag length of two is therefore used in both the cointegration test and in estimating the over-parameterized model. The study further estimated a parsimonious error correction model by eliminating the entire group of insignificant variable in the over-parameterized model. This is to enable the estimate the final Error Correction Model over only significant regressors. The result of the parsimonious model is showed in table 5.3 below while the result of the over-parameterized model is presented in table A3 of the appendix.

Table 5.4: Result of Final Error Correction Model

Dependent Variable: DLHCE
 Method: Least Squares
 Sample: 1970 2006
 Included observations: 37

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.323472	0.276012	1.171952	0.2557
DLHCE(-1)	-1.063985	0.255434	-4.165401	0.0005
DLATH	5.543882	2.402814	2.307245	0.0325
DLATH(-1)	18.95348	3.123694	6.067649	0.0000
DLATH(-2)	8.993819	3.206372	2.804983	0.0113
DLGDP	1.709174	0.387701	4.408482	0.0003
DLGDP(-1)	1.249044	0.366027	3.412434	0.0029
DLGDP(-2)	0.603896	0.275446	2.192427	0.0410
DLLEB(-2)	4.209559	3.264876	1.289347	0.2128
DLPOP15(-1)	-10.59022	2.595969	-4.079479	0.0006
DLPOP65(-1)	-9.047834	3.432526	-2.635905	0.0163
DLURB	4.339251	1.649881	2.630037	0.0165
DLURB(-1)	3.968602	1.374207	2.887920	0.0094
ECM(-1)	-0.375986	0.066072	-5.369055	0.0000
R-squared	0.790238	Mean dependent var		0.285928
Adjusted R-squared	0.646716	S.D. dependent var		0.269497
S.E. of regression	0.160183	Akaike info criterion		-0.528586
Sum squared resid	0.487512	Schwarz criterion		0.106296
Log likelihood	22.72166	F-statistic		5.506055
Durbin-Watson stat	1.866380	Prob(F-statistic)		0.000457

Note: D represents first difference operator of the variables and L represents the logarithm. **Bold** t-Statistics indicates significance at 5% and 1% level of significance. All variables are as previously defined.

Substituted Coefficients:

$$\begin{aligned} \text{DLHCE} = & 0.32 - 1.06\text{DLHCE}(-1) + 5.54\text{DLATH} + 8.95\text{DLATH}(-1) + 8.99\text{DLATH}(-2) \\ & + 1.71\text{DLGDP} + 1.25\text{DLGDP}(-1) + 0.60\text{DLGDP}(-2) + 4.21\text{DLLEB}(-2) - 10.59\text{DLPOP15}(-1) \\ & - 9.05\text{DLPOP65}(-1) + 4.34\text{DLURB} + 3.97\text{DLURB}(-1) - 0.38\text{ECM}(-1) \end{aligned}$$

Table 5.4 Results of diagnostic test

Diagnostic tests	F-Statistic	Probability
1)Normality test: (Jarque-Bera Statistic)	0.2448	0.8849
2)Serial correlation: (Breusch-Godfrey serial Correlation LM test)	0.0342	0.9665
3)ARCH test: (Autoregressive conditional Heteroscedasticity)	0.2415	0.6266
4) Heteroscedasticity: (White Heteroscedasticity test : no cross)	0.7511	0.6910
5) Heteroscedasticity: (White Heteroscedasticity test : with cross)	0.5658	0.8784
6) Stability Test: Chow breakpoint (1984)	0.1801	0.2105
:Chow forecast test (1984 to 2006)	0.1423	0.1520
7) Specification test: (Ramsey Reset Test)	0.4264	0.3031

5.2.5 Results of Diagnostic test

It is extremely important to critically examine the properties of the regression model. Here we conduct a statistical test for normality (Jarque-Bera statistic), Breusch-Godfrey test for serial correlation, ARCH test for Autoregressive conditional heteroscedasticity, the white heteroscedasticity test, Chow breakpoint and Chow forecast for stability, and the Ramsey Reset test for specification errors. The diagnostic test result displayed on the table 5.4 below shows that the the regression residuals are normally distributed with no serial correlation. The parameters are stable and the model is correctly specified.

5.2.6 Interpretation of Results of the Parsimonious models (ECM)

Table 5.3 above presents the results of the parsimonious error correction model. This is extracted from the general or over-parameterized error correction model shown in table A3 of the appendix

of the study. The model included only the significant variables and some lagged values from the over-parameterized model with a maximum lag length of two.

The result shows the R^2 in the regression which measures the goodness of fit or the explanatory power of the regression. The adjusted R^2 of 0.6467 shows that about 64.67% of variations in healthcare expenditure is explained by the independent variables in the regression with the F-statistic which also measures the overall significance of the regression shown to be statistically significant at 1% level indicating that the overall result is good. The other tests results like the Durbin-Watson statistic of 1.866 which is approximately 2.0 is an indication of the presence of no autocorrelation in the regression.

The coefficients from the final regression has implication for the growth of healthcare expenditure. This result confirms the general assertion that healthcare expenditure depends on its one period lagged values since the the budget for the current year depends on the budget for the previous years and government usually considers this lagged relationship in their spending behaviour. The coefficient of one period lagged per capita governemnt healthcare expenditure is negative and significant at 1% level indicating that a one percent increase in healthcare expenditure in the previous year will decrease healthcare expenditure in the current year by ten percent.

The t-statistic of the constant of the regression suggests that it is insignificant at 5% and positive. This confirms the macroeconomic principles that people/nations will spend even at a zero income level either through borrowing or through other means. Both economic theory and practice has it that a government ability to spend depends greatly on the income level.

The coefficient of GDP and its lagged values are 1.7091 and 1.2490 respectively. Both coefficients are statistically significant at 1% in the short run. Interestingly, the results from the long run relationship found the income elasticity of per capita public healthcare expenditure to be less than unity (0.21). This led to the obvious conclusion that healthcare is a necessity in the long run. However, the coefficient of per capita GDP and its lagged values in the short run relationship are above unity (1.7 and 1.25). The result therefore found a contradiction between both short and long run income coefficients. Although not very different, a similar finding by Moore et al. (1992) found healthcare to be a necessity in the short-run while a luxury in the long-run. The variation in the income estimates between both the short run and long run relationship may be due to fact that there are time lags for changes in income transcend into the budgetary allocation. The results therefore found that per capita healthcare expenditure depend on two period lagged values of GDP per capita.

The health status of the population measured quantitatively in terms of life expectancy at birth also influence the growth of per capita healthcare expenditure of nations. Since more expenditure may be needed to maintain previously high health status, the coefficient of life expectancy at birth as a measure the effects of the population health status is significant at 1% and shows that

an increase in life expectancy at birth (number of years a new-born baby is expected to live) by a percentage will increase healthcare expenditure by about 4.2%.

Other results from the coefficients of the age structure of the population brings to mind certain attributes in the demand for healthcare and thus per capita government healthcare expenditure. The coefficients of the proportion of population below 15 years and proportion of population age 65 years and above are also significantly different from zero at 1% level of significance. The study found that both variables are negatively related to per capita government healthcare expenditure. Economic theory of healthcare demand suggests that the vulnerable population (persons aged below 15 years and persons above 65 years) tend to demand more healthcare than the youthful and active population since the depreciation rate in the aged is higher than the rest in the age structure (see Grossman 1977, 1992). The negativity of these coefficients are however not a theoretical contradiction. Economic theory on healthcare also suggests that the people make choice over the consumption of healthcare and all other goods (exercise, leisure, market goods and life style choice) in the production of good health. The results indicates that children and the aged in the population structure rather consume more of other health productive inputs like exercise, good diets, healthy lifestyle choice than the active population.

The results also indicates that a percentage increase in the proportion of the population below 15 years and the proportion ages 65 years and above will decrease healthcare expenditure by as much as 10% and 9 % respectively. Urbanization rate and its lagged values exerts a very significant and positive influence on the growth of healthcare expenditure. The statistically

significant coefficient of urbanization rate are about 4.33 and 3.96 respectively. This indicates that a one percent increase in urbanization rate will increase per capita healthcare expenditure by about 4%.

The proportion of the population with access to basic healthcare facilities together its two period lagged values also exert a positive and significant impact on per capita healthcare expenditure at 1% significance level. This supports the theory that the more people access to healthcare facilities, the more they will demand healthcare and its consequences on healthcare expenditure.

The results further shows that the speed of adjustment of healthcare expenditure to the long run equilibrium path is very relatively low. About 38% specifically of the disequilibrium errors that occurs in the previous year, are corrected in the current year.

The overall results suggests that GDP, proportion of the population with access to basic healthcare, life expectancy at birth, urbanization rate exerts significantly positive impact on healthcare expenditure. However, the one period lagged healthcare expenditure, the proportion of the population below 15 years and the proportion ages 65 years and above significantly exert negative impact on healthcare expenditure while GDP and its two lagged values, Urbanization rate and life expectancy at birth exerts significantly positive impact on healthcare expenditure.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATION

6.1 Introduction

This chapter summarises the entire work and provides the main conclusions, recommendations and areas for future research. Identifying the key demand side determinants of per capita healthcare expenditure in Ghana has been the main intent of this study. The specific econometric method used was the error correction model since all the variables were non-stationary at their levels and stationary after differencing them once. Cointegration of these variables suggest the relevance of this method. The coefficients from the error correction model are conveniently interpreted as semi or partial elasticities.

6.2 Summary

The main purpose of this study is to empirically model the determinants of healthcare expenditure in Ghana. This is necessitated by the fact that, the World Health Organization has a minimum healthcare spending requirement that is expected to meet the health related Millennium Development Goals. Specifically, Using an error correction model, the results from the study show that the lagged HCE, GDP, proportion of the population aged 65 years and above, proportion of population below 15 years, urbanisation rate and the proportion of the population with access to basic healthcare facilities significantly influence the growth of per capita healthcare expenditure in Ghana.

The study also measures the extent, determinants and income elasticity of healthcare expenditure in Ghana. The results from the parsimonious error correction model showed the income elasticity of healthcare expenditure to exceed unity. Thus, healthcare in Ghana is a luxury good. This could be an indication that the health sector in Ghana has a priority among the goals of social and economic development. This finding is consistent with previous studies on the subject that, the income elasticity of healthcare expenditure depends largely on the unit of observation, the econometric method used and type of data analysed (see Newhouse 1977, Gerdtham et al 1992).

This paper concentrated mainly on the demand side determinants of healthcare expenditure. The paper further looked at an overview of the overall health sector in Ghana. Attention has however been drawn to the fact that good data should serve as the basis for sustaining any reform process in the health service.

The paper reviewed the relevant literature on the demand function of healthcare, determinants of per capita government, private and total healthcare expenditure. The study further categorized all previous studies on healthcare expenditure determinants into three generational studies depending on the econometric technique used and the type of data analyzed.

A cointegration analysis of the determinants of healthcare expenditure was carried out on data from 1970 to 2006. Unit roots test based on both Augmented Dickey-Fuller test and the Philip-

Perron test procedure were performed on the variables with only a constant and with both constant and a linear trend to eliminate any spurious results. The tests do not reject the null hypothesis of the existence of unit root in the variables at their levels. All the variables were therefore found to be non-stationary at levels. All the variables were later found to be stationary after differencing them once. The tests confirm that all the variables are integrated of the same order $I(1)$, this further allows us to test for cointegration. The Johansen cointegration test procedure was employed to determine the number of cointegrating relation. The results showed that there were three(3) cointegration equations but the study chose only the first cointegration relation based on the significance of the variables and their conformity to basic economic theory and principle.

6.3 Conclusion

The paper mainly focused on the demand determinants of healthcare expenditure in Ghana over the period 1970 to 2006. The empirical analysis of the study used the Johansen cointegration test in ascertaining the presence or otherwise of the existence of long-run relationships among the variables. An error correction model representation of only the first cointegrating vector was estimated to help explain the growth of healthcare expenditure in Ghana.

It is vital to mention that this paper is the first of its kind in Ghana and that there are a number of salient issues not discussed here due to either unavailability of health data or the model does not emphasize some aspects of the determinants of healthcare expenditure; the production of health, efficiency, equity in the provision of health services. Subsequent research on the subject need to

include variables such as per capita number of physicians, beds, an index of efficiency of medical practitioners. It can be distinguished that the econometric modeling of the determinants of healthcare expenditure used in this paper is based only on the demand side principles of healthcare and can therefore be strongly criticized on its statistical plausibility. It should also be maintained that, the amount individuals allocate to healthcare (out-of-pocket payments) should be considered when deciding on how much government should spend on healthcare.

Another issue that needs mentioning has to do with the power of unit roots test, cointegration and the various tests for auto-correlation, heteroscedasticity and misspecification. Time series modeling of the determinants of healthcare expenditure is however superior to both cross-sectional and panel analyses. Time-series analysis eliminates problems regarding the validity of homogeneity of healthcare demand functions, convertibility in unit of measurement and data comparability, as well as consistent data collection.

The main findings of this study can be summarized as follows;

- Per capita healthcare expenditure is integrated of order one, $I(1)$ and cointegrated with all the other explanatory variables
- The income elasticity of healthcare expenditure is found to be above unity. Thus, healthcare in Ghana is a luxury good. This could imply that public health in Ghana has a high priority among the goals of social and economic development

- GDP and the other explanatory variables explains about 64.67% of all variations in healthcare expenditure. This is shown by the adjusted R^2 of 0.6467
- Surprisingly, the result shows that per capita healthcare expenditure negatively depends on its one period lagged values. This theoretically, may not be so convincing since we expect an ever-increasing government expenditure based on the Wagner's law. This result could however be an indication that healthcare expenditure Ghana is politically driven. In this case, good data may not be basis for healthcare expenditure decisions by government.
- The coefficients of the age structure of the population are statistically significant and exerts negative impact on healthcare expenditure. This supports part of theoretical assertion that children and the aged tends be more careful about their lifestyle and other health improving activities than consuming only healthcare compared to the youth (population ages between 15 and 64 years).
- There is a positive correlation between healthcare expenditure and the health status of Ghana's population. The health status is measured quantitatively by life expectancy at birth.
- From the preferred or parsimonious error correction model, the main determinants of healthcare expenditure are per capita GDP, lagged dependent variable, one and two period lagged GDP, two period lagged values of life expectancy at birth, one period lagged values of both proportion of population (as percentage of total population) under 15 years and proportion of population ages 65 years and above and urbanisation rate and its one period lagged.

- The speed of adjustment of healthcare expenditure to the long run equilibrium path is relatively low. The result shows specifically that about 38% of the disequilibrium errors that occurred in the previous period, are corrected in the current year.
- Finally, the result shows that GDP, life expectancy at birth, urbanization rate, proportion of population below ages 15 years and proportion ages 65 years and above and proportion of the population with access to basic healthcare facilities are the long run determinants of healthcare expenditure in Ghana.

6.3 Recommendations and policy implications

A number of key issues needs to be considered when modeling the determinants of government healthcare expenditures in Ghana. These will provide a basis for recommendations and policy implications.

It is intuitive that, per capita GDP may have both permanent and transitory components, thus, changes in income may not be fully spent in the same period but rather its spending may be allocated through time. Further, current period per capita government healthcare expenditure may also depend on its past values. As confirmed by Roberts (1999), the structure of the adjustment process of per capita government healthcare expenditure is not well known. Getzen (2000) also argues that one should expect lags on the dependent variables such as per capita GDP as the budget is usually prepared at least a year in advance. These shortcomings indicate that the early estimates of the determinants of per capita government healthcare expenditures may have

been biased and conclusions drawn could have been misleading. It is argued that the dynamics of per capita government healthcare expenditures should not be neglected for the purposes of modeling and policy implications.

One may observe from country-specific experience that the mode of healthcare financing might be politically driven. This is because, in situations where the structure of the healthcare system is moved along the lines of a National Health Insurance System or agenda; public health insurance is the mainstream funder and offers healthcare coverage irrespective of government income. In such a case, per capita income may not be the only determinant of per capita government healthcare expenditure.

However, the positive and significant coefficient for GDP might be capturing some evidence of the Wagner law, according to which public expenditure expands with economic development. This can be explained by the fact that the public financing system may not take into accounts an adjustment process for needs/ risks.

Another recommendation that can be from the results is that, the amount spent on healthcare by the government may solely be determined per capita income rather than other factors such as; life expectancy rate, the age structure of the population, urbanization rate and the proportion of the population with access to healthcare are also considered. This observation is very obvious and not particularly new to researchers but has not always been consistently incorporated in the discussions of health policy and programmes.

Interestingly in Ghana since 2005, almost all districts in Ghana have been empowered with healthcare responsibilities through the District-Wide Mutual Health Insurance Scheme (DWHIS). One can infer from the Ghanaian experience that, unless coordination mechanisms is instituted to play a more active role, the development of the National Health Insurance Scheme (NHIS) is unlikely to be fostered. Potentially, one way to promote the expansion of healthcare coverage has to do with the transfer of financial responsibilities to districts and communities so that the mechanisms of competition between schemes take into account potential differences in the delivery of healthcare. In this case, members of each Scheme are able to compare current levels of healthcare coverage they receive with the levels of premium paid.

A potential limitation of our study lies in the fact that no evidence of private health expenditure data is available in Ghana. Some studies indicate that private health insurance (PHI) play only a little role in supplementing public healthcare coverage in several countries.

Finally, the growth of per capita government healthcare expenditure in the long run implies that African governments and people view public health expenditure as important in the promotion of welfare and living standards.

6.4 Areas For Future Research

The main recommendation for studies on the determinants of healthcare expenditure is that, we still need more macroeconomic theories on healthcare and healthcare expenditure. Therefore, we

recommend that future studies should concentrate on analyzing healthcare expenditure on the macroeconomics framework of expenditures. It will further be interesting to analyze the determinants of healthcare expenditure at the micro level (individual level analysis) taking into accounts the effects of institutional factors on the quantity and price of healthcare.

For future research on the subject, it is recommended that considerable attempts should be made to disaggregate the total healthcare expenditure into the public-private mix. This is expected to help measure the different responsiveness of the explanatory variables on the disaggregated public and private healthcare expenditure. This will help examine the impact of both micro and macro factors on the public-private healthcare expenditure in Ghana.

What is also not known is the exact effect of measures of the indicators of the quality of life (QALYs and DALYs) rather than quantity of life (life expectancy at birth) on health and healthcare. Future research should incorporate Quality Adjusted Life Years (QALYs) and Disability Adjusted Life Years (DALYs). Proxy measures for the effectiveness of the healthcare system, the quality of health services and health status can serve such purposes. The proxies for quality of life can include, waiting time for an operation, length of stay in hospital, number of post-operation complications. This will allow us to examine the effects of an increase in the quality of health on healthcare expenditure. Therefore, future studies should be based on qualitative measure of health rather than quantitative measure.

The most interesting issue of concern on future studies should not be based on quantitative measures of health. It is clear that, the standard determinants of healthcare expenditure are so known to almost all researchers on the subject. The experience is that these quantitative measures increase at a slower rate than the increases in healthcare expenditure thus these variables help very little in explaining the growth of healthcare expenditure.

6.5 Limitations of the Study

The main limitation of this study has to do with unavailability of health data on both public and private healthcare expenditure at the national level. Another limitation to this study is that, the study only concentrated on the demand side determinants of healthcare ignoring the effects of the production, supply, efficiency and equity in healthcare on healthcare expenditure. The study also fails to examine the different effect on the regressors on the disaggregated total, public and private healthcare expenditure. Unavailability of health data clearly account for this limitation. It is recommended that future research on the subject should incorporate these limitations when analyzing the determinants of healthcare expenditure based on data availability.

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APPENDIX**Table A1: Summary Statistics of Variables**

	LHCE	LATH	LGDP	LLEB	LPOP15	LPOP65	LURB
Mean	6.361092	3.943344	10.78073	4.011967	3.771847	1.126096	3.585568
Median	6.779524	4.007333	11.31384	4.025352	3.795939	1.098612	3.557061
Maximum	11.35842	4.229749	15.51026	4.094511	3.809326	1.319086	3.882388
Minimum	1.223775	3.449988	5.569489	3.896503	3.664074	1.018847	3.367296
Std. Dev.	3.246239	0.248286	3.266177	0.053684	0.045354	0.086729	0.167102
Skewness	-0.062816	-0.595680	-0.225144	-0.576359	-1.263849	0.747044	0.325969
Kurtosis	1.669398	2.133900	1.718867	2.383460	3.124674	2.366646	1.691926
Jarque-Bera	2.753855	3.344600	2.842928	2.634527	9.874072	4.059882	3.293123
Probability	0.252353	0.187815	0.241360	0.267867	0.070176	0.131343	0.192711
Sum	235.3604	145.9037	398.8871	148.4428	139.5584	41.66555	132.6660
Sum Sq. Dev.	379.3704	2.219258	384.0448	0.103750	0.074051	0.270786	1.005230

Table A2a: Unrestricted Cointegrating Coefficients (normalized by $b'S_{11}b=I$): Johansen cointegration analysis

LAHCE	LATH	LGDP	LLEB	LPOP15	LPOP65	LURB
5.325100	-19.50280	1.123404	-9.996351	-49.30267	-64.48311	-63.21711
-1.653926	-0.226888	1.510212	-74.84686	266.6437	197.8035	-30.42838
0.604528	-67.27432	5.870295	5.847136	129.5622	72.98383	-38.98272
0.173035	-3.288983	-2.816819	-6.098528	214.8799	146.3049	18.48262
-0.276192	-13.62987	-0.295235	61.64643	116.0692	171.7553	-49.75919
0.729262	63.16736	2.383979	-17.18722	-616.1319	-627.0912	34.97473
0.424110	17.21607	3.745807	-16.35021	-309.7911	-230.3463	-85.13198

Table A2b: Normalized cointegration coefficients results of the first cointegration equation**1 Cointegrating Equation(s):****Normalized cointegrating coefficients (standard error in parentheses)**

LHCE	LATH	LGDP	LLEB	LPOP15	LPOP65	LURB
1.000000	-3.662429	-0.210964	-1.877214	-9.258544	-12.10928	-11.87153
	(1.35020)	(0.11173)	(1.41808)	(10.7569)	(9.98941)	(1.72141)

Table A3: General/ over parameterized Error correction Model (ECM)

Dependent Variable: DLAHCE

Method: Least Squares

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.853432	0.692148	1.233020	0.2433
DLAHCE(-1)	-1.479562	0.340325	-4.347499	0.0012
DLAHCE(-2)	0.228842	0.235751	0.970691	0.3526
DLATH	8.557926	3.322556	2.575706	0.0258
DLATH(-1)	23.21348	5.230626	4.437992	0.0010
DLATH(-2)	12.86253	5.575095	2.307141	0.0415
DLGDP	2.161188	0.571587	3.781035	0.0030
DLGDP(-1)	1.766842	0.509226	3.469663	0.0052
DLGDP(-2)	0.969766	0.321710	3.014407	0.0118
DLLEB	2.266997	1.929602	1.174852	0.2649
DLLEB(-1)	1.500848	2.318596	0.647309	0.5307
DLLEB(-2)	10.89335	4.657663	2.338801	0.0393
DLPOP15	25.39025	18.07801	1.404483	0.1878
DLPOP15(-1)	-215.0317	149.1876	-1.441351	0.1773
DLPOP15(-2)	57.45303	119.8349	0.479435	0.6410
DLPOP65	-2.659669	37.37880	-0.071154	0.9446
DLPOP65(-1)	-6.359943	2.502236	-2.541704	0.0274
DLPOP65(-2)	9.359962	26.77128	0.349627	0.7332
DLURB	5.623172	23.26123	2.262269	0.0449
DLURB(-1)	4.825381	1.874725	2.573862	0.0259
DLURB(-2)	1.419620	1.158855	1.225019	0.2462
ECM(-1)	-0.967766	0.200795	-4.819666	0.0005
R-squared	0.893874	Mean dependent var		0.285928
Adjusted R-squared	0.691271	S.D. dependent var		0.269497
S.E. of regression	0.149742	Akaike info criterion		-0.725090
Sum squared resid	0.246648	Schwarz criterion		0.272582
Log likelihood	33.96398	F-statistic		4.411945
Durbin-Watson stat	2.907200	Prob(F-statistic)		0.007263

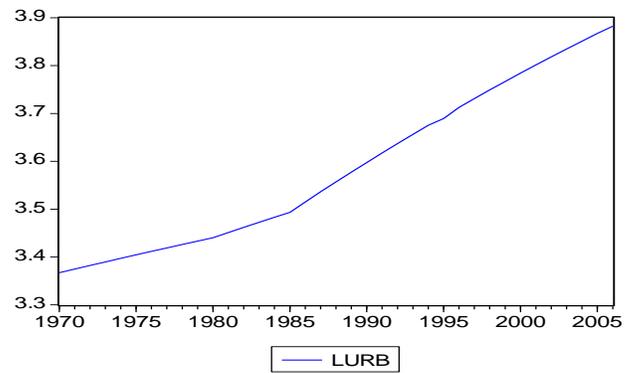
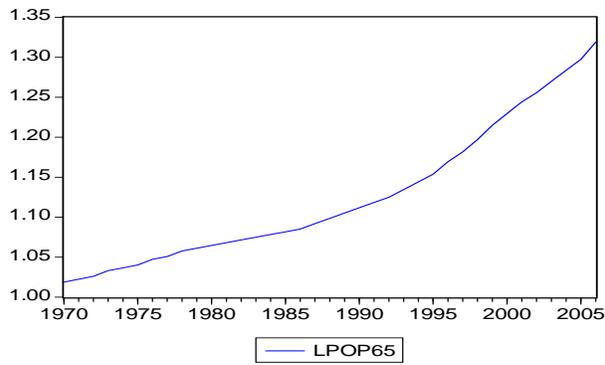
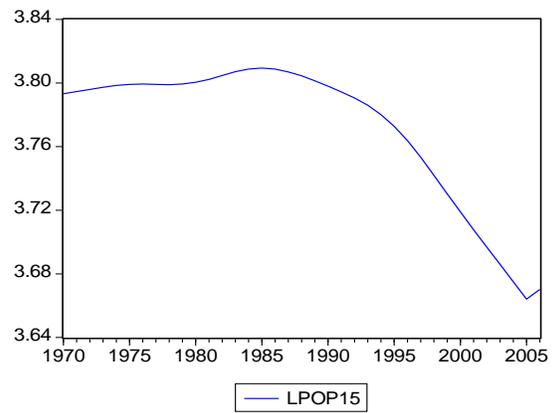
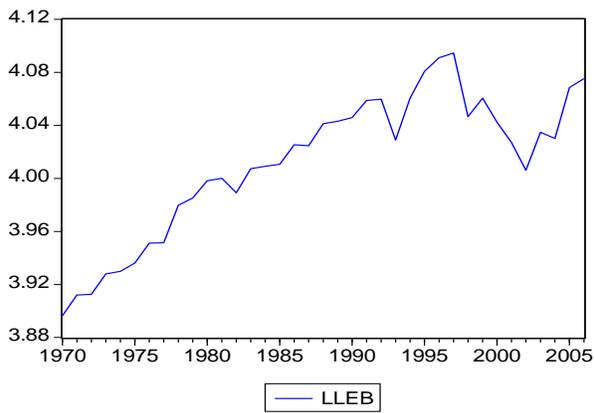
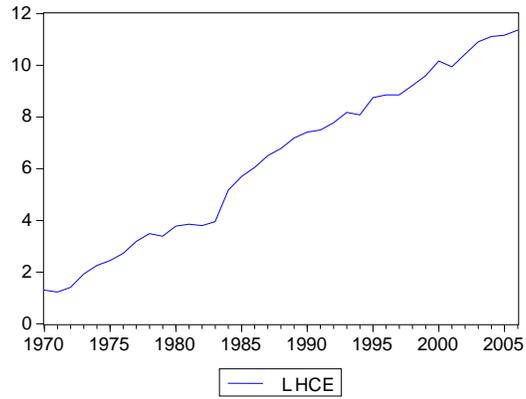
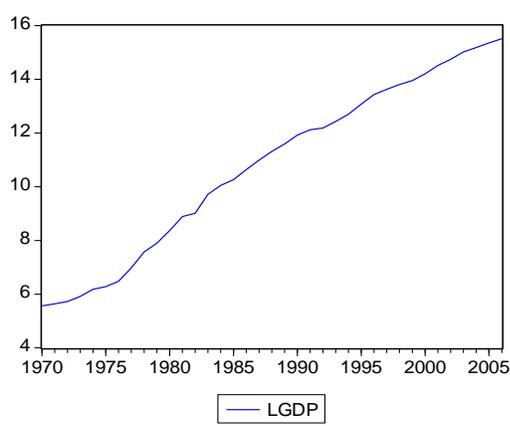
Note; D represents the first difference operator of the variables and L represents the logarithms of the variables. We start with a maximum lag length of 2 and pare it down as per the Akaike Information Criterion, Schwarz information criterion and the log likelihood ratio. There is no general rule on how to choose the maximum lag to start with. Researchers usually employ a rule of thumb which is the cube root of the number of observation. We selected of the significant variables from the over parameterized model to estimate the parsimonious/ final error correction model results in the study.

Table A4: DETERMINATION OF LAG LENGTH

Lag length	LR	AIC	SIC
1	770.54	-40.08	-37.93
2	831.42	-41.91	-37.55
3	924.52	-45.32	- 38.41
4	Values not reported		

Note: LR=log likelihood ratio, AIC=Akaike information Criterion and SIC= Schwarz information Criterion

Figure A1: Graphs of variables at their levels



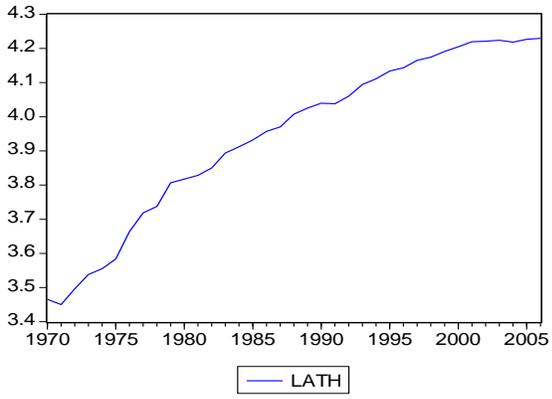
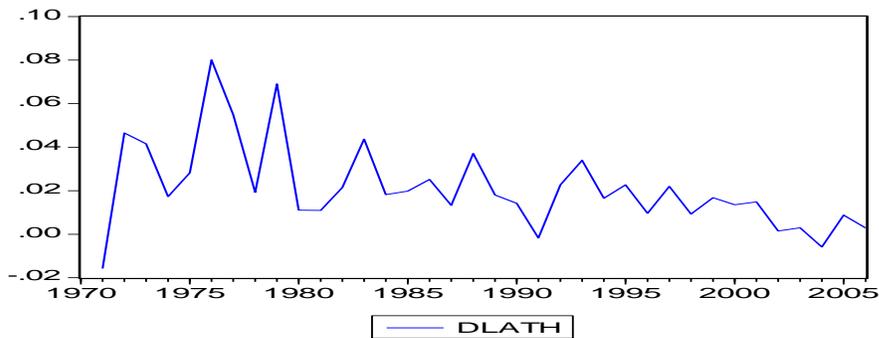
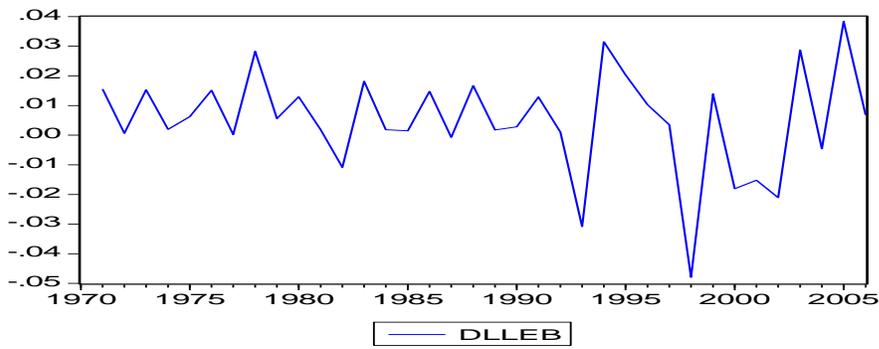
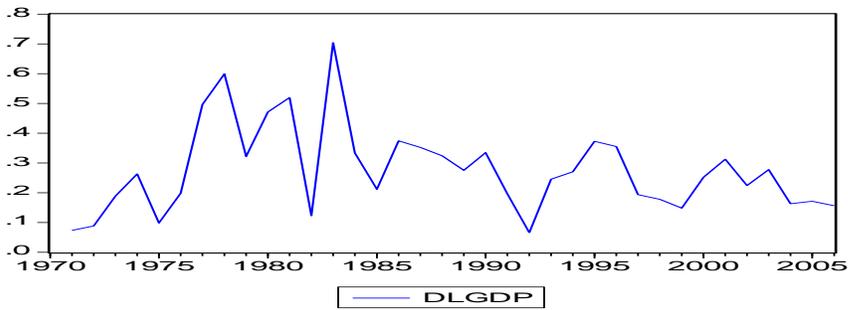
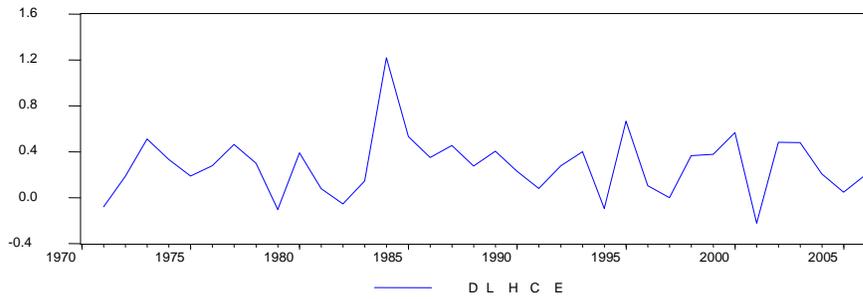


Figure A2 : Graphs of Variables at their first difference



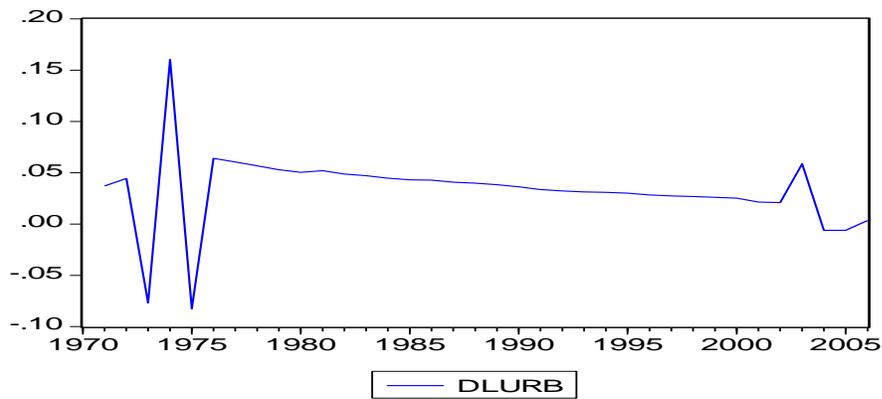
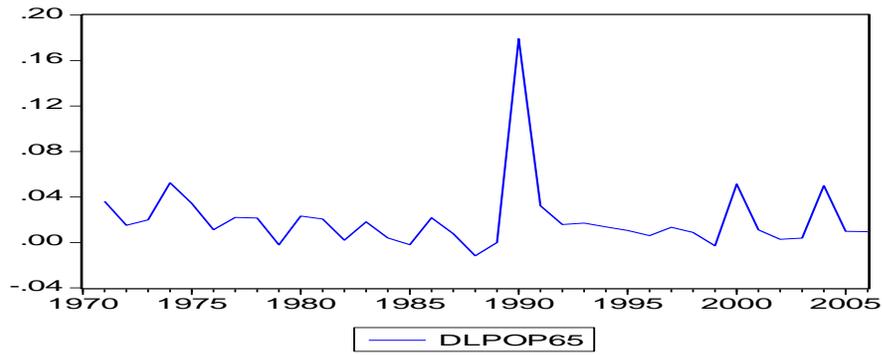
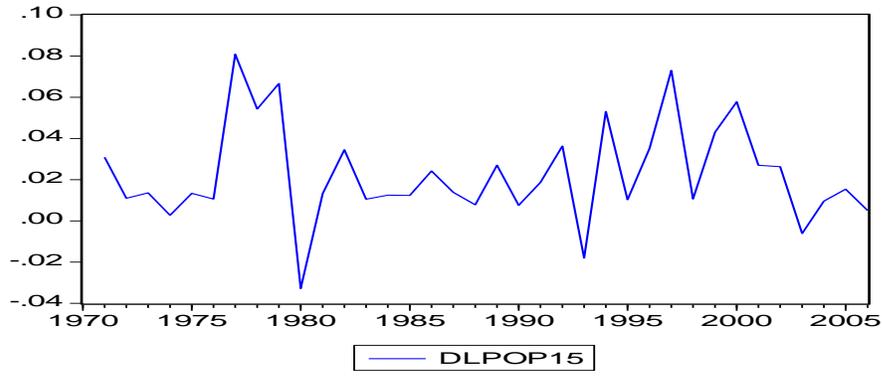


Figure A3: Graphs of Residuals of variables

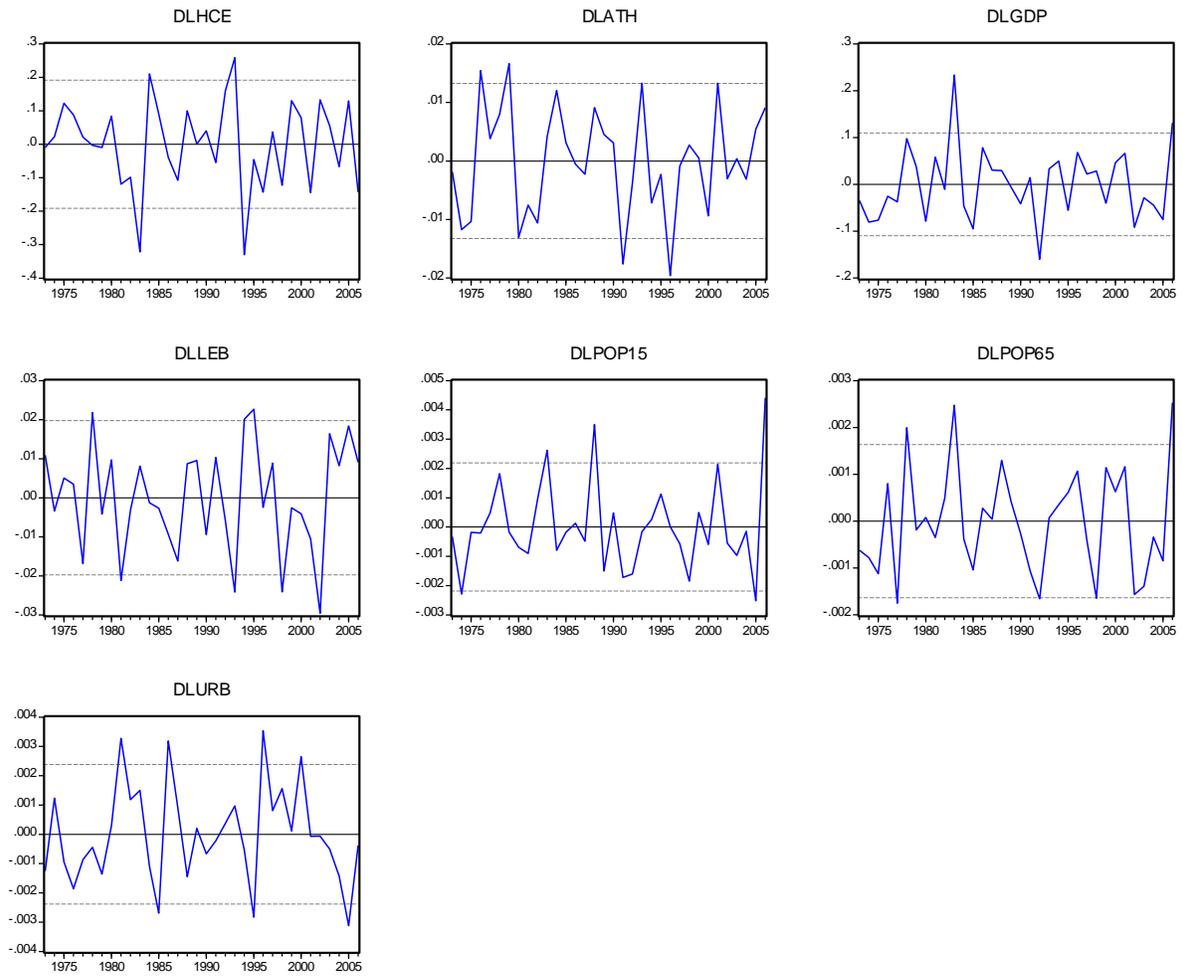


Figure A4: Diagnostic test for residuals

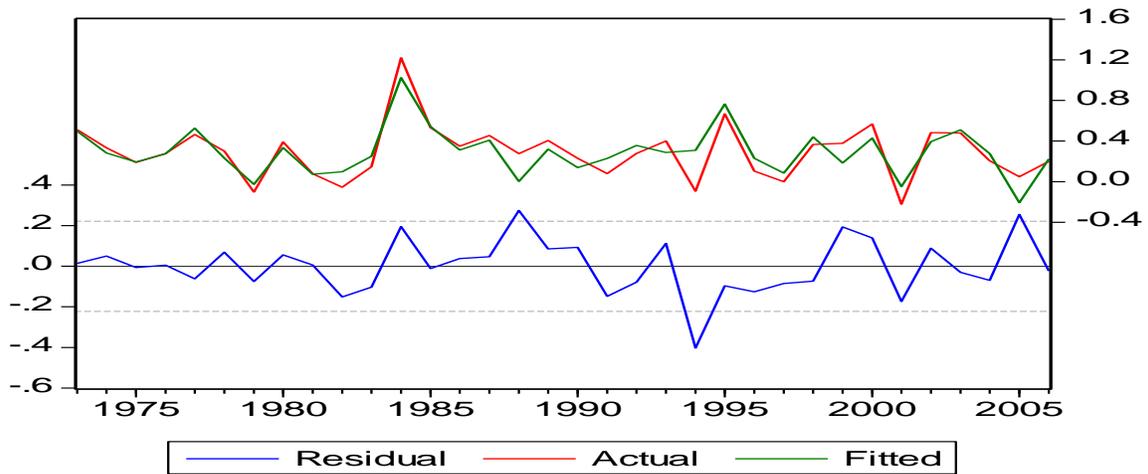


Figure A5: Graph of residual of DLHCE equation

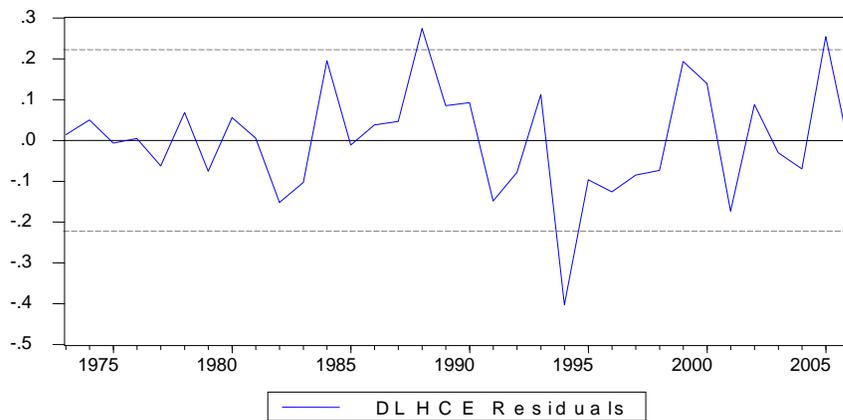


Figure A6: Graphs of Gradient of the residual

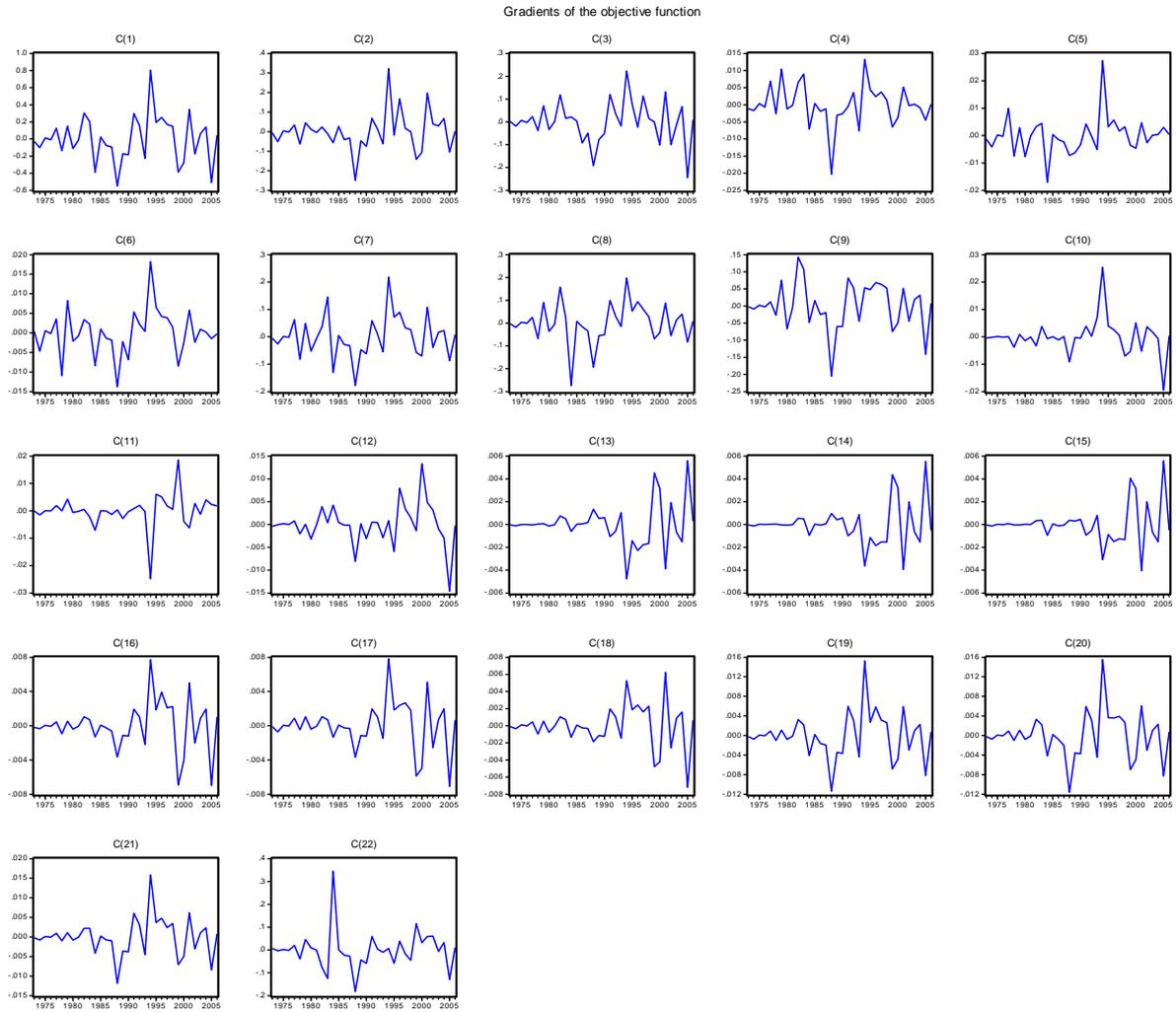


Figure A7: Histogram – Normality test of residual

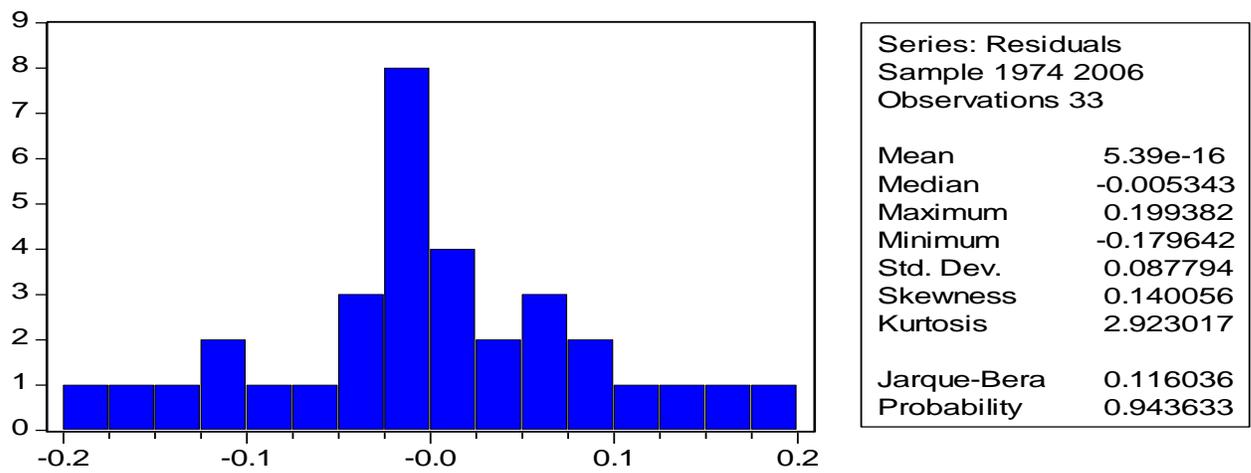
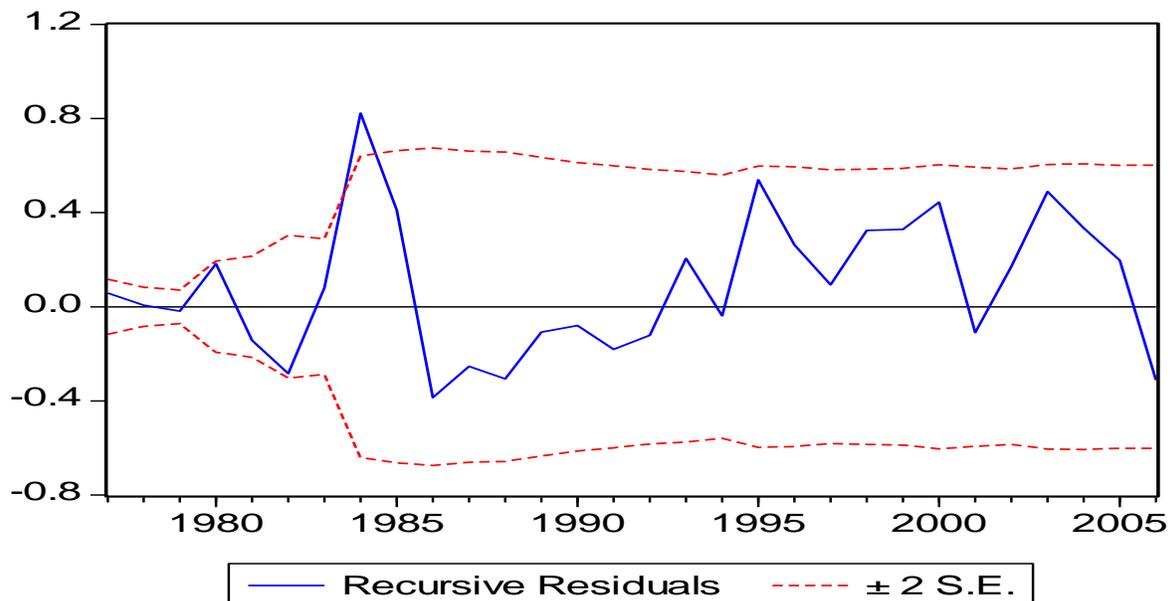


Figure A8: Graph of Recursive Residuals



TableA5: Data Used for the analyse

Year	HCE	GDP	PUB	LEB	URB	POP<15	POP65	ATH
1970	3.68	217.11	1.20	49.23	29.00	44.40	2.77	32.00
1971	3.40	238.86	1.30	50.00	29.22	44.46	2.78	31.50
1972	4.10	265.44	1.40	50.03	29.44	44.52	2.79	33.00
1973	6.84	330.65	1.50	50.80	29.66	44.58	2.81	34.40
1974	9.54	424.12	1.70	50.90	29.88	44.63	2.82	35.00
1975	11.52	463.03	1.60	51.22	30.10	44.66	2.83	36.00
1976	15.22	560.51	1.70	52.00	30.32	44.67	2.85	39.00
1977	24.20	968.94	1.50	52.01	30.54	44.66	2.86	41.20
1978	32.68	1812.53	1.20	53.50	30.76	44.65	2.88	42.00
1979	29.50	2421.59	1.10	53.80	30.98	44.67	2.89	45.00
1980	43.60	3656.70	0.90	54.50	31.20	44.72	2.90	45.50
1981	47.17	5988.41	1.20	54.60	31.54	44.80	2.91	46.00
1982	44.69	6927.75	1.80	54.01	31.88	44.91	2.92	47.00
1983	51.75	14722.02	1.70	55.00	32.22	45.02	2.93	49.10
1984	175.24	19812.44	1.60	55.10	32.56	45.09	2.94	50.00
1985	298.43	23731.62	1.80	55.18	32.90	45.12	2.95	51.00
1986	423.49	36799.05	1.60	56.00	33.62	45.09	2.96	52.30
1987	667.43	52295.59	1.50	55.96	34.34	45.01	2.98	53.00
1988	879.65	71643.22	1.40	56.90	35.06	44.90	3.00	55.00
1989	1318.78	93284.18	1.30	57.00	35.78	44.76	3.02	56.00
1990	1660.70	123483.43	1.30	57.16	36.50	44.61	3.04	56.80
1991	1799.89	152317.84	1.60	57.90	37.24	44.45	3.06	56.70
1992	2375.69	170508.83	1.80	57.96	37.98	44.28	3.08	58.00
1993	3546.34	205437.69	1.90	56.20	38.72	44.08	3.11	60.00
1994	3229.27	271168.98	1.60	58.00	39.46	43.82	3.14	61.00
1995	6293.09	397139.63	1.80	59.19	40.02	43.50	3.17	62.40
1996	6984.86	554350.22	1.80	59.80	40.96	43.11	3.22	63.00
1997	6985.20	678413.86	1.70	60.01	41.72	42.66	3.26	64.40
1998	10072.02	814456.31	1.80	57.20	42.48	42.18	3.31	65.00
1999	14701.81	948852.53	1.80	58.00	43.24	41.69	3.37	66.10
2000	25942.17	1239492.63	2.40	56.96	44.00	41.22	3.42	67.00
2001	20789.80	1657540.99	2.80	56.10	44.76	40.76	3.47	68.00
2002	33693.03	2075922.54	2.90	54.93	45.52	40.32	3.51	68.10
2003	54431.45	2726428.44	2.77	56.53	46.28	39.88	3.56	68.30
2004	66906.48	3338072.38	2.83	56.27	47.04	39.45	3.61	67.90
2005	70181.79	3981639.76	3.22	58.47	47.80	39.02	3.66	68.50
2006	85683.61	4788132.50	3.34	58.87	48.54	39.26	3.74	68.70