HIV/AIDS AND ECONOMIC GROWTH IN GHANA

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THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF MPHIL ECONOMICS DEGREE.

OCTOBER, 2010

DECLARATION

I, **ASRAVOR RICHARD KOFI,** do hereby declare that except for references to other people's work which have been duly acknowledged, this dissertation is the result of my own research work carried out in the Department of Economics under the supervision of Prof. Amoah Baah-Nuakoh and Dr. A.D.A Laryea and that this dissertation has neither in whole nor in part been presented for another degree elsewhere.

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DEDICATIONS

This dissertation is dedicated to my parents, Benedictus Yao Asravor and Esther Fianu, sisters and brothers, Jennifer Asravor, Cynthia Asravor, Jacob Asravor and Benjamin Asravor and to Phyllis Ametume. I say a heartfelt thank you, for your endless love and for believing in me. I wouldn't have come this far without your push and support. Thank You.

ACKNOWLEDGEMENTS

"With God all things are possible." This biblical saying sums up how through God's intervention this thesis has been successfully completed. I thank the Lord for His endless favours because I couldn't have made it without HIM, particularly during the dark and stormy times of the past few months.

To my supervisors, Prof. Amoah Baah-Nuakoh and Dr. A.D.A Laryea I say thank you for guiding me through this dissertation with those helpful comments, suggestions and corrections and invaluable inputs towards the completion of this dissertation.

I also want to thank the African Economic Research Consortium (AERC) for their financial support and sponsorship.

I thank God for blessing me with loved ones such as Mr. Simeon Emerson, Justice Korkor, Eric Siaw, Derrick Osei, Linus Tannor and Miss. Danu whose support and encouragement saw me throughout the dissertation process. Thank you for motivating me to work harder and for the many sacrifices of time and energy you dedicated just to see me thrive. Your advice and imparting priceless knowledge towards the accomplishment of this dissertation is worth mentioning. Thank You.

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ABBREVIATIONS AND ACRONYMS

ADF	Augmented Dickey- Fuller
AIC	Akaike Information Criterion
AIDS	Acquired Immune Deficiency Syndrome
BMC	Budget and Management Centers or Cost Centres
CHPS	Community-based Health Planning and Services
DHA	District Health Administration
DHMT	District Health Management Team
ECM	Error Correction Model
ERP	Economic Recovery Programme
HIV	Human Immunodeficiency Virus
GAC	Ghana AIDS Commission
GDP	Gross Domestic Product
GHS	Ghana Health Service
MOH	Ministry of Health
NACA	National Advisory Commission on AIDS
NACP	National AIDS Control Programme
NSF	National Strategic Framework
OLS	Ordinary Least Square
RHA	Regional Health Administration
SAPRI	Structural Adjustment Programme Review Initiative

SC	Schwartz Criterion
STDs	Sexually Transmitted Diseases
SWAP	Sector – Wide Approach
TBA	Traditional Birth Attendants
UNAIDS	United Nation Agency for International Development
UN	United Nation
UNDP	United Nation Development Program
WB	World Bank
WDR	World Development Report
WHO	World Health Organisation

ABSTRACT

AIDS is a growing problem throughout the world and has become one of the worst pandemics of the 21st century. Africa is one of the worst hit regions in the world, having seven countries with more than 15 percent of the population infected. This study reports estimates of the economic impact of HIV/AIDS on economic growth in Ghana using the human capital approach of the Augmented Solow growth model. The model is estimated with health capital as an input. HIV/AIDS is assumed to influence the accumulation of health capital proxied by a life expectancy shortfall measure. The model is estimated empirically using time series data spanning the period 1980–2009. The statistical package used for the work is the E-view software. The result from the study shows that HIV/AIDS has an insignificant effect on the growth of the Ghanaian economy. Additionally, human capital has a negative and significant impact on growth. This is expected as HIV/AIDS first impact on human capital first before impacting on growth. The impact on human capital is seen through absenteeism of worker on days that they should be at post leading to the lost of the manpower and productivity. The study recommends that there is the need to take into consideration the macroeconomic effects of any intervention to combat the disease. This will help assess which programmes in the country give the best value for money.

CHAPTER ONE

1.0 INTRODUCTION TO THE STUDY

1.1 Background

According to the former United Nation (UN) Secretary General, Mr. Kofi Annan, "The fight against Human Immunodeficiency Virus (HIV)/Acquired Immune Deficiency Syndrome (AIDS) requires leadership from all parts of government and it needs to go right to the top. HIV/AIDS is far more than a health crisis. It is a threat to development itself." (Better World "Quotes for fighting AIDS", N.D., August 1. 2009).This epitomizes the power of the HIV/AIDS disease. Acquired Immune Deficiency Syndrome (AIDS) is caused by the Human Immunodeficiency Virus (HIV). Since its detection about thirty years ago, dealing with its effect has become one of the major public policy issues confronting the world. While the disease is seen basically a health issue, the impact of HIV/AIDS goes beyond health because of its extensive human, social and economic effects. The disease is now a global epidemic spreading through all continents, nations and countries rapidly and also erratically. According to United Nation Development Program (UNDP), the disease has inflicted the single greatest reversal in human development in modern history. (UNDP, 2005)

Using its power and might, HIV/AIDS has ravaged through the African continent and homes with such devastating rapidity beyond understanding. Though Africa was the last continent to be hit by the pandemic, the devastation has been more by all accounts. It is estimated by the World health Organisation (WHO) that about two-third of all HIV

positive people in the world live in Sub Saharan Africa, and the disease is also increasing each day on the continent. Three million people died from AIDS in 2001, making it the world's fourth biggest cause of death, after heart disease, stroke, and acute lower respiratory infection that year (WHO 2004). In 2004, an estimated 4.9 million deaths worldwide were attributable to HIV/AIDS (WHO 2004). The 2008 WHO report indicated that in Africa, an estimated 22.5 million people are living with the disease. This consists of 13.7 million women and 2.2 million children. The AIDS orphans for the same period totalled 11.4 million (WHO, UNAIDS 2008). In most part of the African continent HIV/AIDS has spread right through the general population, rather than being concentrated in specific sub-groups of the population as tends to be the case elsewhere in the world. HIV/AIDS according to UNAIDS and WHO is a known threat in the world, especially in Sub-Saharan Africa (UNAIDS/WHO 2003).

The role of human capital in economic development is now widely accepted, particularly in the context of the endogenous growth models. HIV/AIDS annihilates the human capital (Bonnel, 2000). There is no ambiguity that the health statuses of individuals have positive and significant effect on economic growth (Bloom, et al., 2001). Nevertheless, the relationship between HIV/AIDS and economic growth is complex, especially considering the fact that HIV/AIDS has wider effects beyond health. It is difficult to measure the economic impact of the epidemic since the impact of HIV/AIDS on development is multifaceted and not necessarily direct. Furthermore, factors like drought, corruption and economic mismanagement affect the economic performance of a country and complicate the task of economic forecasting.

Due to the devastating effect of HIV/AIDS in the world the United Nations has made 1st December of every year World AIDS Day. On this day issues relating to HIV/AIDS are discussed and participants are educated on the new trends of the disease such as the causes, symptoms, distinction between the HIV virus and the AIDS diseases. The distinction between HIV and AIDS is often very difficult to make. HIV is basically a sexually transmitted disease which has an incubation period of about 5-8 years for most developing countries, but may be longer in the Western countries. The incubation period is usually accompanied by infrequent incidences of ill health or morbidity which has limited economic impact, but as individuals become "AIDS sick", the length and greatness of illness escalates. Individuals become less productive with the costs associated with their care increasing. This therefore, may lead to the diversion of economic resources at a time when the household most needs it. Economic resources also become increasingly difficult to secure as income is reduced and diverted to health care needs. Households, who have their bread winners suffering from AIDS, might resort to borrowing money from their relatives or friends, selling their assets or using up their savings or investments to maintain an income.

Children, particularly the girl child in most African countries, may be made to drop out of school to lessen the labour shortages of the family. The dropping out of the girl child from schools may have long term repercussions for the individuals involved. The constant reliance on social and familial obligations may cause a break up in family tides. The paradox of the situation is that as a household's need for resources increase, so their capacity to generate income is reduced. While there are other more prevalent diseases in

Africa, the characteristics of HIV/AIDS suggest that its economic and demographic impact will be profound most especially in the area of investments. The HIV/AIDS disease can gravely affect the confidence that foreign investors have in the African economies. This is bound to happen at a time when Africa seeks to attract more international investment.

In Ghana, the Government of Ghana created a National Advisory Commission on AIDS (NACA) in 1985 as a governing body in charge of AIDS, but the first case of HIV/AIDS was reported in March 1986. After the occurrence of the disease, the government established a National AIDS Control Programme (NACP) in 1987. In the year 2000, fifteen years after the discovery of HIV/AIDS, the Government of Ghana inaugurated the Ghana AIDS Commission (GAC). This was closely followed by the implementation of the country's National Strategic Framework (NSF) on HIV/AIDS for 2001-2005. The duty of GAC is to coordinate the various, usually ineffective, public sector efforts to create awareness about the menace. It was also responsible for the development, formulation and implementation of a national policy on the HIV/AIDS pandemic. Although awareness of the epidemic is thought to be relatively high in the country, it has not translated into behavioural changes. From the available statistics HIV/AIDS incidence appears to be rising each passing day. The 2005 HIV prevalence rate reported in the 2006 report on the global AIDS epidemic indicated that the adult HIV prevalence rate of Ghana was 2.3% compared to the 7.5% prevalence rate of the Sub-Saharan African and 1.1% globally. The median HIV prevalence among women attending antenatal clinic in Ghana has ranged between 2.3% and 3.6% between 2000 and

2006(Ministry of Health Ghana, 2007). In 2003, 24,000 children in Ghana were estimated to be living with HIV/AIDS and there were an estimated 170,000 AIDS orphans.

There is significant variation in HIV prevalence rates across the country with the highest rates found in the Eastern Region and the lowest in the Upper West and Northern Region. HIV prevalence rates are also higher in the border towns, in mining areas and along major transportation routes. Currently, in Ghana, more than 500,000 people have HIV but have not shown signs of the sickness. There is growing evidence that suggests that as HIV prevalence rates rises, both total and growth in national income (gross domestic product, or GDP) of a country fall significantly (Bloom, et al., 2001). While few people, including economists will doubt the potential of the epidemic; there have been relatively fewer studies into the economic impact of the disease on the Ghanaian economy.

1.2 Statement of the Problem

In many diverse ways, the prevalence of AIDS among individuals and families ultimately affects a country's overall economic performance. From the micro perspective, there is a loss of experienced and skilful workers or professionals. This drains the production and manufacturing sectors which are key sectors to national developments. More dangerously, AIDS can erase the people's morale, deteriorating their self-belief in the future, further injuring productivity and destabilizing their ability to save and invest. Aside these micro effects of the disease, it is expected that the disease will have a considerable macroeconomic impact. To start with the most obvious effect of the disease is increased mortality. The increased mortality means that the economy is left with fewer

workers, both in total and across different occupations and skill levels. As private and public employees and also civil servants fall ill and eventually die, the efficiency of production or administrative processes is diminished. On the consumer side, households can seldom fully compensate for the loss of a breadwinner; as a result, poverty rises and children's access to education deteriorates.

In the long run HIV/AIDS affects the accumulation not only of human capital but of physical capital as well. For example, as expenditure is shifted toward HIV/AIDS related activities, aggregate saving is likely to decline, leaving fewer resources available for investment; at the same time, increased production costs and deteriorating economic prospects make investment in the affected countries less attractive. Hence the impact of HIV/AIDS on macroeconomic variables such as economic growth, per capita incomes, savings, investment and employment is likely to be significant. For governments, HIV/AIDS has an adverse fiscal impact, as expenditures rise with higher spending on health care and social support, and revenues are affected by slower economic growth. UNAIDS estimates that when HIV prevalence rates rises above 20 percent in any nation, gross domestic product (GDP) in that country can be lowered by as much as 2 percentage point a year. In South Africa, the investment bank ING Barings has projected that HIV/AIDS could drag down GDP by 0.3 to 0.4% a year. The UN Development Programme (UNDP), in its Botswana Human Development reports, cites government studies that HIV/AIDS will result in GDP being between 24 percent and 38 percent lower by 2021.

The impact of HIV and AIDS on the Ghanaian economy is well known but little work has been down on quantifying the economic impacts of the disease on the growth. It is against this background that the study is being undertaken.

1.3 Research Questions

In line with the statement of the problems, the following questions are worth asking:

I. What is the effect of HIV/AIDS on human capital accumulation in Ghana?

II. How will the spread of HIV/AIDS and the accompanying rise in adult mortality affect a country's economic performance and hence economic growth?

1.4 Research Objectives

General objective

To assess the impact of HIV/AIDS on the Ghanaian economy using the human capital approach.

Specific objectives

- To find out the effect of HIV/AIDS on human capital hence on economic growth.
- To provide policy recommendations from the findings of the study.

1.5 Research Hypothesis

The study seeks to test this hypothesis:

H_0: HIV/AIDS has no impact on economic growth in Ghana.

H_1: HIV/AIDS has a negative impact on economic growth in Ghana.

1.6 Justification/significant of the study

It is generally agreed that HIV is a health problem but not readily seen as a developmental one. Thus the significance of this study is to shift this perception and intensify understanding of the ways in which HIV transforms development prospects of a country like Ghana. The disease HIV/AIDS is killing mostly young adults, taking from the children of AIDS victims of one or both parents who are to raise and educate them, and so undermining the basis of economic growth over the long haul. The people of a nation are its greatest resources in the process of attaining a higher rate of growth and development. They are both the producers and consumer of all the goods and services available in the country at any given time.

Additionally, literature on the impact of HIV/AIDS on economic growth in Sub-Saharan African countries, including Ghana is very limited. In Ghana, there exists no study that directly investigates the impact of HIV/AIDS on economic growth. Existing studies have rather focused on the effect of stigmatization and behavioural changes and its impact on selected macroeconomic variables like unemployment, savings rates and capital

accumulation. This study therefore seeks to investigate the impact of HIV/AIDS on economic growth and also contribute to existing knowledge. The study also seeks to create awareness within academic circles and whip up the interest of potential researchers for further empirical research on the subject.

Finally, the findings of the study is expected to equip policy makers with the relevant information for the design and implementation of appropriate economic policies that will result in higher and sustainable growth rates for the country.

1.7 Organisation of the study

This study is divided into five chapters. Chapter one discusses the background information and the research design. Chapter two presents an overview of the health sector in Ghana. Additionally, this chapter discusses the evolution of the problem. The review of literature (theory and evidence) is presented in chapter three. Chapter four discusses the methods and the procedure to be employed in the process of carrying out the research. This same chapter presents the data analyses and the finding of the study. Finally, chapter five contains the summary, conclusions, recommendations and also policy implications of the study.

CHAPTER TWO

THE HEALTH SECTOR AND THE EVOLUTION OF HIV/AIDS IN GHANA

2.1 Introduction

This chapter builds on chapter one, by taking a careful and critical look at the health sector in Ghana and the evolution of the disease HIV/AIDS disease in the country.

2.2 Historical Background of the health sector in Ghana

Before the independence of Ghana, then Gold Coast in 1957, herbalists or traditional healers were those mostly consulted on health issues. These herbalists or healers used herbal concoctions to cure diseases such as fever, malaria, diarrhoea and piles (G.J.M.Van Den Boom et al, 2008). The rewards for these healers or herbalists were usually in the form of animals and foodstuffs. The quantities of rewards depended on the severity of the diseases treated and also the kind of disease treated. We still have this mode of treatment in the 21st century Ghana, most especially in the rural areas of the country. This time it is in a modernized form both in the quality of work and the environment in which they operate. A good example is the special government herbal medicine hospital and Research center at Akwampim-Mampong.

The historical background of Ghana's healthcare system is influenced by the British. Until 1957, Ghana remained a territory of the British government and as a result the system of healthcare delivery was modelled by the British, perhaps after their own system

back home (Abekah-Nkrumah, 2005). The development of formal health services in Ghana can be traced back to the establishment of the Gold Coast medical department in the late 1880s by the British (Anne Mills, 1998).The purpose of the medical department was to cater for the health needs of the colonial administrators and the British military. The country's health systems at the time was described as focusing on hospital based clinical care; initially served expatriate Civil Servants and merchants and most facilities were concentrated in port towns and areas with commercial activities; and focus on sanitation activities in towns and cities. Additionally, the missionaries who were in the country by then, also established health facilities to render health services to the local populations as part of their souls winning drive.

By the beginning of the 20th century, the British had expanded and extended their health services to the local people. With this gesture it was expected that most Gold Coasters (Ghanaians) would utilize these health services. The colonial masters built more health facilities and also incorporated preventive health care in the mainstream health service. Consequently, they established a sanitary branch in 1909 to take charge of preventive healthcare which was later followed by the establishment of a medical research institute (Laboratory) branch. The number of health care facilities was increased from 9 in 1909, to 22 in 1912 and later to 39 in 1939 (Anne Mills, 1998) . It was during this period that the Korle-Bu hospital (1923) was built. The importance of this hospital in meeting the critical health needs of the nation cannot be understated. In addition to the above rural health stations called "Medical Field Units" were constructed to cater for the health needs of the rural folks. As a way of grooming local paramedics, the British trained some

Ghanaians in the new field of medicine. The missionaries in the country also established health care facilities. These Mission health care facilities were usually free. However, available literature indicates that, in situations where user fees were charged, they were generally low compared to others.

After the immediate post-independence period (1957), the health sector started addressing issues of equity in health care by expanding the availability of hospitals and health centres to cover much more of the countryside. Nevertheless these facilities were still not equitably distributed. The action to ensure equity happen together with the introduction of new cadres of health care workers such as Medical Assistants (or Health Centre Superintendents), Technical Officers and Field Technicians for Diseases Control and Surveillance.The focus of healthcare delivery at the time was the delivery of basic healthcare services to take care of the health needs of civil servants and the general populace.

Additionally, the government of the day in its attempt to demonstrate to the whole world that the black man is capable of managing his own affairs launched the expansion of health service infrastructure to cover most parts of the country. The Northern part of the country benefited most. The new government completely abolished user charges which were primarily charged by most colonial health institutions. More health training institutions were established to train more health professionals. The training of most health professional was done free of charge. This was to fill the newly constructed

hospitals and clinics. Successive governments continued to provide more health infrastructure as well as train more health professionals free of charge. More budgetary allocations were also made to the health sector to improve quality of services. The commitments of governments on the health sector continued, until the late 1970s and early 1980s when the country was respectively hit by the oil shocks and debt crisis. These developments seriously constrained government efforts at resourcing the health sector and consequently led to a reduction in health spending to 20% of its former level between 1975 and 1985 (Anne Mills, 1998).

To compound the above situation, Ghana like many other Sub-Saharan African countries was hit by the economic crisis of the 70's. Frequent coups d'etat and changes in government also contributed to severe reductions in the resources available for health care. As noted by the World Bank, these problems resulted in poor service conditions for health workers and a rapid decline in morale. The period also witnessed low payment of salaries to health workers, shortage of drugs, materials and equipments and poorly maintained health facilities. These unfortunate developments made the government (PNDC government) encourage private sector participation in the health sector. In 1985, the government of Ghana therefore introduced user fees into the health services marking a significant shift in health policy towards cost recovery, decentralization of management and rationalization of services. Cost recovery popularly known as "Cash and Carry" in the health sector. This was subsequently removed and replaced by the national health insurance scheme in 2003.

Modern medical services in Ghana are provided by the central government, local institutions, Christian missions (private nonprofits agencies), and a relatively small number of private for profit practitioners. According to the UN, about 60.2 percent of the country's total population in 1975 depended on government or quasi-government health centers for medical care. Of the available health facilities represented in the 1984 census, about 62.9 percent were still described as government and quasi-government institutions. Mission hospitals represented a large percentage of the remainder, while private hospitals constituted less than 2 percent of modern medical care facilities.

2.2.1 Health reforms in Ghana

The focus of most of the health sector reforms in Ghana has been on a shift from curative to preventive health care, and emphasis on primary health care which is in line with the Alma-Ata declaration of health for all beyond 2000 in 1978. Under the ERP/SAP there was the introduction of public sector spending controls, cost-sharing schemes and the removal of general subsidies especially in the social sectors. This therefore led to an intensification of fee collection for services and the enactment of the hospital fees Act (Act 650) in 1985. From a system of charging token fees for consultation under this Act, the user-fee regime changed in 1985 to one in which fixed fees were charged for consultations, examinations and laboratory and related diagnostic procedures, and drugs were priced at full cost. This full cost recovery for drugs was popularly known as the "cash and carry system". The main aim of the introduction of user charges or fees in health delivery was to reduce the burden of health expenses on the national budget and also remove inefficiency in the health care systems (SAPRI, 2004).

The introduction of user fees under cost recovery and revenue generation schemes has imposed serious constraints on access by the poor to health care services. Several studies pointed out that, the introduction of user fees for health care service had led an increasing number of people and families to opt for self- medication and home care instead of visiting clinics and hospitals (Asenso-Okyere et al, 1998).More people therefore sought medical attention only when their illness was severe. This led to an increase in the number of deaths.

A comprehensive health sector reform was undertaken by the government in the 1990s. The aim was to increase the geographical accessibility of health services and improve the quality of health service delivery. To achieve this aim, the health sector Act (Act 525) was passed in 1996. This helped in the development of a medium term health strategy and accompanying programme of works (POW) with specific targets to achieve. These reforms were based on the vision 2020 document. The Ghana Health Service came into being in 1996 under Act 525 and was responsible for policy making and regulation. The medium term health strategy provided an innovative sector-wide approach focusing on Ministry of Health reorganization and public health planning.

The Sector-Wide Approach (SWAp) had as primary objectives the making of health sector reform more effective by reducing duplication, increasing efficiency of health service provision, and channeling scarce resources in to their most productive activities (Cassels, 1997). The POW has been built on an overall five year programme of work. A

review of the progress POW is done yearly and presented at biannual health summits. The first five years of POW ran from 1997 to 2001 and immediately followed by the second, from 2001 to 2006. Both POW I and II have the same objectives which are:

- Improving quality of health delivery
- Increasing access to health services
- Improving the efficiency of health service delivery
- Fostering partnerships in improving health and
- Improving financing of the health sector

Many annual reviews have been conducted but the 2000 review was more in-depth and was the background for "The Health of the Nation" report in that same year. The focus of the POW is to bridge the inequities between north-south, urban-rural, males-females and literate-illiterate.

The Ghana Poverty Reduction Strategy (GPRS) was formulated in 2001 by the government of Ghana. This was to enable the country benefit from the debt relief under the HIPC initiative and also improve its macroeconomic environment. A crucial part of the GPRS was the improvement of the health of the poor for poverty reduction. This is because ill health is both a consequence and cause of poverty. A significant role of the GPRS in the health sector is to deepen the design and implementation of initiatives based on three broad policy objectives:

- Bridging the equity gap in access to quality health and nutrition services

- Accelerating the institutionalization of sustainable financing arrangements that protect the poor
- Enhancing efficiency in service delivery within the health sector in general and especially in the areas relating to preventive healthcare and environmental sanitation sub sectors

Also, the focus of the GPRS in the health sector is to address the following diseases: HIV/AIDS and Sexually Transmitted Infections (STIs), Malaria, Guinea worm, and Tuberculosis so as to develop the human resource base of the nation. The GPRS further promises special care for the disabled, elderly and people living with HIV/AIDS. A mention has also been made of the need to focus on reproductive and child health, expansion of immunization programmes and emergency care, the expansion of health training institutions, and provision of staff accommodation.

In the area of health financing, the main policy reform has been the replacement of the cash and carry system which was creating equity concerns with the National Health Insurance Scheme (NHIS).The national health insurance Act (Act 650) was passed into law by the parliament of Ghana in 2003. Health insurance works to pool funds as well as spread the risk of incurring health care costs over a group of subscribers. Thus, it provides a sustainable health financing scheme that protects the poor and vulnerable.

The Ghana national health insurance scheme essentially combines social health insurance for formal sector employees with a community based/Mutual health insurance for the

informal sector. The NHIS among other things also has an exemption package for maternal deliveries especially for the three Northern regions and the central region which have high maternal mortality rates (Budget, 2004). The good thing about the NHIS in Ghana is that, it allows for the involvement of private health providers, nongovernmental organizations, District Assemblies, and Traditional and alternative medicine providers. However, the scheme faces the problem of moral hazard where people in most cases unnecessarily demand more health services after they have paid their premiums. There are also complains of delays in payment of money by the insurance organizations to health providers for services rendered.

2.2.2 The Structure of the Health Care System.

The health care system in Ghana mainly comprises the public and private systems. The public health care system is run by government through the Ministry of Health (MOH) and the Ghana Health Service (GHS). The medical system in Ghana comes under the jurisdiction of the Ministry of Health, which is also charged with the control of dangerous drugs, narcotics, scientific research, and the professional qualifications of medical personnel. The MOH is the legislative body in charge of the health system, hence in discussing the health care system attention would be given to the GHS which is the implementing body. Available statistics reveal that, health facilities under the public health care system form about 47.6% of all health facilities.

The Ghana Health Service (GHS) is a Public Service body established under Act 525 of 1996 as required by the 1992 constitution. It is an autonomous Executive Agency

responsible for implementation of national policies under the control of the Minister for Health through its governing Council (the Ghana Health Service Council). The GHS continues to receive public funds and thus remain within the public sector. However, its employees are not part of the civil service, and do not follow all civil service rules and procedures.

The independence of the GHS is designed primarily to ensure that staff members have a greater degree of managerial flexibility to carry out their responsibilities, than would be possible if they remained wholly within the civil service. It is important to note that GHS does not include Teaching Hospitals, Private and Mission Hospitals (www.Ghana Health Service.org). The establishment of the Ghana Health Service is an essential part of the key strategies identified in the Health Sector Reform process, as outlined in the Medium Term Health Strategy (MTHS), which are necessary steps in establishing a more equitable, efficient, accessible and responsive health care system. The reforms build on the reorganization of the MOH that began in 1993, which was explicitly designed to set the scene for the establishment of the Ghana Health Service. The reforms also provide a sound organizational framework for the growing degree of managerial responsibility that has already been delegated to districts and hospitals.

Administratively GHS is organized at 3 levels: National level, Regional level and District Level. At the national level GHS is made up of a Council which is at the top hierarchy. This is followed by the office of the Director General and Deputy Director General and eight national divisional directors. The regional level of the GHS is headed by 10

Regional Directors of Health Services. These Regional Directors are supported by Regional Health Management Teams and Regional Health Committees. At the regional level, curative services are delivered at the regional hospitals whilst public health services are delivered by the District Health Management Team (DHMT) as well as the Public Health division of the regional hospital. The Regional Health Administration or Directorate (RHA) provides supervision and management support to the districts and sub-districts within each region.

The districts level is made up of all 110 districts and headed by District Directors of Health Services, who are also supported by the District Health Management Teams and the District Health Committees and also Sub District Health Management Teams. At the district level, curative services are provided by district hospitals many of which are mission or faith based. Public health services are provided by the DHMT and the Public Health unit of the district hospitals. The District Health Administration (DHA) provides supervision and management support to their sub-districts. The sub-district levels provide both preventive and curative services as well as outreach services to the communities within their catchments areas. Basic preventive and curative services for minor ailments are being addressed at the community and household level with the introduction of the Community-based Health Planning and Services (CHPS). The role played by the traditional birth attendants (TBAs) and the traditional healers is also receiving national recognition.

Functionally GHS is organised at Five (5) Levels: National level, Regional level, District level, Sub-district level and Community level. Additionally, the GHS is governed by a 12-member Council. The GHS Council has the following functions: ensuring the implementation of the functions of the Service and submitting to the Minister recommendations for health care delivery policies and programmes. It also promotes collaboration between the Ministry of Health and Teaching Hospitals and also advises the Minister on posts in the Service and other matters that the Minister may request. The above administrative levels are organised as Budget and Management Centres or Cost centres (BMC) for purposes of administering Government of Ghana and Developmental Partner Funds. There are a total of 223 functional BMCs and 110 Sub-Districts BMCs of Record. A breakdown of the BMCs is as follows: Currently, the headquarters of the GHS is managed as one BMC; 10 Regional Health Administration, 8 Regional Hospitals, 110 District Health Administrations and 95 District Hospitals.

2.3 The origin and spread of HIV/AIDS

During the early 1980's that is 1980 and 1981, five young men in the United States of America were treated for a disease called pneumocystis carinil, this disease was mostly found in older persons. These cases were reported to and investigated by the Centres for Disease Control and Prevention, United States of America. The number of cases kept increasing and soon scientists identified this to be a different illness it was named AIDS (Ward 1999:366-368). In 1984, HIV was identified as the cause of AIDS. The most crucial evidence came from a later test conducted in Thailand between 1988 and 1994, where 200,000 Thais were tested in 1988 and 700,000 Thais were tested in 1994 (Ward

1999:378). Ever since then HIV/AIDS has become one of the major public policy issues in many parts of the world.

The origin of the HIV/AIDS disease is not really known but scientist only speculate about the origin of HIV, with many believing that HIV-2 was present in African monkey and became transmissible to human through a series of mutations, and that HIV-1 was originally carried by African chimpanzees (Ward 1999:376; Janse Van Rensburg 2000:267). The means by which HIV is transmitted has been identified as having unprotected sexual contact with an infected person, contact with infected blood or through bodily fluids, blood products or tissues, accidental needle pricks, or breaks in the skins, transfer from an infected mother to her infant before or during birth and breast-feeding. (Ward 1999:35-37; Janse Van Rensburg 2000:268). No new facts are known about the transmission of the virus and the questions such as whether a mosquito that bites a person will be able to spread the virus, can still not be answered with certainty. Societies and governments today focus on the preventing infection and developing a vaccine (Barnett & Whiteside 2002:45).

2.3.1 HIV/AIDS in the world

For every nation to develop, it is very important that it takes a critical look at the health of its citizens. Due to the importance attached to the health of individuals, the Alma-Ata Declaration elevated health to the status of a basic and fundamental human right. Notwithstanding this, the world seems to be experiencing a new threshold in this new millennium. This threshold is the disease HIV/AIDS, which seems to be the biggest

health and development challenge the world has ever confronted. This disease according to UNAIDS, is unique in its devastating impact on the social, economic and demographic foundations of development. It is therefore hard to believe that a disease, that was all but unknown barely two decades ago, by 1999 had caused the death of 18.8 million people globally, among them 13.7 million from Africa alone (UNAIDS 1999a). The global trend of the disease keeps escalating from one year to another. Statistically, the number of people infected with HIV as at 1999 in the world was estimated to be 34 million with about 95 percent living in the developing world and a wobbling 70 percent in Sub-Saharan Africa (UNAIDS 2000).

Virtually all continents and countries in the world are affected. Those countries that took a lukewarm attitude after some few successes in combating the disease have started experiencing a renewed increase in numbers of people infected. In Sub-Saharan Africa, the overall percentage of adults with HIV infection has remained stable in recent years, but the number of people living with HIV is still growing (UNAIDS, 2004). The rate of infection varies from continent to continent and even within regions. At the country levels the rate of infections seems to differ from districts to districts, cities and towns.

Table 2.0 Global HIV/AIDS estimates, end of 2007

	Estimate	**Range**
People living with HIV/AIDS in 2007	33.0 million	30.3-36.1 million
Adults living with HIV/AIDS in 2007	30.8 million	28.2-34.0 million
Women living with HIV/AIDS in 2007	15.5 million	14.2-16.9 million
Children living with HIV/AIDS in 2007	2.0 million	1.9-2.3 million
People newly infected with HIV in 2007	2.7 million	2.2-3.2 million
Children newly infected with HIV in 2007	0.37 million	0.33-0.41 million
AIDS deaths in 2007	2.0 million	1.8-2.3 million
Child AIDS deaths in 2007	0.27 million	0.25-0.29 million

UNAIDS (2008) 'Report on the global AIDS epidemic'

Table 2.1 Regional statistics for HIV & AIDS, end of 2007

Region	Adults & children living with HIV/AIDS	Adults & children newly infected	Adult prevalence*	Deaths of adults & children
Sub-Saharan Africa	22.0 million	1.9 million	5.00%	1.5 million
North Africa & Middle East	380,000	40,000	0.30%	27,000
Asia	5 million	380,000	0.30%	380,000
Oceania	74,000	13,000	0.40%	1,000
Latin America	1.7 million	140,000	0.50%	63,000
Caribbean	230,000	20,000	1.10%	14,000
Eastern Europe & Central Asia	1.5 million	110,000	0.80%	58,000
North America, Western & Central Europe	2.0 million	81,000	0.40%	31,000
Global Total	33.0 million	2.7 million	0.80%	2.0 million

UNAIDS (2008) 'Report on the global AIDS epidemic'

Africa is the continent with the highest recorded cases of the disease. On the African continent southern Africa currently has the highest levels of HIV prevalence. This is why Africa has been the focus of most literature on HIV/AIDS. In its 2007 report, UNAIDS estimates that about 22.5 million people in sub-Saharan Africa were living with HIV/AIDS. This figure represents nearly 68 percent of the total 33.2 million cases worldwide. The new infections figures of HIV among children and adults on the continent in 2007 numbered 2.5 million, this represents almost 61 percent of HIV infections in the sub region is found in women, a higher percentage than any part of the world. Nearly 76 percent of the million AIDS related deaths worldwide in 2007 occurred in sub-Saharan Africa, where AIDS is by far the most common cause of mortality, according to the UNAIDS 2007 *Epidemic Update*. Additionally, the region is home to an alarming 80% of the world's children who have been orphaned or otherwise made vulnerable by the disease. The region's HIV/AIDS epidemiological profiles differ considerably, while majority of the hardest impacted countries having a generalized epidemics; others have concentrated epidemics with disease hotspots. The prevalence estimates of the disease ranges from fewer than 2 percent in the Sahel to more than 15 percent in most part of southern Africa. Almost all the countries on the continent appear to have steady epidemics, with the number of people being newly infected with HIV roughly matching the number of people dying of AIDS related illnesses.

Table 2.2 Top 15 HIV/AIDS prevalence African Countries (2005)

Countries	Percentage of the population infected with HIV/AIDS
Swaziland	**33.4**
Botswana	**24.1**
Lesotho	**23.2**
Zimbabwe	**20.1**
Namibia	**19.6**
South Africa	**18.8**
Zambia	**17.0**
Mozambique	**16.1**
Malawi	**11.8**
Central African Republic	**10.7**
Gabon	**7.9**
Cote d'Ivoire	**7.1**
Uganda	**6.7**
Tanzania	**6.5**
Kenya	**6.1**

Source: World Population Data Sheet (2006)

2.3.2 HIV/AIDS epidemic in Ghana

The first case of AIDS was reported in Ghana in March 1986. By the end of that year a total of 42 cases had been reported to the health authorities. There was an increase of the disease among STI clinic patient from 2 percent in 1988 to nearly 9 percent in 1991 (WHO, 2000). By 1997, HIV prevalence among sex workers tested in Accra had reached

7.3%. The number of reported cases has been increasing steadily over the year with a cumulative total of 43,587 as at the end of December 2000 (WHO, 2000). HIV/AIDS is one of the most serious public health challenges facing Ghana today due to its mammoth effect on economic growth but until about the year 2000, HIV/AIDS in Ghana was managed as a disease rather than a development issue. In Ghana, HIV surveillance information on antenatal clinic women has been available since 1990. Information was available only from Accra in 1990, but, by 1994, 20 sentinel surveillance sites were reporting HIV prevalence. By 1997, Kumasi and Tamale had been included as major urban areas for the sentinel surveillance.

The HIV/AIDS rate among pregnant women in Ghana slowly increased between 1990 and 1998. This rate among antenatal clinic women tested increased from 1% in 1990 to 3% in 1998. In 1998, HIV prevalence ranged from 2% to 7% (National AIDS/STI Control Programme, GHS, and Ministry of Health (MOH), 2003). The HIV/AIDS prevalence rate (the percent of people living with the disease) in Ghana is still relatively low compared to the Sub-Saharan African region overall, and appears to be fairly stable.

The AIDS statistics show that as at December 2002, the Ministry of Health (MOH) had recorded a total of 64,316 AIDS cases since the first official case was recorded in Ghana in 1986. This meant that on the average, the country had recorded about 3,783 AIDS cases annually since 1986.

Ghana's HIV/AIDS epidemic has exhibited a different pattern from that found in many other parts of sub-Saharan Africa. The HIV/AIDS prevalence rates peak at 3.1 percent in 2003. The figure fell to 2.3 percent in 2006 (WHO, 2007). The seriousness of the HIV/AIDS epidemics in Ghana cannot be understated since about three percent of the entire adult population of the country is HIV infected (MOH, 2001). In 2000, about 350,000 Ghanaians were infected with HIV, the virus that causes AIDS (MOH, 2001). This figure included 330,000 adults and 20,000 children. In addition, more than 185,000 Ghanaians have died from AIDS since the beginning of the epidemic in the early 1980s (National AIDS/STI Control Programme, GHS, and Ministry of Health (MOH), 2003).

Two major transmission mechanisms have been identified to account for most new HIV infections in the country. These are heterosexual contact and mother-to-child (MTC) transmission (National AIDS/STI Control Programme, GHS, and Ministry of Health (MOH), 2003) with heterosexual contact being the highest (80%).

The distribution of number of HIV/AIDS cases in the country varies from region to region. The 2002 HIV/AIDS records show that Ashanti Region leads with 30.1 percent of all cases followed by Greater Accra Region with 17.3 percent and Eastern region with 14.6 percent (Table 2.5). Thus, these three regions alone contain 62 per cent of all AIDS cases in the country. The pattern of distribution indicates that HIV prevalence is highest in the best-developed and economically endowed regions of Ghana.

Table 2.3: HIV/AIDS in Ghana

Indicator	Ghana	Sub-Saharan Africa	Global
Estimated number of people living with HIV/AIDS, 2003	350,000	25 million	37.8 million
Percent of adult population estimated to be living with HIV/AIDS, 2003	3.10%	7.50%	1.10%
Estimated number of deaths due to HIV/AIDS, 2003	30,000	2.2 million	2.9 million
Women as percent of adults estimated to be living with HIV/AIDS, 2003	56%	57%	48%
Percent of young women, ages 15-24, estimated to be living with HIV/AIDS, 2001	2.1 - 3.9%	8.90%	1.40%
Percent of young men, ages 15-24, estimated to be living with HIV/AIDS, 2001	0.95 – 1.8%	4.40%	0.80%
Estimated number of AIDS orphans, 2003	170,000	12.1 million	15 million
Number of people estimated to be receiving antiretroviral therapy (ART), June 2005	2,500 –3,000	500,000	970,000
Number of people estimated to be in need of ART, June 2005	58,000	4.7 million	6.5 million

UNAIDS, *2004 Report on the Global AIDS Epidemic*, July 2004.

Table 2.4: HIV and AIDS Estimates

HIV	Estimate
Total Population	22.9 million (mid-2007)
Estimated Population Living with HIV/AIDS	320,000 [270,000-380,000] (end 2005)
Adult HIV Prevalence	2.3% [1.9-2.6%] (end 2005)
HIV Prevalence in	Sex Workers: Stationary Sex Workers (Accra) 52% (2006) and Mobile Sex Workers (Accra) 37% (2006)
Most-At-Risk Populations	
Percentage of HIV-Infected People Receiving Antiretroviral Therapy	16% (end 2006)

UNAIDS, *2004 Report on the Global AIDS Epidemic*, July 2004.

Table 2.5: Reported Cumulative Aids Cases by Region (1986-2002)

Regions	Numbers	Percentages
Ashanti	19330	30.1
Brong-Ahafo	5262	8.2
Central	4249	6.6
Eastern	9420	14.6
GT. Accra	11106	17.3
Northern	3200	5.0
Upper East	2836	4.4
Upper West	1249	1.9
Volta	2423	3.8
Western	5155	8.0
Not Stated	86	0.1
Total	64316	100

Source: National AIDS/STI Control Programme, GHS, and Ministry of Health (MOH), 2003

2.4 Conclusion

The Ghanaian health sector has evolved from a simple traditional sector to a more complex and modern sector, treating all manner of diseases including HIV/AIDS. The health sector is also key towards the survival and growth of a healthy labour force and country. Due to the above problems enumerated much attention has been given to that sector.

CHAPTER THREE

3.0 LITERATURE REVIEW

3.1 Introduction

This chapter presents the theoretical underpinning of the research as well as the empirical research that have been conducted on the problem under investigation.

3.2.0 Theoretical Literature

3.2.1 Conceptual framework for the impact of HIV/AIDS on the economy

The HIV/AIDS epidemic can affect the economy in a number of ways: The AIDS epidemic will slow or reverse growth in the labour supply. The economic impact can vary according to the sector of the economy, the degree to which HIV/AIDS affects hard-to-replace skilled labour and whether or not there is a substantial pool of "surplus labour". Savings and investments of families will be reduced owing to the increase in HIV/AIDS-related health expenditures. If children's education, health and nutrition suffer as a result, prospects for longer-run economic growth and development will decline.

The AIDS epidemic may also divert public spending from investments in physical and human capital to health expenditures, leading over time to slower growth of the gross domestic product. Foreign and domestic private investment might also decline if potential investors become convinced that the epidemic is seriously undermining the rate of return on investment.

The HIV/AIDS epidemic may also deepen the poverty of the most affected countries by decreasing the growth rate of per capita income and by selectively impoverishing the individuals and families that are directly affected.

Cohen (1997), among others, stresses the effect of HIV on the size of the working population, which tends to reduce total output and worsen the dependency ratio. More children and elderly persons may have to be supported by a smaller active labour force. In addition, the composition of the labour force may change with respect to skills, education and experience, which would decrease the productivity of labour.

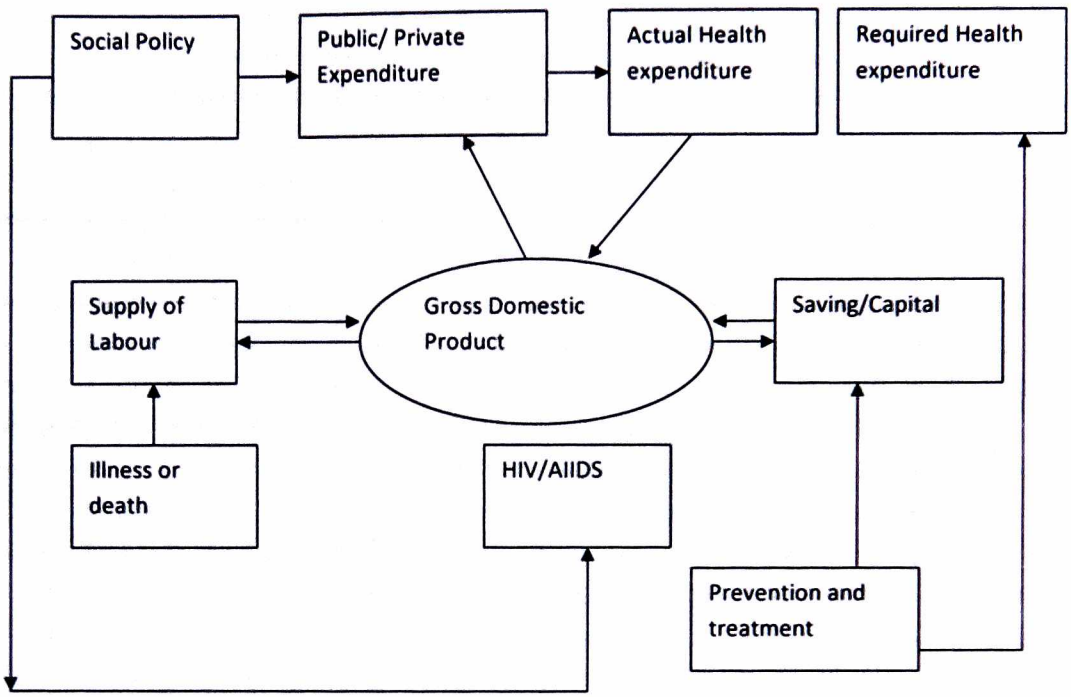
Theodore (2001), in a model applied to several Caribbean countries, identified four channels through which HIV/AIDS may affect the economy: the production channel; the allocation channel; the distribution channel; and the regeneration channel (figure 3.1). The production channel refers to the mechanisms through which HIV/AIDS affects the main factors of production labour and capital causing the production process to be less fruitful than it would have been in the absence of HIV/AIDS. The second channel through which HIV/AIDS may affect the economy is the allocation channel.

One of the most important functions of the economic system is to ensure an efficient allocation of resources. HIV/AIDS reroutes some of those resources to medical expenses and away from other productive uses. The third assumed channel through which HIV/AIDS affects the economy is the distribution channel, specifically, the distribution of income. In the face of an epidemic that increases health expenditures and weakens the

income base, the lowest income groups may fare the worst. While the rich may have other assets like their savings, land or capital often the only productive asset of the poor is their own labour, which HIV/AIDS attacks.

The upper in-come groups, though they are also affected, may be better placed to protect themselves and better able to afford treatment. Thus, the HIV/AIDS epidemic has the potential not only to affect all groups but also to widen the gap between different social strata. The fourth channel, the regeneration channel, refers to the investments in human capital, physical capital and new technology that are needed to keep the economy growing. If the HIV/AIDS epidemic compromises the saving capacity and the human capital of the economy, it will undercut the process of economic development.

Figure 3.1 Conceptual Framework for the impact of HIV/AIDS on the economy



Source: Karl Theodore, "HIV/AIDS in the Caribbean: economic issues—impact and investment response". Commission on Macroeconomics and Health Working Paper Series, Paper No. WG1:1 (Cambridge, Massachusetts, Harvard University, Center for International Developments; and Geneva, World Health Organization, 2001).

3.2.2 Approaches to estimating the effect of HIV/AIDS

In modelling the economic impact of the HIV/AIDS disease on growth several models have been used. In a broad-spectrum, most of these estimates have been done using a

case in which the economy performs in the absence of AIDS and contrast that result with an estimate of economic performance, given an estimated or projected number of HIV/AIDS cases. Most of the economic variables or results studied are Gross Domestic Product per capita and the growth in total GDP. Only few studies have concentrated on the effect of the diseases on intermediate outcomes like the effects on savings rates and investment. Other researchers have analysed the epidemic's differential effects on particular sectors of the economy as in estimating its effects on GDP as a whole.

Several studies done in this area have employed cross-national data, which may pertain to a single time period or to a time series. In those analyses, regression analysis was used to estimate the effects of one or more indicators of the volume of HIV/AIDS infections or deaths on economic outcomes, controlling for other variables that previous work had identified as having an important effect on economic growth (United Nations Department of Economic and Social Affairs/Population Division: The Impact of AIDS, 2001).

Some analyses have further elaborated the model by positing a dual-sector economy, in which there is a relatively well-paying and productive formal sector, which tends to employ the more highly skilled workers, and a relatively low-wage, low-productivity informal sector that employs labour that is in surplus to the needs of the formal sector. With such a dual sector model, the predicted economic effects of the HIV/AIDS pandemic can vary significantly depending on the degree to which infections are assumed to be concentrated in the more skilled workers that are keys to the functioning of the formal sector. If a country has a substantial pool of surplus labour with very low marginal productivity, and if HIV/AIDS is highly concentrated in the pool of unskilled labour, then

even a substantial prevalence of HIV/AIDS might have only a small effect on performance of the macro-economy, while if the same number of infections were to occur in the skilled labour force, the macroeconomic effect could be large.

The latter type of model has, however, been criticized by some analysts (for example, Cohen, 2002) for downplaying the importance of the informal sector as an engine of economic advancement and also for downplaying the degree of expertise embodied in informal-sector employees and entrepreneurs, whose knowledge may be as difficult to replace as that of the skilled workers of the formal sector. Even if a substantial loss of unskilled labour were to have only a minor impact the growth of GDP in a particular economy, the impact on the families that depended on such labour would be dire. Many families depend on low-wage workers to maintain a basic level of subsistence, and the loss of those workers will deepen their poverty.

Other, more elaborated models have also been used to analyse how the impacts of HIV/AIDS on different sectors of an economy relate to overall economic performance. For instance, Kambou, Devarajan and Over (1992) applied an eleven-sector computable general equilibrium (CGE) model to estimate the economic effects of HIV/AIDS in Cameroon. The model is based on a snapshot picture of an economy contained in a social accounting matrix. CGE models are rich in sectoral and distributional data as compared with time series-based and aggregated macroeconometric models, and are widely used to evaluate trade and expenditure, since they commonly have differential impacts within society. Again, a lack of knowledge about many of the variables and their relationships often makes it necessary to make assumptions or borrow estimates from other situations

in order to apply the models to the situations of particular countries affected by HIV/AIDS.

3.2.3 The Model: An Augmented Solow Model

An influential attempt to examine the impact of human capital on economic growth using an econometric framework is found in Mankiw, Romer, and Weil (1992). Although Felip and McCombie (2002) have documented some criticism of the empirical implications of Mankiw et al.'s growth regression it still stands out as the best model for this study. Mankiw et al's framework augments the standard Solow growth model by incorporating human capital as a factor of production. The basic assumption in this model is that aggregate output (Y_{it}) in country (i) and time (t), is a function of physical inputs K_{it}, labour L_{it}, labour-augmenting productivity A_{it}, as well as human capital E_{it}:

$$Y_{it} = (K_{it})^{\alpha}(E_{it})^{\beta}(A_{it}L_{it})^{1-\alpha-\beta}$$

Where α and β are the elasticities. Human capital is conceptualized solely as educational attainment and do not incorporate health in their empirical estimation. A later paper by Knowles and Owen (1995) extends their framework by incorporating both education (e_{it}) and health (H_{it}) as components of human capital:

$$Y_{it} = (K_{it})^{\alpha}(e_{it})^{\beta}(h_{it})^{\varphi}(A_{it}L_{it})^{1-\alpha-\beta-\varphi}$$

Health is included as an input of the macroeconomic production process because health is directly correlated with labour productivity while a healthier population due to lower health-related expenditure and higher probabilities of future survival are most likely to

save and invest for the future. Health, in addition to providing utility in itself, also influences the ability of individuals to gain utility from consumption of other products (Ajay Tandon, 2005). In their empirical estimates Knowles and Owen (1995) find a strong, more robust relationship between health capital and income per capita than between education capital and income per capita.

Theoretically, the most appealing and apparent way to incorporate HIV/AIDS into the augmented Solow model is following the approach taken in Dixon, McDonald, and Roberts (2001) and in McDonald and Roberts (2004). This approach assumes that HIV/AIDS prevalence has an effect on the accumulation of health capital. In addition to an aggregate production function, it specifies a second equation characterizing a health production function, whereby health outcomes in a country are assumed to be a function of several inputs (Ajay Tandon, 2005). These inputs Z_{it} could be taken to include factors such as health expenditure, infrastructure, governance, education, etc. Health outcomes are also assumed to be functions of a country's epidemiological environment d_{it}, (such as disease prevalence rates):

$$H_{it} = f(z_{it}, d_{it})$$

By taking the HIV prevalence rate to be a proxy measure for d_{it}, we can estimate its impact on macroeconomic growth through its effect on health capital accumulation. Based on the above formulation, output per capita in a country can be derived to be a function of the share of resources devoted to physical, education, and human capital. As is standard in the literature, we use the share of gross domestic product (GDP) invested on average over the period (I) as a proxy for the share of resources devoted to physical

capital. Education capital accumulation E is proxied by the secondary school enrollment ratio. For health capital H, the methodology of Anand and Ravallion (1993) and others is followed. The health production function is presented as follows:

$$ln(h) = f[ln\ HIV, ln(MAL), ln(CAL)$$

The health function is incorporated as an independent variable in the levels equation. For the health production function, health system determinants are proxied by income per capita. Other determinants included are caloric intake per capita (CAL). The disease environment is proxied by the proportion of the population at risk of malaria (MAL) as well as by the HIV prevalence rate. The estimated equation as presented by Knowles and Owen (1995) is:

$$Y_{it} = (K_{it})^{\propto}(e_{it})^{\beta}(h_{it})^{\varphi}(A_{it}L_{it})^{1-\propto-\beta-\varphi}$$

But in it log form as

$$ln(Y_c) = \alpha ln(K) + (1-\propto -\beta - \varphi)ln(AL) + \beta ln(e) + \varphi ln(h)$$

3.3.0 Empirical Literature

Various attempts have been made to comprehend the economic implications of the HIV/AIDS epidemic on growth. These works have been appearing in the literature for the past two decades. The earliest efforts were made by researchers like Bloom and Mahal (1995); Cuddington, Hancock, and Rogers (1994); Cuddington (1993); and Kambou, Devarajan, and Over (1993). Most of these studies on AIDS and economic growth to date have typically focused on physical capital accumulation and rates of technical progress as the main channels through which the pandemic impacts economic growth.

Over (1992) using a model that differentiated between three classes of workers and between rural and urban production, projected the macroeconomic impact of AIDS on the growth trajectories of 30 countries in Sub-Saharan Africa over the period 1990-2025. He estimated that between 1990 and 2025 the 10 countries with the most advanced epidemics would see a reduction in growth per capita of about a third of a percentage point compared to a non AIDS scenario. The effect in the 10 most advanced countries would be 0.6 percentage point if all the treatment costs were financed from savings.

Additionally, the macroeconomic impact varied depending on the assumptions about relative levels of HIV infection on educated and uneducated workers and also the amount spent on treatment taken from personal savings. For the assumptions Over (1992) regarded as most plausible (that 50 per cent of the treatment costs were financed out of savings and that each educational class of workers has double the risk of the one beneath it), the net effect of the AIDS epidemic on the annual growth rate of per capita GDP will lead to a reduction of about 0.15 percentage point on average and one third percentage point in the ten countries with the most advanced epidemics.

Similarly, Cuddington and Hancock (1994), using a neoclassical one-sector, two factor growth model to predict economic growth in Malawi suggest that between 1985 and 2010 Malawi could experience an average real GDP growth up to 1.5 percentage points lower, while Cuddington (1993a) estimates that in the United Republic of Tanzania per capita GDP could be up to 10 percent smaller. GDP growth would be reduced by up to 1.5 percentage points in Malawi and 1.1 percentage points in the United Republic of

Tanzania. Assuming that AIDS treatment costs would be entirely financed from savings, the AIDS epidemic would reduce per capita GDP growth by 0.3 percentage points in Malawi and by 0.1 percentage points per year in the United Republic of Tanzania.

Kambou, Devarajan and Over (1992) applied an eleven-sector computable general equilibrium (CGE) model to analyse the economic effects of HIV/AIDS in Cameroon. The model is based on a snapshot picture of an economy contained in a social accounting matrix. CGE models are rich in sectoral and distributional data as compared with time series based and aggregated macro-econometric models, and are widely used to evaluate trade and expenditure, since they commonly have differential impacts within society. Again, a lack of knowledge about many of the variables and their relationships often makes it necessary to make assumptions or borrow estimates from other situations in order to apply the models to the situations of particular countries affected by HIV/AIDS. Kambou, Devarajan and Over (1992) found that over a period of five years the loss of an urban worker had seven times the negative impact on production as would the loss of a rural worker. In the capital goods, construction and services sectors, the negative impact would be 100 times larger when the lost workers were skilled and urban.

Broomberg (1993) estimated the cost of HIV/AIDS in South Africa. The costs are divided into direct costs and indirect costs, where direct costs include the costs of health services provided by both public and private sectors to the persons living with AIDS at all stages of the disease, including testing costs, prevention research and education. The indirect costs include the economic value of disability and premature mortality as a result

of HIV/AIDS, estimated as the present value of lost future earnings. The approach leaves out such macroeconomic effects as reduced investment as resources are diverted from other economic areas in order to cope with HIV/AIDS. It is argued that a good quality estimate of the direct and indirect costs of dealing with the epidemic are, however, much needed in order to derive sound estimates of the full macroeconomic effects.

Nicholls et al (2000) published what is probably the first study of AIDS impact in the Caribbean. They use a range of macroeconomic indicators to assess impact using a variant of the Cuddington and Hancock model (Cuddington, 1993; Cuddington et al, 1994). In contrast to many other studies, they try to model the rate of epidemic spread using a network modelling framework that takes into account regional social and cultural particularities. Their conclusion is consonant with other findings, that is, a rising HIV/AIDS epidemic will lead to negative growth, a fall in the level of GDP and substantial decline in the level of domestic savings.

Two micro level studies add to the macro orientation of the impact of the disease. They are: a study of the economic impact of HIV on male sugar workers in South Africa (Morris, Burdge and Cheevers, 2000) and one of household and community adjustment in Kagera, Tanzania (Lundberg and Over, 2000). Morris et al. used data from clinic, hospital, insurance and employment records in a Kwa-Zulu Natal sugar mill. Information was also collected from a seroprevalence survey of 302 members of the total workforce of 372 people present on one day in 1999. These data were fed into a model projecting

seroprevalence in the workforce over six years. The impact of AIDS from the employer's perspective was measured by reference to absenteeism, productivity losses, lost wages, replacement workers, retirement and medical costs. Most infected workers (93.6 per cent) were in the lowest two payroll bands. The main conclusions of the study were:

1. 5 per cent of the workforce could be expected to die over an eight year period, and these people would be predominantly among the unskilled and semi-skilled bands;

2. 5.7 per cent of the workforce could be expected to take ill health retirement over the same period;

3. Costs to this industry in this setting arising from AIDS will increase by as much as ten times over the next six years assuming that no treatment will be available which might be expected to decrease disease progression – an important qualifier in the light of debates about the pricing of anti-retroviral drugs.

Dixon, McDonald and Roberts (2001a: 382) in their introductory essay argue that AIDS "is of fundamental importance to African economies as it is at the heart of determining the standard of living for their entire populations, not just those afflicted by HIV/AIDS, a crucial determinant of the ability of countries to support HIV/AIDS victims." In surveying the contents of the volume, the authors note that "Economic models may be useful in assessing the impact of the AIDS epidemic, but they cannot, by themselves point to the policies that will minimize the reductions in economic growth and standards of living." (Dixon, McDonald and Roberts, 2001a, 385). In their own paper, Dixon, McDonald and Roberts (2001b, 411-426) look at the relationship between seroprevalence and growth in GDP per capita in two broad groups of countries, Southern and Eastern

Africa (an area with markedly high reported rates of seroprevalence) and a category they label "Rest of Africa" (areas which include North Africa and which have lower reported seroprevalence and the word "reported" is important here as in some cases, for example Nigeria, the epidemic statistics have been very poor indeed). They suggest that reductions in life expectancy in Africa are now so great as to suggest that the epidemic is now entering a stage where loss of life is already adversely affecting "social and economic interactions". This conclusion was based on an augmented Solow model in which growth in income per head is partially determined by health capital the latter in turn is of course determined by the epidemic.

Dixon, McDonald and Roberts, note that growth models typically aggregate and homogenise "labour" and this is exactly the problem. Different types of labour have different susceptibility to infection and illness and death will impact upon different types of vulnerability depending on sector. In particular, these models leave out the important "socially reproductive" sectors that fall outside of the neo-classical definition of what is to be considered as "economic" activity. This means that their view that "the countries of the Southern and Eastern Africa sample, where HIV and malaria are health problems on a scale that even the Rest of Africa countries regards as catastrophic, the economies appear unable to maintain 'normal' economic relationships." (Dixon, McDonald and Roberts, 2001b, 423), may seem too optimistic.

Arndt and Lewis's paper (Arndt and Lewis, 2001, 427-449) is closely related to the one already discussed. Here they move from the gross macroeconomic effects of the epidemic to consideration of its implications for sectors and for unemployment in South Africa. They conclude that: · Labour demand will be depressed by decline in the overall growth

rate·. There will be reduction in investment which will particularly depress demand for skilled and semi-skilled labour. AIDS related illness will further reduce output by skilled and semiskilled workers. In general, Arndt and Lewis conclude that given the poor job creation record of the South African economy over the past thirty years, the effects of HIV/AIDS on growth will be profound. This conclusion is derived from growth models which more typically report smaller effects on growth (Dixon, McDonald and Roberts, 2001a, 385).

Garnett, Grassley and Gregson (2001) review the ways in which HIV/AIDS contributes to a "development disaster". They look at its effects on population in particular and argue that "An increased political commitment and allocation of resources to HIV prevention programmes is a priority. However, strategies to cope with the impact of AIDS in other sectors are also important if the development impact of AIDS is to be mitigated." (Garnett, Grassley and Gregson, 2001, 405). The literature further concludes that although some progress have been made in combating the disease for sometime now, there is the need for social scientists to face the demand for good, useful and theoretically eclectic and synthesising research on the impact of HIV/AID on growth. Research evidence suggests that the HIV/AIDS epidemic is likely to have severe effects on labour supply and productivity, and increased aggregate costs to society; especially costs relating to medical care and funeral expenses. Lower investment and savings are expected, which in turn will contribute to a reduction in the nation's gross domestic product (GDP) (Bollinger and Stover, 1999).

Arndt and Lewis (2000) developed an economy-wide Computable General Equilibrium (CGE) model to estimate the impact of HIV/AIDS epidemic on the South African economy. The model projects that population growth is expected to slow down considerably (Arndt and Lewis, 2000) and real GDP per capita to increase (Balyamujura, et. Al., 2000). Arndt and Lewis (2000) find evidence that household spending patterns will shift towards health and related expenditures inducing higher government spending on health, education and social services. Topouzis (2000) argued that the agricultural sectors in developing countries tend to be disproportionately affected relative to the industry and service sectors by the impact of HIV/AIDS epidemic. He also maintains that it is difficult to isolate and measure the impact of HIV/AIDS on agriculture because of the adverse effects other factors such as natural disasters.

Topouzis identified the existence of two forms of agriculture in South Africa, namely a viable commercial sector and a poorer subsistence smallholder sector. It is estimated that there are over a million smallholders in South Africa (Fiscu, 2001). HIV/AIDS undermines agricultural systems and affects agricultural production, nutritional situation and food security of rural families. The disease also depletes both the human capital base through reducing the availability of labour skills and time. Household income that may be diverted to cover costs related to sickness and death (FAO, 2001).

The HIV/AIDS epidemic is having and will continue to have a significant impact on agricultural production if the spread is not curtailed. The consequence of labour shortage on agricultural output due to HIV/AIDS as described by FAO (2000) can be summarised in four ways. First, sickness and death of an adult can result in the inability of the household to cultivate all the land at its disposal resulting in the reduction in land area

under cultivation. The allocation of household incomes to care for the sick, and often times resulting in the sale of livestock, which often represents a form of savings of households, leads to a decline in livestock production. A case study conducted in the United Republic of Tanzania revealed that one person in a household falling ill due to AIDS allocates 29 percent of household savings to take care of the ill individual (UNAIDS, 2002). Second, the inability to maintain the labour force needed for the farming activities could lead to households abandoning their farms. Households may resort to growing less labour-intensive crops at the expense of cash crops that are labour intensive. This shift from cash-oriented production to subsistence production may result in a change in cropping patterns. There is also the likelihood of delay in farming operations such as tillage, planting and weeding and a reduction in the ability to control crop pests.

Third, there is loss of agricultural knowledge and management skills since the head of households with the skills are dying leaving the unskilled labour in the family. Owing to the gender division of labour and knowledge, the surviving parent is not always able to transfer the skills of the deceased one (du Guerny, 1999; Topouzis, 2000). Fourth, HIV/AIDS also influences food security. The HIV/AIDS pandemic causes a reduction in labour productivity and supply, and the allocation of productive time to care for the sick and for the mourning. It is estimated that in some parts of Africa, families mourn for up to 40 days. In rural areas where there is often lack of food, this exacerbates the poverty situation. Due to the loss of labour, household food security are likely to fall through an increase in the number of people to feed arising from caring for the sick and fostering children (du Guerny, 1999).

In Ethiopia, the AIDS-affected households were found to spend between 11.6 and 16.4 mean hours per week performing agricultural duties, compared with a mean of 33.6 hours for AIDS-unaffected households (UNAIDS, 2002). The incidence of HIV/AIDS has important implications for the Ethiopian economy because of its effects on food demand and security, household expenditure, agricultural production and productivity. Additionally, a number of studies (FAO, 1995, Evans, 1992, Gillespie, 1989) have examined the socio-economic impact of HIV/AIDS on rural households and their productive systems in some parts of Africa. Although interrelations between the HIV/AIDS epidemic and overall economic growth and development of a country have been acknowledged in the literature, the linkages to agriculture have received less attention because of the perceived notion that it is largely an urban disease.

Another study conducted in South Africa indicated that commercial farmers were not particularly concerned of the impact of HIV/AIDS epidemic on their labour force because they perceive unskilled workers to be relatively easily replaced (Simbi and Aliber, 2000). On the other hand, when considering the high rate of orphanage together with young adult mortality, labour supply in agriculture is likely to be adversely affected. Especially, in terms of the loss of agricultural knowledge, skills and practices that might not be easily replaced as is commonly assumed (Topouzis, 2000). In an attempt to demonstrate the likely impact of HIV/AIDS on the rural workforce in agriculture, reference are made on Morris, et al. (2000) work on Sugar Mill workers in Kwa-Zulu Natal, South Africa.

The study indicated that over an 8 year period in which the study ran there was a 5 percent death rate, 5.7 percent ill-health retirement among workers, and only 58 percent of those that were initially infected were still employed at the end of the study period.

Given the high HIV prevalence, the impact of the HIV/AIDS disease on this segment of the agricultural workforce provides a proxy for the general agricultural workforce in South Africa. Labour losses in the agricultural sector will contribute to the decline in agricultural production and food insecurity. This will therefore impact negatively on the growth of the South African economy.

Other analyses have employed an economic model fitted to the data of a particular country and, usually, projected for 10 or 15 years into the future. In a typical neoclassical growth model, AIDS is said to affect total output directly, by decreasing the number and efficiency of workers, and also indirectly, by decreasing savings and investment. Since HIV/AIDS also results in a lower population than would otherwise have existed, the effect on GDP per capita is smaller than the effect on total output; at least in principle, there could be situations in which the net effect on GDP per capita would be nil or even positive. Since it is commonly the case that the values of some of the model's key parameters are not precisely known, analyses often include various scenarios, assuming different plausible values for the unknown parameters.

Available empirical literature on the disease in Ghana is limited. Most studies done on HIV/AIDS in Ghana are basically behavioural and qualitative in nature (Avotri, 2004; Claypoole and Nazzar, 2004; Osei Agyekum, 2004; Odoi Agyarko, 2004), and heavily focused on baseline studies of HIV/AIDS knowledge, attitudes and practices among vulnerable sub-population groups. Dela Attipoe (2004) conducted a research to assess HIV/AIDS situation among men that have sex with men (MSM) in Accra, Ghana. The study revealed that MSM are real in Ghana with Ghanaians fully involved. It is not a

recent phenomenon being visited on Ghana and Ghanaians by 'whites' or foreigners. MSM in Ghana also cut across all social classes, religions, and ethnicities. However, the activities of the gay are mostly underground due to society's unfriendly reactions to homosexuality. The study established that, MSM contribute significantly to HIV/AIDS statistics in the country. This is evidenced by the fact that, AIDS is the number two killer of prisoners in Ghana.

Some recent studies tried to assess government policy response to HIV/AIDS in Ghana (Fobil and Soyiri, 2006).The study recognized the inauguration of the Ghana AIDS commission (GAC) and national AIDS control programme by government to formulate and Implement AIDS policies to help curtail any further spread of the disease. Government, over the years has always scaled up resource allocations to AIDS prevention activities in its bid to meet the Abuja (2001) declaration. The primary goal of the Abuja declaration is to arrest and reverse the accelerating rate of HIV infections. As a result, African countries including Ghana accordingly committed themselves to allocate at least 15% of the national budget to the health sector, particularly for the fight of HIV/AIDS. However, most of these HIV/AIDS response policies/activities are donor driven. Unlike the other studies, Peter O. Preko et al (2008) conducted a research on HIV/AIDS related stigma in Kumasi; Ghana.

The purpose of the research was to determine the predictors of HIV/AIDS related stigma and discrimination, and to identify the perceptions of community members towards HIV/AIDS and persons living with HIV/AIDS in Ghana. The findings revealed that, discrimination against people living with HIV/AIDS especially at the work place really exist and continue to rear its ugly head in the country. The study also found that, 29% of

the respondents agreed that people with HIV/AIDS should be isolated in certain villages or towns.

More recently two studies have focused on Botswana (BIDPA, 2000; MacFarlan and Sgherri, 2001), with both using variants of calibrated neoclassical growth models. MacFarlan and Sgherri concluded that GDP growth in Botswana would decline from around 5.5 percent to between 1.5 percent and 2.5 percent per annum as a result of the epidemic, and would have non-negligible impacts across production sectors, households and labour types while placing substantial burdens on the government budget. However there have been very few cross-country statistical studies. Bloom and Mahal (1997) concluded, there is more flash than substance to the claim that AIDS impedes national economic (income) growth, while acknowledging that the negative impact on life expectancy may affect development.

There are reasons related to the data to doubt the robustness of Bloom and Mahal's results. The empirical estimates were based on data for the period 1980–1992, when prevalence estimates were typically one seventh to one fifth of those now produced. Additionally, the AIDS epidemic was still in its early stages and hence its impacts upon morbidity and mortality were still relatively restrained. Given the data limitations it is not surprising that Bloom and Mahal's sample was constrained to 51 countries, although it is worrying that countries with high infection rate such as South Africa, Botswana, Rwanda, Namibia and Swaziland were not included. There are also theoretical and statistical reasons to re-evaluate Bloom and Mahal's results.

Bonnel (2000) also concluded from a cross country study using African data, that HIV/AIDS on average reduced Africa's per capita growth rate by 0.7 percent points, which is substantial given an average growth rate in the sample of 0.4 percent per annum per capita. Furthermore, if the countries were also affected by malaria, the growth rate was lowered by a further 0.3 percent points. These results were obtained using a cross-section or cross country growth equation estimated in a system with equations for policy variables and HIV. It would therefore seem that Bonnel's work using more recent and comprehensive data are sufficient to cast doubt upon Bloom and Mahal's earlier study.

Robalino, Jenkins and El-Maroufi (2002) developed a growth model to assess the risks of an HIV/AIDS epidemic and its potential economic consequences in nine countries in Western Asia and Northern Africa: Algeria, Djibouti, Egypt, Iran, Jordan, Lebanon, Morocco, Tunisia and Yemen. Adult HIV prevalence is still low in those countries, and prospects for future transmission are highly uncertain. However, given the mean values from Robalino, Jenkins and El-Maroufi simulations, HIV prevalence may reach 3-4 percent of the adult population by 2015 (higher in Djibouti), and over the period 2000-2025, the annual growth rate of GDP would be 0.3-0.4 percentage points lower than in the absence of AIDS (1.6 points in Djibouti).

A 2002 World Bank study of the economic impact of HIV/AIDS in the Russian Federation showed that GDP in 2010 could be up to 4 percent lower and that without intervention the loss could rise to 10 percent by 2020 (Ruhl, Pokrovsky and Vinogradov, 2002). The study projected that the most significant impact for long-term development

was the uninhibited spread of HIV, which would diminish the economy's long-term growth rate, taking off half a percentage point annually by 2010 and a full percentage point annually by 2020. Another result of the study was that investment would decline more than production. In the pessimistic scenario, its level would decline by 5.5 percent in 2010 and 14.5 percent in 2020. How large are these effects in comparison to other factors affecting economic growth? Some analysts note that other factors can produce effects on economic growth that are at least as large as those estimated to result from the spread of HIV/AIDS. For instance, Greener (2002) states that a reduction in the rate of growth of GDP by between 0.5 and 2.6 percentage points, which encompasses the size of the effect indicated by most studies, "is within the range of variation that could be caused by poor economic management or fiscal policy".

Dixon, McDonald and Roberts (2002) and Cornia and Zagonari (2002) reviewed studies that attempted to quantify the effect of HIV/AIDS on growth of GDP and GDP per capita in Africa. According to Dixon, McDonald and Roberts (2002, p. 233), "the consensus from these studies is that the net effect on the growth of GDP per capita will be negative and substantial. The more recent studies show greater effects; and the most recent estimates indicate that the pandemic has reduced average national growth rates by 2-4 (percentage points) a year across Africa". Impacts on GDP per capita are smaller, and range from substantially negative to negligible or even positive impacts over the medium term of 10 or 15 years.

"It therefore means the macroeconomic impact of HIV/AIDS can be substantially reduced by appropriate policy interventions" (Greener, 2002, p. 49). Nevertheless, such observations cannot bring much comfort, since such factors as poor economic management, war or drought are likely to make it all the more difficult to mount an effective response to the threat of HIV/AIDS.

3.4 Growth and human capital

The involvement of human capital to the growth process is not a recent phenomenon and has been critical in most researches (Mankiw et al., 1992; Barro and Lee, 1993; Benhabib and Spiegel, 1994, among many others). Mankiw et al. (1992, p. 408) augmented a neoclassical growth model with a human capital variable to counter the misspecification bias that will arise if both physical and human capital exist and human capital is omitted from the estimating equation. It has been established in most academic literature that human capital is a complex input that consists many important variables aside education and

productive skills. Sections of these literature stresses on the importance of health capital as a dimension of human capital, e.g., Schultz (1961), Mushkin (1962) and Dasgupta (1993). Hence any misspecification bias will only be partially addressed if other dimensions of human capital are not included in estimating equations.

Nevertheless estimates of the effects of health on growth are limited, e.g., Hicks (1979), Wheeler (1980), Knowles and Owen (1995), Bhargava et al. (2002) and McDonald and Roberts (2002). The latter three studies have proved the empirical importance of health

capital as a determinant of economic growth. It is still common in the empirical growth literature for estimating equations to be specified using the cross country cross section method, despite the well-known potential weaknesses of this method, in particular, the need to impose the assumptions that there are common initial technologies, rates of technical progress and preferences across countries. Moreover the method discards potentially important information by collapsing dynamics. These issues can be addressed by adopting panel data methods and thereby explicitly testing the critical assumptions of the cross-section method by making use of information arising from variation across countries and over time. Most panel data studies relating to cross country economic growth have indicated that the results of cross-section studies may be suspect (Islam, 1995; Lee et al., 1997; Miller, 1996; Cellini, 1997; McDonald and Roberts, 1996, 1999, 2002).

Table 3.1 Summary of Literature on the Subject

Author	Country	Method	Period Covered	Impact on growth rates GDP	Impact on GDP per Cap
Over (1992)	30 Sub-Saharan African Countries	Econometrics estimation & stimulations CGE	1990-2025	-0.56% to -1.08%	0.17% to -0.35%
Dixon, McDonalds and Roberts (2001)	41 Countries		1960-1998	2-4% per year	
	10 most Advance			-0.73% to -1.47%	0.13% to 0.60%
Kamboue, Devarian & over (1992)	Cameroun	CGE	1987-1991	-1.90%	n/a

Dixon, McDonalds and Roberts (2001)	41 Countries		1960-1998	2-4% per year	
Bloom & Mahal	51 countries	Econometric estimation	1980-1992	Negative but small	
Cuddington (1993a,b)	Tanzania	Aggregate growth model	1985-2010	-0.6% to -1.1%	0.0% to -0.5%
Cuddingon & Hancock	Malawi	Aggregate Growth Model	1985-2010	-0/1% to 0.5%	-0.1% to -0.3%
BIDPA (2000)	Botswana	Aggregate Growth Model	1996-2021	-0.8% to -1.9%	+0.4^ to 0.5%
Quatteck/ING Barring (2000)	South Africa	Macro-econometric model	2001-2015	-0.30%	Positive
Arndt & Lewis (2000)	South Africa	CGE	2001-2010	-1.60%	-0.80%
MacFarlan & Sgherri (2001)	Botswana	Aggregate Growth Model	1999-2010	-3.5% to 0.5%	0% to -1%
Laubscher et al/ BER (2001)	South Africa	Macro-Econometric Model	2001-2015	-0.33 to 0,65%	0% to -1%
Bell, Devaraian & Gersbach	South Africa	Overlapping Generation Model	1990-2080	n/a	-0.2% to -2.5(+)
Lofgren, Thurlow & Robinson	Zambia	CGE	2001-2015	-0.4% to -0.9%	+0.2%
Masha, I (2004)	Botswana	Aggregate Growth Model	Aggregate Growth Model	1991-2016	-0.8% to 2% to n/a
BER (2006)	South Africa	Macro-Econometric Model	2000-2020	-0.4% to 0.6%	+0.3% to +0.4%

Source: updated from Table in Bureau for Economic Research (BER) (2006)

3.5 Conclusion

So far both the theoretical and empirical literatures reviewed conclude that HIV/AIDS has a negative effect on most macro and microeconomic indicators, hence on growth. Additionally, most renowned economic studies done on the disease on the African soil have been undertaken in the Eastern and Southern part of the continent where the prevalence rate of the disease is very high. Those parts of the continent also have reliable and adequate data. In Ghana most studies done are social and behavioural in nature and look at the qualitative aspect of the disease. What this research seeks to do differently is to look at the economic impact of the disease on growth. This research is therefore a shift from the social and behavioural researches, meaning that the research is quantitative in nature.

CHAPTER FOUR

4.0 METHODOLGY AND PRESENTATION OF RESULTS

4.1 Introduction

This chapter presents the methodology adopted for the study. It also presents the findings and discussions of these findings.

4.2.0 Model specification

The aggregate growth model was adopted for this study. The model is derived as follows:

$$Y_i = (K_{it})^{\propto}(E_{it})^{\beta}(H_{it})^{\varphi}(A_{it}L_{it})^{1-\alpha-\beta-\varphi} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Rewriting this in terms of the quantities per effective unit of labour:

$$y_{it} = (k)^{\propto}(e_{it})^{\beta}(h_{it})^{\varphi}$$

Where

$$y = {}^{Y}/_{AL}, e = {}^{E}/_{AL}, h = {}^{H}/_{AL}$$

Assuming a constant function of output is saved and invested, labour grows at a country-specific rate n_i: technology grows at a specific rate g_t and all forms of human capital depreciate at the same date of δ for all countries yields the equation for the steady-state output per capita (y_{it}):

$$Iny_{it}^{*} = InA_{i0} + g_t t - C_1 In(n_i + g_t + \delta) + C_2 InS_i^{K} + C_3 InS_i^{E} + C_4 InS_i^{H} \ldots\ldots\ldots\ldots\ldots (2)$$

Where$C_1 = {(\alpha+\beta+\varphi)}/{(1-\alpha-\beta-\varphi)}$, $C_2 = {(\alpha)}/{(1-\alpha-\beta-\varphi)}$, $C_3 = {(\beta)}/{(1-\alpha-\beta-\varphi)}$

$C_4 = {(\varphi)}/{(1-\alpha-\beta-\varphi)}$

S_i^k, S_i^E *and* S_i^H are the share devoted to physical, education, and the health capital respectively. A_{i0} is the initial level of technology in the country *i*. Linearizing around the steady-state, and the second in terms of level of the output per capita, we get the following two equations. The first is in terms of growth in output per capita, and the second in terms of level of output per capita:

$$Iny_{it}^{*} - Iny_{i0}^{*} = -\varphi Iny_{i0}^{*} + \sum_j \theta_j x_{it}^{j} + n_t + \mu_{it} + v_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where

$$\varphi = 1 - e^{\lambda t}, \theta_1 = \theta_2 = {\varphi\alpha}/{(1-\alpha)}, \theta_3 = {\varphi\beta}/{(1-\alpha)}, \theta_4 = {\varphi\psi}/{(1-\alpha)},$$

$$x_{it}^2 = In(n_i + g_t + \delta), x_{it}^2 = InS_i^k, x_{it}^3 = Ine_{it}^{*}, x_{it}^4 = Inh_{it}^{*}$$

and $\eta_t = g_t t, \lambda$ *is the convergence rate.*

Rewriting equation (3)*above in terms of levels gives us the equation below*:

$$Iny_{it}^{*} = (1-\varphi) Iny_{i0} + \sum_j \theta_j x_{it} + \eta_{it} + \mu_i + \upsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

4.2.1 Data Requirements and Sources

The data used for the study is a secondary-time series data from 1980-2009.The above time frame was selected because of the time the disease was discovered in Ghana and also to avoid the situation where the result drawn from the study will be biased.

The major source of data was the World Bank (1999) specifically the World Bank Development Indicators (WDI) for the year 2009.The income data are real GDP per capita adjusted for purchasing power parity, which are an update of the Penn World Tables (PWT) developed using data from the Global Development Finance & World Development Indicators databases). Rates of growth for GDP were estimated by log linear regression of the GDP.

The population (POP) data are those reported in World Development Indicators (World Bank, 2009). The population growth rate was estimated by log linear regression of the population series. The data for investment rates were calculated from current price data on GDP and domestic investment reported in World Development Indicators (World Bank, 2009). There are four education series, primary school enrolment rates, secondary school enrolment rates and tertiary enrolment rates, which were from World Development Indicators (World Bank, 2009), and estimates of the average years of schooling (Barro and Lee, 2000).

Data for the health capital equation are limited in terms of both coverage of the country and length of time series. Two alternative variables are used as a proxy for health capital. The first is life expectancy at birth, which is defined as the mean age at death of a fictitious generation subject to the mortality conditions of the period considered; this is

expressed as the shortfall of life expectancy relative to a nominal benchmark, i.e., LE = -ln(80 – life expectancy). This proxy has been defended by Sen (1998), but can be criticised for making "no allowance for the quality of health beyond survival" (Knowles and Owen, 1995, p 102).

4.3.0 Justification of Variables

4.3.1 Economic growth

Economic growth is an increase in real GDP over, implying a sustained increase in GDP for a long period of time. Most macroeconomic researches on the impact of HIV/AIDS are done using growth in real GDP per capita as a dependent variable. In line with the objective of this study therefore, the growth rate of real GDP per is used as a measure of economic growth.

4.3.2 Share of GDP invested

Share of GDP invested basically refers to the portion of GDP that a country invests back into the economy. The more investment is made in that is made in the economy the likelihood that it will grow. The share of GDP invested is therefore expected to have a positive sign as well as being statistically significant.

4.3.3 Population growth rate

The population growth rate is expected to have a negative impact on growth of per capita income. Thus an increase in population tends to decrease per capita income.

4.3.4 Secondary School enrolment

Mankiw et al. (1992) conceptualize human capital solely as educational attainment. Educational attainment is estimated of the average years of schooling (Barro and Lee, 2000). Education capital has a negative effect on per capita income, but the coefficient is insignificant.

4.3.5 Life expectancy

The number of years that one is expected to live as determined by statistics .In demography, life expectancy is a statistical measure of the average, or mathematical expected value, of the remaining lifetime of an individual in the given group (www.wordiq.com). Life expectancy is expected to have a strong negative effect on growth but not significant.

4.3.6 HIV Prevalence

The AIDS epidemic is one of the most destructive health crises of modern times, ravaging families and communities throughout the world (Lori S. Ashford, 2006). Because AIDS deaths are concentrated in the 25 to 45 age group, communities with high rates of HIV infections lose disproportionate numbers of parents and experienced workers and create gaps that are difficult for society to fill. The effect of HIV/AIDS prevalence rates on growth is negative but the significance of its coefficient varies. This is because estimated figures from Southern Africa show the significance of the diseases on growth (Quattek et al.,2000; BIDPA, 2000; World Bank, 2001) whilst the global

estimate show that the disease's impact on growth is insignificant (Ajay Tandon, 2005; Over, 1992; Bloom et al., 2000).

4.3.7 Population at risk with Malaria

Malaria ranks among the foremost health issues facing tropical countries (Holger Wolf, 2001). In Sub-Saharan Africa, the most affected region, malaria-related illnesses claim the life of one out of every twenty children below age five. A morbidity and mortality rate for this disease is strongly linked to income per capita levels since it affect both the volume and the productivity of input (Gallup, Sachs, and Mellinger 1998). Malaria incapacitates part of the labor force. This loss of labor input has been the primary focus of the classic aggregate studies of malaria (Ross 1911, Sinton 1935/36).

Malaria enters negatively and significantly in the model. Endemic malaria also reduces the growth potential for some industries, notably tourism, and sharply raises the cost of infrastructure projects and other collective enterprises. The disease is also the leading cause of workdays lost to illness in Ghana, thereby contributing more to potential loss of income than any other disease. According to Asenso-Okyere and Dzator (1997), on average, three workdays are lost per fever episode by the patient and two workdays by the caregiver

4.3.8 Calories

A calorie is an energy measurement. In other words, a calorie is a measure of heat energy. For people, calorie has come to mean the amount of basic energy that is available

in a specific portion of food. Each person requires a certain amount of this energy to survive, and an additional amount to provide the energy for daily activities. FAO derives its estimations of calorie consumption from its Food Balance Sheets. The figures are obtained by confronting estimated production with trade data, stock changes, estimates of feed use and seed use, which leads as closing item to the total amount of calories available for consumption in a specific country in a particular year. Division of this total by the population total gives the estimate of national per capita availability. Since the growth of a nation depends on the health of its citizens, caloric consumption is expected to have a significant positive effect on growth.

Table 4.1 Variable and Data Source

Variable	Definition	Source	Presentation of variables
YC	Real GDP per capita	Penn World Tables (2004)	LRGDPP
I	Share of GDP invested	World Development indicators (World Bank 2009)	LGDPI
$n+g+d$	n= population growth rate	World Development indicators (World Bank 2009)	LPGR
	g= Technological growth rate	Unavailable	NIL
	δ= Depreciation rate of capital	World Development indicators (World Bank 2009)	LDEP
E	Secondary School enrolment	World Development indicators (World Bank 2009)	LSEN
H	Life expectancy shortfall	World Development indicators (World Bank 2009)	LLEB
HIV	Prevalence of HIV	UNAIDS (2009)	LHIV
MAL	Population at risk with Malaria	National Malaria control Center, Korle Bu	LMAL
CAL	Calories intake per capita	FAO 2009	LCAL

4.3.9 Data limitation

Data for the health capital equation are limited in terms of both coverage and length of time series. Data problems are now becoming in-built characteristics of developing worlds of which Ghana is not an exception. The problem is even worse in health related issues due to the confidentiality usually attached to such information. Therefore, there are a number of caveats with regard to the data quality. For instance, data are not available for every variable for every year, a problem that would have some negative effect on the analyses of the results of this study. Secondly, there are differences in how some variable are defined due to the limited nature of data for this thesis. Lastly, where data was available, there was a problem in releasing such data as a lot of cumbersome procedures had to be followed. To overcome the above limitations, proxies have been used for most of the variables where it was unavailable.

4.4.0 Estimation technique and Results

4.4.1 Estimation

Empirical research has shown that most macroeconomic time series data are trended, hence stationary; such that the constancy doctrine is not satisfied by the time series variables (Seddighi et al, 2000). Time series data are therefore said to be stationary if its mean, variance and covariances remains constant over time (Thomas, R.L.,1997), meaning the quantities will remain the same whether the observation for the series where for different time periods. Another definition of stationarity is taken from Challis and

Kitney (November 1991). They define Stationarity, as a quality of a process in which the statistical parameters (mean and standard deviation) of the process do not change with time. To avoid the situation of non-stationarity it is worthy to primarily investigate the stationarity of the data before proceeding to use the variables to carry out any empirical test. The most important property of a stationary process is that the auto-correlation function (acf) depends on lag alone and does not change with the time at which the function was calculated. A weakly stationary process has a constant mean and acf (and therefore variance) while a truly stationary (or strongly stationary) process has all higher-order moments constant including the variance and mean.

Since most data are non-stationary, Statistical inference based on these estimations without verification that the variables involved in the estimation are stationary may produce not only questionable results but also misleading ones (known as spurious regression in econometrics).This is because; the normal properties of $t\,(t-statistic), R^2\,(coefficient\ of\ determination) and\ DW(Durbin\ Watson)$ statistics may break down. To avoid this, a stationarity test for the time series properties of the data, using the DF and ADF was conduct on the level variables.

4.4.2 Unit Root Test for Stationarity

In statistics and econometrics, a **unit root test,** tests whether a time series variable is stationary or non-stationary. It is important to do this because cointegration tests can be performed depending on the nature of the results obtained. Stationary time series data is necessary to have a valid t statistics and F statistics. To test for the presence of unit root, the methodology of Dickey and Fuller (1979) was utilised. An augmented Dickey–Fuller

test (ADF) is a test for a unit root in a time series data. The ADF helps check for the non-stationarity of economic variables and prevent "spurious regression" problem that might arise from the equations that is estimated with the ordinary regression method.

In time series models the presence of unit root causes a violation of the assumptions of classical linear regressions. A unit root means that the observed time series is not stationary. When non-stationary time series are used in a regression model one may obtain apparently significant relationships from unrelated variables (this phenomenon is called spurious regression).

To achieve the objective of this study the Augmented Dickey Fuller test is used. The unit root presented use intercept or constant with no trends. Variables that are integrated of order zero [I(0)] are stationary at level whiles those integrated of order one [I(1)] become critical after being differenced once. The number of lags used in the computation was determined by the Akaike and Schwartz Information Criteria The table below presents the results of the unit root test.

Table 4.2 Unit Root Test Results of Variables

Variable	ADF				Number of Lags	Order of Integration
	Level	C.V	First Difference	C.V		
LCAL	-0.958488	0.7537	-8.365985**	0.0000	0	**I(1)**
LDEP	-4.676422**	0.0008	-6.813854**	0.0000	0	**I(0)**
LGDPI	-1.120733	0.6932	-7.926286**	0.0000	0	**I(1)**
LHIV	-2.153369	0.2275	-4.090713**	0.0038	0	**I(1)**
LLEB	-2.190996	0.2136	-7.135382**	0.0000	1	**I(1)**
LMAL	-4.877602**	0.0005	-6.152083**	0.0000	0	**I(0)**
LPGR	-2.369043	0.1588	-5.299929**	0.0002	0	**I(0)**
LRGDPP	-5.570539**	0.0001	-6.356607**	0.0000	0	**I(0)**
LSEN	-0.088511	0.9414	-4.954425**	0.0005	0	**I(1)**

Source: Author's computation, 2010

NB. * Variables stationary at 5%

** Variables stationary at both 5% and 1%

In analysing the results using the critical values given above, the null hypothesis is:

$H_0 = Non - stationarity$

$H_1 = Stationarity$

Evidence of unit roots and hence stationarity is indicated when the absolute value of the test statistic is below the significance level. Table 4.2 above contains the results of the unit root test using the variables in their logarithm levels. It is obvious that **LCAL** (calories intake in logs), **LGDPI** (share of GDP invested in logs), **LHIV** (HIV/AIDS prevalence rate in logs) **LLEB** (life expectancy at birth in logs) and **LSEN** (secondary school enrollments) have unit roots in their log-levels, thus, necessitating the use of their first-difference for the test during which it was found that every trace of this problem had been completely eliminated.

4.4.3 Cointegration Analysis

Following the findings that all the series are stationary in their first differences, the study proceed to examine whether the variables are cointegrated using the maximum likelihood procedure suggested by Johansen and Juselius (1991). Cointegration tells us about the presence of long run relation among two or more variables. Cointegration of the variables implies that there must be an adjustment process to prevent deviation from the long run equilibrium from becoming larger. The choice of this technique is based on the number of variables included in the model. The Engel and Granger techniques could not be used for this study because it assumes one cointegrating equation.

4.4.4 Johansen-Juselius technique

The Johansen's maximum likelihood approach estimates the test for the presence of multiple cointegrating vectors; it relies on the relationship between the rank of the matrix and the characteristics roots, which determine the number of cointegrating vector and the

speed of adjustment parameter. Cointegration with unrestricted intercept and linear deterministic trend (restricted) in Autoregression (VAR) was used. The critical values are from MacKinnon et al. (1999) and the cointegrating vectors at the 5 percent level. The cointegration test results are summarized in the tables below.

Table 4.3 Johansen-Cointegration Test on Eigenvalues and Trace statistic

Null Hypothesis	**Alternative Hypothesis**	**Maximum Eigenvalue**		**Trace Statistic**	
		Statistics	**5% C.V.**	**Statistics**	**5 % C.V.**
R=0	**R=1**	100.2557	50.59985	239.0968	150.5585
R≤1	**R=2**	44.09766	44.49720	138.8411	117.7082
R≤2	**R=3**	33.82265	38.33101	94.74345	88.80380

Source: Author's computation, 2010

The first null hypothesis to be tested under this technique is that there is no cointegration given by R=0. The alternative is that, there is at least one cointegration vector R≤1. The decision rule is to reject the null hypothesis if the statistics is greater than the critical value. From the above table the test statistics from the maximum Eigenvalues test statistics 100.2557 is bigger than the critical value 50.59985 at 5% significant level. Therefore, we reject the null hypothesis of no cointegration. The same is confirmed using the trace statistics, hence from both Johansen cointegration tests we reject the null hypothesis of no cointegration. This therefore means that there is at least one cointegration equation.

A further cointegration test was carried out, for a cointegration equation for one or less cointegration test. The null hypothesis was given by R≤1, whiles the alternative hypothesis was given by R=2. The test indicates that, the maximum eigenvalues 44.09766 is smaller than the critical value of 44.49720 at 5 percent hence we fail to reject the alternative hypothesis of two (2) cointegration equation from the eigenvalues. The trace statistic rejects the null hypothesis of at least one cointegration and accept the alternative hypothesis of more that one cointegration equations.

The study therefore adapts the maximum eigenvalue test of one cointegration equation over the trace statistics. This is because when doing the Johansen test, if there comes up a different result between the trace statistic and the maximum eigenvalue test, the maximum eigenvalue result is preferred (Banerjee et al 1993). We therefore conclude that there is a long run relationship between the variables (i.e. they are cointegrated). To take this into account, we rum the error correction models in what follows

4.4.5 Error Correction Model

Error correction models are based on the behavioral assumption that two or more time series exhibit an equilibrium relationship that determines both short- and long-run behaviour. The cointegration test carried out revealed the existence of a long run behaviour among the variables. Therefore to take into account the relationship of both the long run and short run, the error correction mechanism (ECM) which was first used by J.D. Sargan (1984) and popularized by Engel and Granger was employed in the studies. The ECM relates the short run changes in the dependent variable LHIV to the short run changes in the explanatory variables by tying these changes to the long run effect through

a feedback mechanism. This enables exploitation of the information on long run relationship between both stationary and the non-stationary times series variables with a statistically consistent model. Subsequently, some optimality criterion, namely, the Schwartz Bayersian criterion (SBC), the maximum R^2 criterion and the Akaike information criterion (AIC), are used to select the parsimonious form of the model. This model simply includes a term called the error correction variable (ECV), which include the lagged residuals in the equation expressed in the level of the variables to the specification in their difference. Table 4.4 presents an error correction representation of the model.

Table 4.4 ECM for the dependent variable DLRGDPP estimated by the OLS on cointegration VAR (1)

Variable	Coefficient	Std. Error	t-statistics	Prob.
DLHIV	-0.094812	0.066722	-1.420996	0.1734
DLGDPI	0.399128	0.202813	1.967955	0.0656
DLMAL	-0.989186	0.462493	-2.138812	0.0561
DLDEP	-0.119213	0.055275	-2.156726	0.0456
DLSEN	-0.177911	0.104468	-1.703011	0.0501
C	0.030700	0.031212	0.983602	0.3391
DLMAL(-1)	-0.433093	0.240975	-1.797254	0.0901
DLGDPI(-1)	-0.230230	0.372814	-0.617548	0.5451
DLCAL(-1)	-0.308734	0.549994	-0.561342	0.5819
ECM(-1)	-0.18073	0.57150	-0.31623	0.0070

R-squared	0.650295	Mean dependent variable	0.007437
Adjusted R-squared	0.465157	S.D. dependent variable	0.219489
S.E. of regression	0.160519	Akaike info criterion	-0.542693
Sum squared residual	0.438027	Schwarz criterion	-0.062753
Log likelihood	17.32635	F-statistic	3.512484

Table 4.5 Diagnostic test

Test	F-statistics	Probability
White Heteroskedasticity Test	2.862712	0.231745
ARCH Test:	0.019133	0.891051
Ramsey RESET Test:	1.434469	0.114575
Breusch-Godfrey Serial Correlation LM Test	0.035063	0.801182
Jarque –Bera	0.903381	0.636551

Source: Author's computation, 2010

4.4.6 Diagnostic test

A test for autocorrelation model specification and normality test have been done and presented above. No autocorrelation and heteroscedasticity was found using the Autocorrelation conditional Heteroscedasticity and autorrelation test. For instance, the LM test of the residual accepts the null hypothesis of no serial correlation or autocorrelation. The test also indicates that the error term is normally distributed since we accepted that null hypothesis of normality of the error. Thus the error term is homoscedastic. This implies that the used of the ordinary least square yields unbiased estimates.

4.4.7 Discussion of Regression Results

From the table the result reveals that the overall fit of the model is satisfactory given the R-square. This means that about 65% of the systematic variation in real gross domestic product is explained by the explanatory variables in the model. The F-statistics of 3.512484 suggests that the coefficients of the explanatory variables are significantly different from zero (0), meaning that, they explain variation in the dependent variable.

As mentioned earlier, cointegration analysis takes into account the long run behaviour of variables. The long run relationship is captured by the error correction term ECM(-1) as presented in table 4.4. According to the ECM(-1), which is expectedly negative in sign, -0.18073 (18.1%) represents the speed of adjustment between the short run and the long run. Meaning that 18.1% of the previous period disequilibrium is the growth in Real GDP is corrected in the current level. This also implies that roughly 18% of the disequilibria in period t-1 on the log of real gross domestic product per capita are corrected in the current period. This term is also highly significant at 1 percent significance level. The strong significance of this variable indicates that there is indeed a long run equilibrium relationship between the Real GDP and the factors that influence it. The error term is free of noise as indicated by the D-W statistic of 2.0

It should be noted that the log HIV, secondary school enrollment are presented in their first deference form, hence their coefficient represent short run elasticities, which indicate the short run effect on the log of real gross domestic product per capita. The short run effect of HIV on the real gross domestic product per capita is negative and

insignificant. As mentioned earlier, the results of the econometric estimation using a global sample of countries indicate a negative effect, that of Ghana is also negative which indicates that HIV/AIDS prevalence on GDP per capita with a –0.094812 in magnitude.

The coefficient of secondary school enrolment was compared with the a priori expectation of secondary school enrollment derived by other Authors. It was found to be negative and statistically significance. This confirms Scott McDonald and Jennifer Roberts's estimation on the growth equation, which also shows negative and significant coefficients for the savings/investment variable in all samples from Sub-Saharan Africa. A unit increase in secondary school enrolment which is a proxy for human capital decreases growth in real GDP by 0.177911which is significant at 5%.

Since Malaria is an I(0) variable it has both short run and long run phenomenon. The short run effect of malaria on the real gross domestic product per capita is also negative and significant. The coefficient of the malaria index, LMAL, had the expected negative sign and is statistically significant at the 10% level. A percentage increase in the malaria morbidity rate results in a decrease in growth in real GDP per capita by 6%. The significant negative association between malaria and economic growth confirms earlier studies by Gallup and Sachs (2001) and McCarthy *et al.* (2000). The short run effect of the malaria disease is also felt in the long run since it is negatively related to the real GDP per capita and also significant. The DMAL(-1) implies that current year Malaria depends on previous years malaria.

The share of GDP invested also has the expected positive sign. The coefficient of the of the share of GDP invested (0.399128), points out that a percentage point increase in the share of GDP invested increases the real GDP per capita by 0.399128 percentage point. It is significant both in the long and short run.

4.4.8 Conclusion

It is important to recognize that HIV is not only a threat to the health and economic well-being of those affected. HIV/AIDS strains the economic, social, and security fabric of countries, undermining recent development gains and destroying communities while destabilizing regions. As prevalence rates rise, so do per capita costs of addressing the epidemic.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This is the last chapter of the study. It presents the summary and conclusion of the findings to the study as well as the policy recommendations of the study.

5.2 Summary

It is important to note that the study sought to find out the economic impact of the HIV/AIDS disease on growth using the human capital approach. This study on HIV/AIDS pandemic and economic growth agreed that the disease could have large economic impacts on the Ghanaian economy. The result from the study indicates that the impact of the disease on growth is significant. The human capital effect on growth is very significant. This impact is expected since from the literature reviewed, the combination of HIV/AIDS and human capital yields a significant impact of the human capital on growth. The epidemic, if unchecked, could transform the developmental performance of the country not simply in terms of national economic growth rates, but also in terms of those broader social indicators that more accurately reflect improvements in the standard of living. No sectors of the economy are immune to the impacts of the epidemic, and all social strata is affected. The study had the objective of assessing the economic impact of the disease on economic growth. To achieve this objective, various literatures were reviewed in relation to the topic. An overview of the Ghanaian health sector and the genealogy of the disease were critically studied and presented. It was also found out from

the literature reviewed that empirical studies have concentrated on Africa, especially, the southern part of the continent were the prevalence rate of the disease is very high.

The Augmented Solow growth model which has incorporated the human capital as well as the health status of people of a country was adopted for the study. In the estimation, unit root test was carried out since most macroeconomic time series data tend to be trended, hence stationary. After which the cointegration test were carried out. The cointegration criteria helped in the determination of the lag length as well as the VAR criteria used for the study and the number of cointegration equation to be used for the study. After which the stability and normality test were carried out.

5.3 Conclusion

To conclude, the Human Immunodeficiency Virus and Acquired Immune Deficiency Disease has become one of the worst killers in the modern day world and a major policy issue of concern internationally. HIV/AIDS has a diverse impact in the economy as it affects the labour force and hence output, government expenditure and revenue, apart from the social chaos that it creates. In this study, an attempt is made to assess the economic impact of HIV/AIDS the Ghanaian economy using time series data form Ghana over the period 1980–2009. The model extends the Augmented Solow growth framework by assuming that: (i) health capital is one component of human capital influencing economic growth, and (ii) HIV/AIDS has an impact on the accumulation of human capital and, via this channel, influences economic growth.

It is important to note that the study sought to find out the economic impact of the HIV/AIDS disease on growth using the human capital approach. The major findings of this study can be compactly summarized;

- The impact of the HIV/AIDS disease is insignificant on economic growth due to the long time lags between infection and the onset of AIDS.
- Secondary school enrollment is negative and significant. Since the disease impact first on the labour force which is a proxied for human capital, it implies that AIDS has an impact on growth through the human capital.
- The impact of gross domestic product invested from the model using the human capital approach in assessing the impact of HIV/AIDS on growth is positive and significant.

5.4 Policy Recommendation

The preceding analysis has focused on implications of the HIV/AIDS pandemic on economic growth. HIV/AIDS pandemic is a major policy issue of concern internationally particularly in Africa and Ghana where it is gradually taking it toll. In order to develop an effective health policy initiative, it is necessary not only to understand the epidemiology of the disease but to also understand its impact on economic development. As a matter of policy, the following is suggested:

- There is the need to empower the keeping of detailed, accurate and representative data on HIV/AIDS so that micro level measurements and analysis would give more reliable assessments, which would also improve the macroeconomic analysis.

- There is the need to take into consideration the macroeconomic effects of any intervention to combat the disease. This will help assess which programmes in the country give the best value for money

5.5 Area for further studies

The study though elaborate could not touch certain sensitive areas, due to time constraints and inadequate fund. It is therefore suggested that:

- Future research needs to concentrate on the cost and on clinical effectiveness of the disease.
- Future studies should look at the micro impact of the disease on household since the households are the most affected. In many different ways, the devastation of AIDS among individuals and families ultimately affects a country's overall economic performance.

5.6 Limitations of the study

One major challenge faced in this study was that the disease is multifaceted, with effects both in short and long run thus making the analysis of the economic impact of HIV/AIDS on growth very difficult is mainly analyzed in terms of its effects on determinants of economic development.

Another challenges encountered in the study was the unavailability of the actual information needed hence proxies had be used for most of the variables used.

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LIST OF APPENDICES

Appendices A: UNIT ROOT TEST

Null Hypothesis: LCAL has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on SIC, MAXLAG=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.958488	0.7537
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LCAL) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.365985	0.0000
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LDEP has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=1)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.676422	0.0008
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LDEP) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on SIC, MAXLAG=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.813854	0.0000
Test critical values:	1% level	-3.699871	
	5% level	-2.976263	
	10% level	-2.627420	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LGDPI has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on SIC, MAXLAG=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.120733	0.6932
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LGDPI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.926286	0.0000
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LHIV has a unit root
Exogenous: Constant
Lag Length: 7 (Automatic based on SIC, MAXLAG=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.153369	0.2275
Test critical values:	1% level	-3.769597	
	5% level	-3.004861	
	10% level	-2.642242	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LHIV) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=1)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.090713	0.0038
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LHIV) has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic based on SIC, MAXLAG=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.600844	0.0001
Test critical values:	1% level	-3.711457	
	5% level	-2.981038	
	10% level	-2.629906	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LLEB has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.190996	0.2136
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LLEB) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on SIC, MAXLAG=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.135382	0.0000
Test critical values:	1% level	-3.699871	
	5% level	-2.976263	
	10% level	-2.627420	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LMAL has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.877602	0.0005
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LMAL) has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic based on SIC, MAXLAG=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.152083	0.0000
Test critical values:	1% level	-3.711457	
	5% level	-2.981038	
	10% level	-2.629906	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LPGR has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.369043	0.1588
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LPGR) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.299929	0.0002
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LPGR) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.299929	0.0002
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LRGDPP has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on SIC, MAXLAG=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.570539	0.0001
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LRGDPP) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on SIC, MAXLAG=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.356607	0.0000
Test critical values:	1% level	-3.699871	
	5% level	-2.976263	
	10% level	-2.627420	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LSEN has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.088511	0.9414
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LSEN) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.954425	0.0005
Test critical values:	1% level	-3.699871	
	5% level	-2.976263	
	10% level	-2.627420	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: ECM has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.784561	0.0000
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996) one-sided p-values.

Appendices B: Lag Length Selection Criteria

Lag length

VAR Lag Order Selection Criteria
Endogenous variables: LRGDPP LSEN LMAL LHIV LGDPI LDEP LCAL
Exogenous variables: C
Date: 06/02/10 Time: 03:21
Sample: 1980 2009
Included observations: 28

Lag	LogL	LR	FPE	AIC	SC	HQ
0	122.6256	NA	6.11e-13	-8.258973	-7.925922	-8.157156
1	210.1134	124.9825*	4.38e-14*	-11.00810*	-8.343690*	-10.19356*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Appendices C: Johansen Cointegration test

Date: 06/01/10 Time: 09:11
Sample (adjusted): 1982 2008
Included observations: 27 after adjustments
Trend assumption: Linear deterministic trend (restricted)
Series: LRGDPP LSEN LMAL LHIV LPGR LCAL LGDPI
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.975600	239.0968	150.5585	0.0000
At most 1 *	0.804706	138.8411	117.7082	0.0012
At most 2 *	0.714265	94.74345	88.80380	0.0174
At most 3	0.613007	60.92081	63.87610	0.0864
At most 4	0.465087	35.28836	42.91525	0.2334
At most 5	0.374166	18.39578	25.87211	0.3179
At most 6	0.191566	5.741708	12.51798	0.4938

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.975600	100.2557	50.59985	0.0000
At most 1	0.804706	44.09766	44.49720	0.0552
At most 2	0.714265	33.82265	38.33101	0.1507
At most 3	0.613007	25.63245	32.11832	0.2511
At most 4	0.465087	16.89257	25.82321	0.4668
At most 5	0.374166	12.65408	19.38704	0.3567
At most 6	0.191566	5.741708	12.51798	0.4938

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Appendices D: Over parameterized model

Dependent Variable: DLRGDPP
Method: Least Squares
Date: 06/02/10 Time: 03:39
Sample (adjusted): 1982 2008
Included observations: 27 after adjustments
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLSEN	-1.469645	3.356836	-0.437807	0.6708
DLMAL	0.693843	0.849739	0.816536	0.4332
DLLEB	-6.335492	5.852288	-1.082567	0.3044
DLHIV	-0.061493	0.082686	-0.743695	0.4742
DLGDPI	-0.633072	0.378760	-1.671435	0.1256
DLDEP	-0.089644	0.103598	-0.865300	0.4072
DLCAL	1.941262	1.358102	1.429393	0.1834
C	-0.004336	0.053247	-0.081425	0.9367
DLRGDPP(-1)	0.303549	0.787244	0.385585	0.7079
DLSEN(-1)	0.514715	1.704272	0.302015	0.7688
DLMAL(-1)	-0.038819	0.466708	-0.083176	0.9354
DLLEB(-1)	-2.229445	3.458767	-0.644578	0.5337
DLHIV(-1)	0.023125	0.121544	0.190260	0.8529
DLGDPI(-1)	-0.305434	0.450144	-0.678524	0.5128
DLDEP(-1)	-0.000115	0.140304	-0.000819	0.9994
DLCAL(-1)	0.746581	1.032643	0.722980	0.4863
ECM(-1)	-1.780268	1.222796	-1.455899	0.1761

R-squared	0.777693	Mean dependent var	0.007437
Adjusted R-squared	0.422002	S.D. dependent var	0.219489
S.E. of regression	0.166869	Akaike info criterion	-0.477206
Sum squared resid	0.278453	Schwarz criterion	0.338691
Log likelihood	23.44228	F-statistic	2.186428
Durbin-Watson stat	1.772250	Prob(F-statistic)	0.105935

Appendices D: Diagnostic test

ARCH Test:

F-statistic	0.019133	Probability	0.891051
Obs*R-squared	0.020590	Probability	0.885902

White Heteroskedasticity Test:

F-statistic	2.862712	Probability	0.097334
Obs*R-squared	26.47752	Probability	0.231745

Ramsey RESET Test:

F-statistic	1.434469	Probability	0.248479
Log likelihood ratio	2.489955	Probability	0.114575

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.035063	Probability	0.853819
Obs*R-squared	0.063412	Probability	0.801182