DECLARATION & COPYRIGHT

I, the undersigned Palesa Makhetha, hereby declare that this dissertation is my own original work and that it has not been presented at any other University for a similar or any other degree award.

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Signature

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Date

ACKNOWLEDGEMENTS

I would like to thank Prof. Ncube for his patience, support and for helping me believe I can do it.

I would also like to thank Tashina, Soso, my beautiful daughter (Endy), my family and my friends for all the support.

DEDICATIONS

I would like to dedicate this dissertation to my late guardian father, who worked hard to see me becoming successful and all my friends who died of Aids.

Table of Contents

List of Figures

List of Tables

ACRONYMS AND ABBREVATIONS

AIDS – Acquired Immune Deficiency Syndrome

ASSA- Actuarial Society of South Africa

BER – Bureau of Economic Research

CGE – Computable General Equilibrium

GDP – Gross Domestic Product

HIV- Human Immunodeficiency Virus

HSRC – Human Science Research Council

ILO – International Labour Organisation

NGO – Non- Governmental Organization

SARB – South African Reserve Bank

STATSSA – Statistics South Africa

UNAIDS – United Nations Joint Programmes on HIV an AIDS

WHO – World Health Organisation

Chapter 1

Introduction and Background

1.1 Introduction

The SADC region has felt the impact of HIV/AIDS more than any other region in sub-Saharan Africa and the world. South Africa is the home of the largest number of people living with HIV/AIDS in the world. Historically, South Africa is one the countries that had a very disorderly past and this history is relevant to the explosive spread of HIV/AIDS in the region. The first cases of HIV were diagnosed in 1982 and that is when the first death from this disease was recorded. In 2004 over 5 million people out of a total 46 million South Africans were HIV positive, giving a total prevalence rate of 11%.

HIV/AIDS has affected societies in many ways. Individuals, households and enterprises have all been affected by the pandemic. For individuals, incomes are lost as a result of HIV/AIDS. When individuals fall sick due to the disease, they loose their jobs and incomes. In most cases, these individuals are breadwinners in their households. The available money is then spent on medical services at the expense of other household investments. For example, the loss of a breadwinner inevitably affects rural households investments on farm inputs such as fertiliser, seeds etc. The result is low agricultural output and thus poverty. Dependent members of the households suffer immensely from the loss of income. Those at school are likely to drop out. When children drop out of school, they are more likely to be unemployed or underemployed. This makes them more vulnerable to being poor and other vices, such as crime or even HIV/AIDS. Poverty is another social and health issue that has a two-way relationship with HIV/Aids. Poverty increases individuals' vulnerability to HIV/AIDS especially for females. Through its impact on productivity and loss of life of the economically productive members of the society, the disease condemns many to poverty. Households affected by the disease, are poorer than non-affected households.

At firm level HIV/AIDS may have devastating consequences as well. AIDS-related illnesses and deaths of employees affect firms (both formal and informal) by both increasing expenditures and reducing revenues. During the HIV phase, the worker slowly starts loosing his/her energy and experience a drop in productivity due to a decline in energy, motivation and morale. During the second phase, when the full-blown AIDS has manifested itself, the loss of work capacity and productivity is nearly complete (Giovanni and Fabio, 2002). On the other hand during this phase, the costs to the firm increase due to an increase in expenditure for medical care, drugs and funeral expenses. The costs increase also as employees are frequently absent from work. Recruitment costs increase as employers seek to replace sick employees or those who have succumbed to the disease. Training costs for new employees also contribute to the increase in total costs.

Firms also experience productivity declines due to the epidemic. Productivity declines because of absenteeism due to illness or attendance of funerals and time spent on replacement or training. High labour turnover often leads to a less experienced labour force that is also less productive. If a company decides not to replace the worker, there will be a shortage of workers and a shortage of workers leads to higher wages, which leads to higher domestic production costs. Higher production costs lead to losses in international competitiveness, which can cause foreign exchange shortages.

AIDS also has a significant effect on other key sectors of the economy like health, education, manufacturing, transport, agriculture and mining. The transport sector is especially vulnerable to AIDS. Building and maintaining transport infrastructure often involves sending teams of men away from their families for extended periods, increasing the likelihood of multiple sexual partners. The people who operate transport services (truck drivers, train crews, sailors) are vulnerable as they spend many days and nights away from their families. The losses of such manpower directly and indirectly affect economic activity. The education and health sectors are equally affected by the pandemic. The loss of teachers affects the country's human capital base. The output from educational institutions is compromised with the loss of teachers. In the health sector, the loss

of health personnel due to HIV/AIDS affects output in many ways. A healthy workforce is productive.

The manufacturing and mining sectors are the key sources of foreign exchange for South Africa. South Africa has a highly developed mining sector and is the largest producer of gold in the world, producing about 30% of total world production. Most mining is conducted at sites far from population centres forcing workers to live apart from their families for extended periods. This makes them vulnerable to the HIV/AIDS disease. Many become infected with HIV and spread the disease to their spouses when they return home. The loss of skilled manpower can be difficult to replace and seriously threaten mine production. The manufacturing sector is very sophisticated and products are diverse, and include chemicals, petroleum and coal products, food products, and transport equipment.

Agriculture is the largest sector in most African economies accounting for a large portion of production and a majority of employment. Studies done in Zimbabwe have shown that Aids has adverse effects on agriculture, including loss of labour supply and remittance income, (Ncube, 1999)**.** The loss of some workers at the crucial periods of planting and harvesting either from death or illness can significantly reduce the size of the harvest and land can be left idle or agricultural practices such as regular weeding and maintenance of irrigation systems which maintain soil fertility are neglected. In Gweru (Zimbabwe) it was shown that the shortages of labour, agricultural inputs, draught power and farm implements (sold to cover medical and funeral expenses) forced all 53 households studied to leave some land uncultivated during the 1997/98 season (Ncube, 1999). In situations where food security has been a continuous issue because of drought, any declines in household production can have serious consequences. A loss of agricultural labour is likely to cause farmers to switch to less-labour-intensive crops. In many cases, this may mean switching from export crops to food crops. Thus, AIDS could affect the production of cash crops as well as food crops. In other words, AIDS does not only affect agricultural output, but it also gives rise to a shift in production of cash crops to subsistence farming.

Furthermore, HIV/AIDS affects household's savings and investment; it influences physical capital, which are the main determinants of economic growth. The

accumulation of physical capital is a function of the savings rate of the economy. HIV/AIDS tends to reduce household savings both in absolute terms and as a percentage of household income. In addition, households are likely to invest less towards retirement as the expectation of a lower life span takes hold. HIV/AIDS will also affect physical capital by lowering the volume of domestic savings by governments (Cohen 1992:4). Budgets are affected by increases in costs associated with treating and caring for AIDS related diseases. Other expenditures, such as pension payments increase as workers are forced to take early retirement. The training of newly hired teachers and health professionals, etc, to replace those lost due to the disease - also affects national budgets. Thus, fiscal deficits would tend to worsen generally, as it may be difficult to offset the fiscal cost of the HIV/AIDS epidemic by cutting other expenditures or raising taxes' (Bonnel, Annex 5, 2000:3). In sum, reductions in household and government savings lead to 'less investment, less productive employment, lower incomes and a slower rate of GNP growth, and possibly a lower level of GNP' (Cohen, 1992: 4; Over, 1992).

When income decreases due to HIV/AIDS the level of consumption will also decrease and some households may even be faced with a situation of borrowing from friends and relatives. The decline in overall consumption may be very large to affect the welfare of children and families. Lundberg et al (2000) found a 30% fall in food expenditure over the short-term to be in the lower income group affected by AIDS. Loss of income condemns many households to poverty.

HIV/AIDS also has an impact on human capital accumulation. As previously noted, HIV/AIDS affects the most economically active age groups, thereby reducing both the quantity and quality of available labour (Cohen 1992:16; Seghal 1999: 6). The entire generations of teachers, health workers, civil servants and other skilled and professional people are being lost. Shorter life expectancies are raising the costs of schooling and training, thereby reducing the short-term returns (Bonnel, 2000). Since a significant amount of human capital accumulation takes place within the household, the death or sickness of a parent, particularly a mother, can have a disruptive impact on the inter-generational transmission of knowledge. In addition, as family finances come under increasing strain, children

may be forced to leave school to help replace lost income or production caused by the loss of a parent. Thus, human capital can easily be eroded and incentives to invest in the education and training of replacement labour can be reduced (Bonnel 2000, Annex 5: 4). Without adequate human capital, economies cannot grow. AIDS has the potential to reverse economic growth by destroying human capital, especially for young productive adults, it further weakens the mechanisms for generating human capital and investment in people through loss of income and deaths of parents. This gives rise to new generations of people with less education and knowledge, and thus less able to raise their own children and invest in their education. Thus the impact becomes stronger and devastating with time (ibid).

HIV/AIDS affects not only a country's physical and human capital, but its social capital as well. The epidemic is eroding social networks and traditional support mechanisms as well as challenging the effectiveness of legal and regulatory institutions to respond. The quality of countless lives is being eroded and a generation of children is growing up without the emotional and financial support of their parents (Bonnel 2000: 5).The erosion of social capital means less economic development

1.2 Statement of the problem

The above analysis suggests that HIV/AIDS has the potential of undermining gains in any economy. South Africa is no exception. With about 5.7 million people infected with HIV/AIDS today and 1800 dying daily, the economic gains the country has achieved may be compromised. From as far back as 1992 a few studies have attempted to predict the impact of the disease on economic development. Studies on the economic impact of the disease in South Africa have largely remained speculative and lack concrete evidence on the precise magnitude of the impact. Such studies have speculated that the disease will have a negative and minor impact on economic development. Early macroeconomic predictions demonstrated minor impacts on macroeconomic performance, when compared to more recent models.

A few studies, especially in South Africa have attempted to estimate the impact of the disease (e.g. Bureau of Economic Research (2001), ING Barings (2000),

Barnett et al (1999 and 2001) and Arndt and Lewis (2001)). The results of these studies have exhibited some wide dissimilarity. The Bureau of Economic research predicted a drop of 1.5% in GDP in a "with AIDS" scenario. The ING Barings (2000) and the Arndt and Lewis (2001) predicted an average 3.1% lower growth rate between 2006 and 2010 and 20% lower in 2010. The earlier studies were limited in terms of data and as we have accumulated more experience around HIV/AIDS, we have come to realize that the epidemic is much more complex and extensive than expected (Bell et al (2003)). With the benefit of richer data sets, and sophistication in modelling techniques, more recent studies elsewhere in the world have predicted more severe impacts. The demographic changes that have resulted from the disease coupled with the accumulated longer time series data, it is critical to model and estimate the impact of the disease on the South African economy. Also the longer term economic costs of the disease can be comprehensively evaluated with a longer data set as it is a disease that is transmitted across generations. It is against this background that this dissertation seeks to examine the impact of HIV/AIDS on the South African economy.

1.3 Objective

The objective of this study is to establish the effects of HIV/AIDS on economic growth in South Africa.

1.4 Hypothesis

The hypothesis of this dissertation is that HIV/AIDS in South Africa has a negative and statistical significant effect on economic growth.

1.5 Significance of the Study

A number of studies have been done on the impact of HIV/AIDS on economic growth in other countries. However, AIDS continues to play a huge role in killing children and adults. Most researchers focused on the period between 1990 and 2005, when a number of policies and programs to combat HIV/AIDS were initiated. Most of these studies had to resort to forecasts as data was insufficient. Few of the researchers looked at how AIDS affected the economy from when it

was just discovered until now. This research will span the period when AIDS were not well known and presently when everyone is aware of the epidemic. In this regard this study will assist policy makers as they will be able to appropriately factor in the impact of the disease in economic policy. The study will also contribute to the body of knowledge on the impact of the disease on economic growth, especially in the South African context.

1.6 Organisation of the Study

The study is divided into five chapters. Following this introductory Chapter, an overview of the AIDS pandemic in South Africa is provided. This chapter makes comparisons of situation related to HIV/AIDS with that of other countries. Chapter 3 reviews literature. Chapter 4 is concerned with model specification and other methodological issues. Chapter 4 also provides data sources as well as the empirical findings. Chapter 5 concludes the study and offers some policy recommendations.

Chapter 2

The Incidence of HIV and AIDS and Economic Growth: An Overview

2.1 Introduction

The epicentre of the HIV and AIDS pandemic is in Sub Saharan Africa(SSA). In SSA, South Africa has one of the largest numbers (about 5.7 million) of people infected with the pandemic. Inevitably, such huge infection rates have a bearing on the socio-economic development of the country. This chapter provides an overview of the incidence of the HIV and AIDS pandemic. Since the aim of this study is to assess the impact of the disease on the South African economy, this chapter also provides an overview of the conduct and performance of the South African economy. This chapter is divided into five sub- sections. The first sub-section provides a global picture of the depth of the disease. The second subsection examines the magnitude of the problem in the context of SSA, while the third sub-section looks at the extent of HIV/AIDS in South Africa. In the fourth sub-section, the focus is on the performance of the South African economy. The last subsection seeks to relate trends in HIV /AIDS and economic growth.

2.2. The Incidence of HIV and AIDS: A Global Picture

As recently as the late 1970's, no one was aware of HIV and AIDS disease. When the disease first emerged, no one could have predicted that the epidemic would spread across the breadth of the world like wildfire and that many millions of lives would be lost or changed. When the disease emerged, the causal factors were not clear and consequently no concrete mitigating factors were put in place. At the moment HIV has become the first truly 'international' epidemic, easily crossing oceans and borders. (UNAIDS, 2000)

In less than two decades, more than 65 million people have contracted the HIV globally. Sub Saharan Africa is the epicentre of the disease. Almost 65% of the

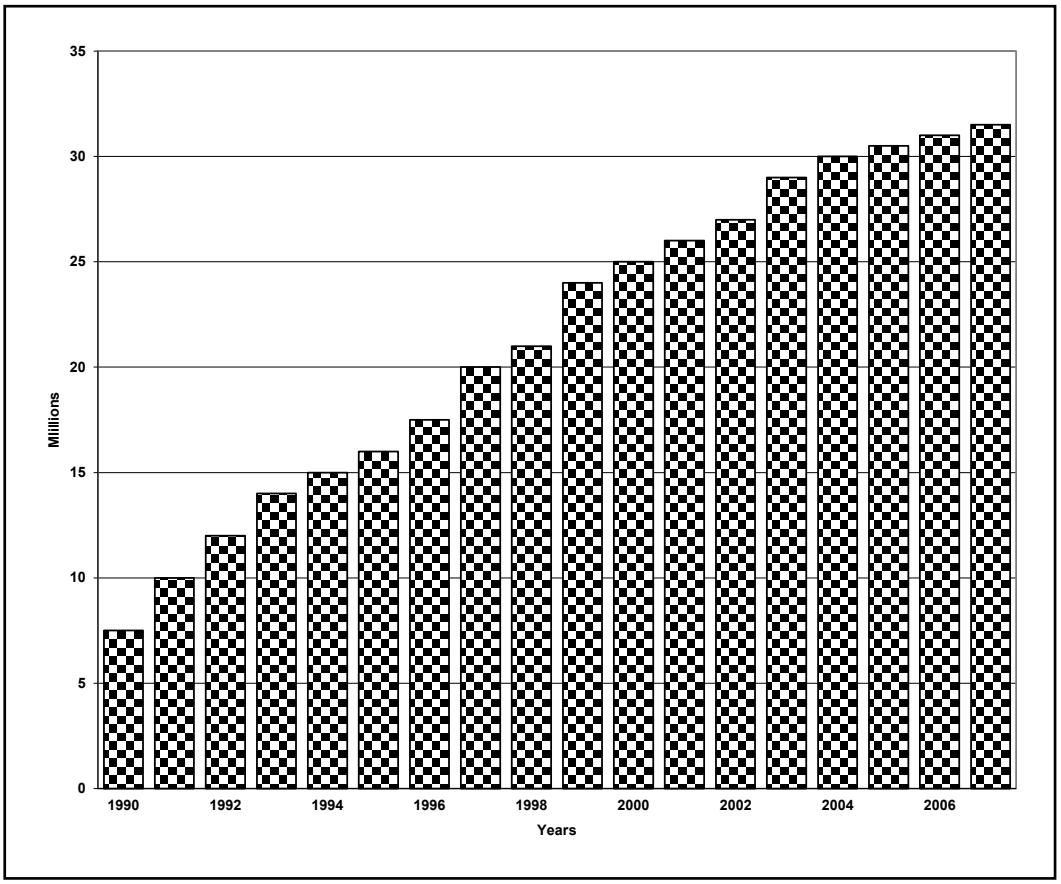
worlds' people living with HIV are in Sub Saharan Africa. Table 1 and Figure 1 below give a picture of the human toll of the disease in the world.

Table 1: World Statistics on HIV and AIDS (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

Source: UNAIDS/WHO in July 2008, and refer to the end of 2007.

Figure 1 HIV prevalence in the world (1990-2007)



Source: UNAIDS, 2000.

The number of people living with HIV in the world has risen from around 8 million in 1990 to 33 million in 2007, and is still growing (see Figure 1).

Table 2: Regional statistics for HIV & AIDS, end of 2007

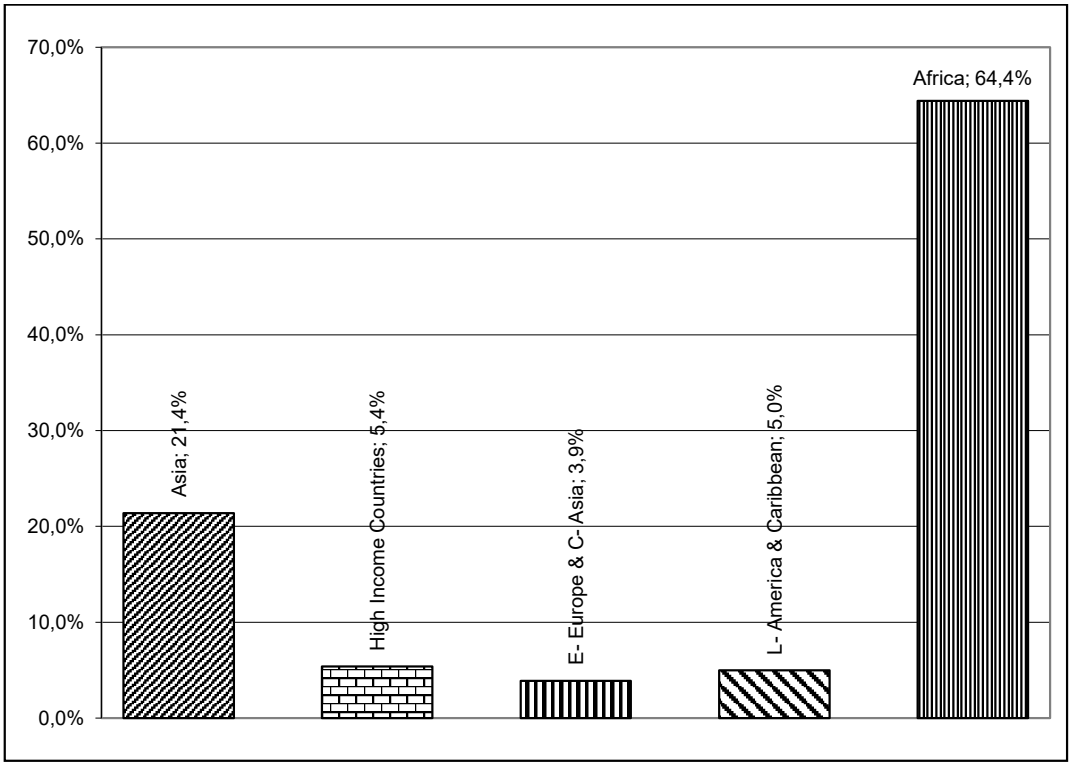
Region	Adults & children living with HIV/AIDS	Adults & children newly infected	Adult prevalence*	Deaths of adults & children
Sub-Saharan Africa	22.0 million	1.9 million	5.0%	1.5 million
North Africa & Middle East	380,000	40,000	0.3%	27,000
Asia	5 million	380,000	0.3%	380,000
Oceania	74,000	13,000	0.4%	1,000
Latin America	1.7 million	140,000	0.5%	63,000
Caribbean	230,000	20,000	1.1%	14,000
Eastern Europe & Central Asia	1.5 million	110,000	0.8%	58,000
North America, Western & Central Europe	2.0 million	81,000	0.4%	31,000
Global Total	33.0 million	2.7 million	0.8%	2.0 million

Source: UNAIDS, 2000.

* Proportion of adults aged 15-49 who were living with HIV/AIDS

According to the 2007 statistics on Table 2, Sub-Saharan Africa is the worst affected region followed by Asia when looking at the number of deaths, but the epidemic is spreading most rapidly in Latin America, Eastern Europe and Central Asia, where the number of people living with HIV increased by 150% between 2001 and 2007.

Figure 2 : HIV Prevalence in Different Regions



Source: UNAIDS, 2000.

According to the 2007 data on Figure 2, Africa accounted for 64.4% of 33 million people living with HIV around the world followed by Asia with 21.4%.

2.3. HIV and AIDS in the Sub - Saharan Africa

Sub Saharan Africa continues to be tormented and traumatized by the HIV/AIDS epidemic. The socio-economic fabric of the continent is under immense stress. It is slowing progress in development, economic growth and it is condemning vast populations into acute levels of poverty. It is not only a health challenge, but it has evolved to become a formidable humanitarian, developmental and even a security challenge.

Sub Saharan Africa is the epicentre of the disease. Almost 65% of the worlds' people living with HIV are in this region. In contrast, this region is home to slightly above 10% of the world's population. Since the detection of the disease some three decades ago, at least 20 million Africans have succumbed to the disease. In 2005 alone, about 2 million adults and children died of the disease and

3.2 million (see Table 3) became newly infected in Sub Saharan Africa. Women remain disproportionately affected by the disease. Women represent almost 60% of the infected adults. In 2003 women in the 15-24 age cohort were 2½ times more likely to be infected than men (UNAIDS/WHO, 2003). The disease attacks the young and more productive persons who make 70% of Africa's 861 million populations. The disease has further orphaned over 11 million children in the region.

Table 3: HIV and AIDS Statistics in Sub Saharan Africa: 2003 And 2005

	Adults & Children living with HIV	Number of Women Living with HIV	Adults and Children newly infected with HIV	Adult Prevalence (%)	Adult and child deaths due to AIDS
2005	25.8 million	13.5 million	3.2 million	7.2	2.4 million
2003	24.9 million	13.1 million	3.0 million	7.3	2.1 million

Source: www.thebody.com/whatis/Africa_subsahara.html (Accessed on 16 May 2007).

Since 1982 when the disease first appeared, individual African countries have reported shocking HIV/AIDS statistics (see Table 4). In Botswana, the present life expectancy of 39 years would have been 72 years had it not been for HIV/AIDS. In Zimbabwe and Zambia 50-80% of patients occupying beds in hospitals have AIDS related illness. South Africa has the greatest number of people living with AIDS in Africa. About 5.2 million South Africans are infected, while the daily infection rates currently stands at 1500 individuals. In Malawi and Mozambique, approximately between one in seven and one in nine people live with HIV, while in Botswana, Namibia, Swaziland and Zimbabwe, it is estimated that 1 in 5 live with HIV in the 15 to 19 age group. Such startling figures on HIV and AIDS in Africa have, inevitably implications on the economic performance of the continent.

Although this epidemic has hit the whole world, some areas are more affected than others. Sub-Saharan Africa has just over 10% of the world's population but around 65% of people living with HIV in the world are in this region.

Table 4: Statistics on HIV in different African Countries

Country	People living with HIV/AIDS	Adult (15-49) rate %	Women with HIV/AIDS	Children with HIV/AIDS	AIDS deaths	Orphans due to AIDS
Botswana	300,000	23.9	170,000	15,000	11,000	95,000
Kenya	1,500,000 2,000,000	7.1-8.5	800,000-1,100,000	130,000-180,000	85,000-130,000	990,000-1,400,000
Lesotho	270,000	23.2	150,000	12,000	18,000	110,000
Malawi	930,000	11.9	490,000	91,000	68,000	560,000
Nigeria	2,600,000	3.1	1,400,000	220,000	170,000	1,200,000
South Africa	5,700,000	18.1	3,200,000	280,000	350,000	1,400,000
Swaziland	190,000	26.1	100,000	15,000	10,000	56,000
Uganda	1,000,000	6.7	520,000	110,000	91,000	1,000,000
Zambia	1,100,000	15.2	560,000	95,000	56,000	600,000
Zimbabwe	1,300,000	15.3	680,000	120,000	140,000	1,000,000
Total sub-Saharan Africa	22,000,000	5.0	12,000,000	1,800,000	1,500,000	11,600,000

Source: www.thebody.com/whatis/Africa_subsahara.html (Accessed on 16 May 2007).

HIV prevalence varies considerably across this region - ranging from less than 1% in Madagascar to over 25% in Swaziland. According to the 2007 statistics, 22 million people were living with HIV/AIDS in this region. An adult prevalence rate was at 5% by the end of 2007. An estimated 1.9 million adults and children became infected with HIV during 2007. HIV prevalence (the proportion of people living with HIV) appears to have fallen slightly in this region over recent years because the number of new infections is exceeded by the number of deaths each

year. However, the total number of people living with HIV is still rising because of overall population growth.

In Sub-Saharan Africa, AIDS killed approximately 1.5 million people in 2007. Average survival in the absence of treatment is around 10 years after infection. ARV drugs can dramatically extend survival, allowing many years of healthy life, but these remain unavailable to most Africans.

Unlike women in most other regions in the world, African women are considerably more likely - at least 1.4 times to be infected with HIV than men. There are a number of reasons why female prevalence is higher than male in this region, including the greater efficiency of male-to-female HIV transmission through sex and the younger age at initial infection for women. All this also lead to 11.6 million AIDS orphans in the African continent just in 2007. According to the statistics South Africa has the highest number of people living with HIV/AIDS.

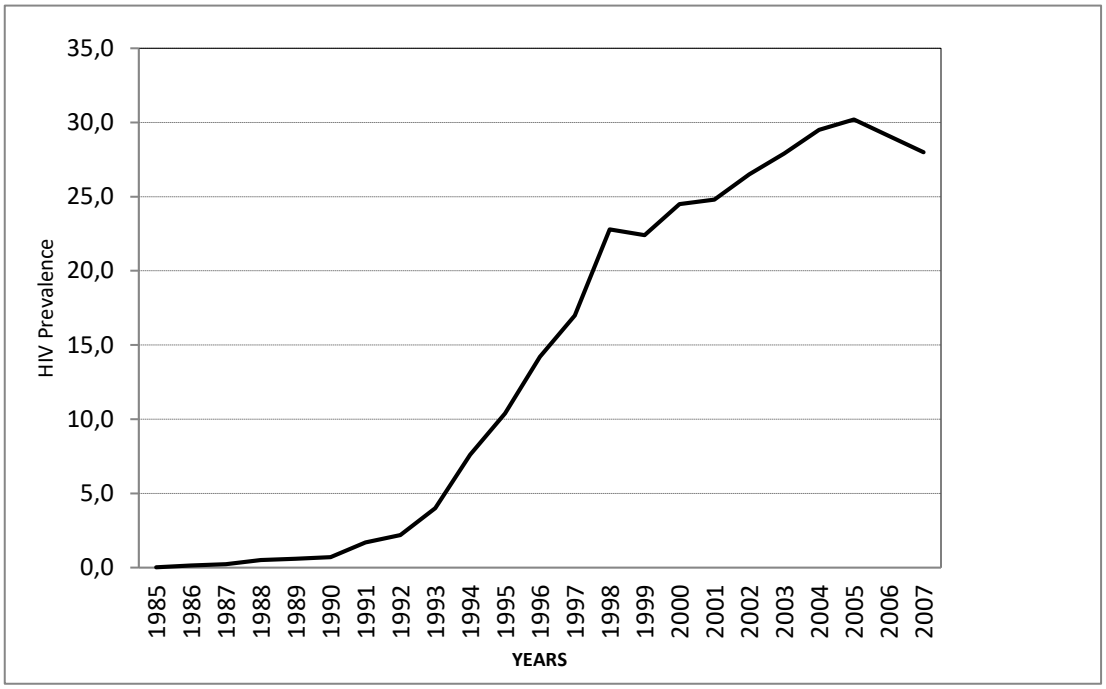
2.4. HIV/AIDS in South Africa

The HIV/AIDS epidemic emerged in South African around 1982. As the country was in the midst of the racial horrors of apartheid, the HIV problem was for the most part ignored. The first two patients were diagnosed with HIV in South Africa in 1985 and the first recorded death owing to AIDS occurred in the same year. By 1986, there were 46 recorded AIDS diagnoses. Estimates from 2000 indicated that 5% of actual infections and only 1% of actual deaths due to AIDS were reported prior to 1990. Prior to 1990, AIDS was more common among homosexual people. By 1990, less than 1% of South Africans had AIDS. By 1996, the figure stood at around 3% and by 1999 the proportion of HIV infections had reached 10%. AIDS infection started reaching epidemic proportions around 1995.

Since the first cases were reported over 25 years ago, the HIV epidemic has had a devastating impact on South Africa's socio-economic fabric and development prospects. HIV/AIDS is widely acknowledged as a major risk of doing business in South Africa, along with other notable risks such as asset security, exchange rate volatility, crime and infrastructure risk. The timeframe in which the epidemic has

gained a foothold has been remarkably short: in 1990, South Africa's HIV prevalence was less than 1%. And by 1997, the prevalence rate had climbed to 17%. Three years later in 2000, the national prevalence rate was estimated at 24%. In 2005, the national rate stood at almost 30%. In Figure 3 we trace the prevalence rate since 1985.

Figure 3: HIV Prevalence in South Africa



Source: Department of Health of South Africa

Figure 3 indicates that the prevalence rate increased steadily between 1985 and 1990. The period between 1985 and 1990 was marked by denialism and lack of concrete policies, programs and strategies to deal decisively with the disease. This impact of "denialism" and a deficit in policy regimes to combat the scourge was probably felt in the 1990s. The increase became more accelerated after 1991.The number of people infected between 1993 and 1998 was increasing by almost 3 percent annually. Infection rates increased to 30.2% in 2005, with some noticeable deceleration in 2006.

The gravity of the HIV/Aids pandemic is illustrated in Figure 6 (below) and Table 5 below. Figure 6 tracks new HIV/AIDS infections, deaths, and orphans due to AIDS.

Perhaps the greatest challenge and most tragic long term consequence of the epidemic in South Africa is the number of orphans. The population of orphans has increased by more than the number of people dying of the disease or the number of people being infected. The incidence of infections, the number of people who are newly infected in a specified time period, is one of the most important indicators of the progression of the epidemic that needs to be monitored, particularly in the more mature stages of the epidemic. Incidence peaked at nearly 700 000 in 1998 and has started to decrease. Figure 6 shows that the Aids deaths and the infections will stabilize after 2010 while the number of orphans will continue to increase, reach a peak at about 1.85 million around 2015and only stabilize around 2025. The AIDS incidence peaked in about 1998, at about 930 000 infections a year. On the other hand, the prevalence is projected to stabilize in 2014. The AIDS deaths are expected to peak in about 2010, at about 800 000 deaths a year.

Another grave statistic emerging from the HIV and AIDS problem is the rapid decline in life expectancy in South Africa. Table 5 provides a picture of the consequences of the disease on life expectancy.

Table 5: Life Expectancy at Birth Estimates by Year and HIV

Year	Life Expectancy at Birth
1985	61
1990	62
1995	61
2000	57
2005	51
2010	50
2015	50

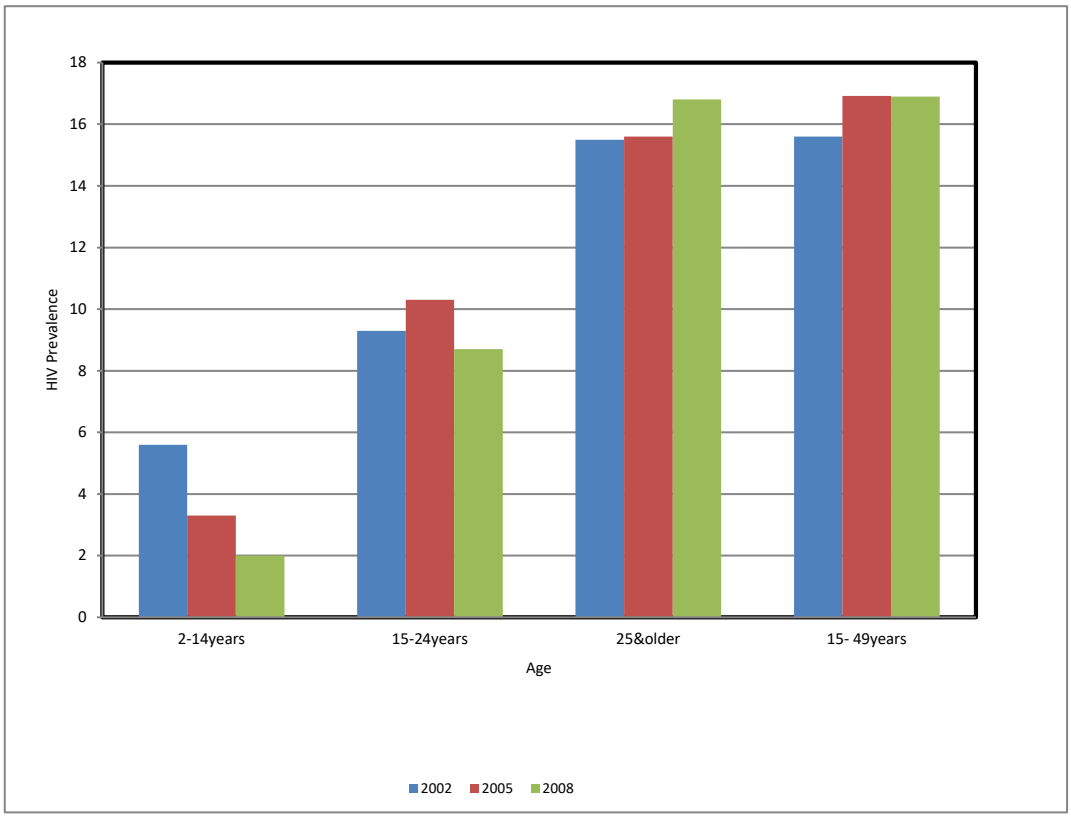
Source: Department of Health of South Africa (2007).

The demographic impact of HIV and AIDS on the South African population is apparent in statistics such as life expectancy. The pandemic has seen life expectancy in South Africa fall from 61 years in 1985 to 50 years in 2009. The average life expectancy in sub-Saharan Africa is now estimated at 47 years, when it could have been 62 years without AIDS. In the under-5, the mortality rate has increased from 65 deaths per 1000 births in 1990 to 75 deaths per 1000 births in 2006. Mortality rates in 1990 suggested that a 15-year old had a 29% chance of dying before the age of 60. The mortality rates in 2006 suggest that the 15-year olds have a 56% chance of dying before they reach 60.

2.5. HIV/AIDS by Age and Gender

The HIV and AIDS disease has affected different age groups differently. The impact of the disease has also gender manifestations. Figures 4 and 5 shows the gender and age impacts of the disease. Figure 4 indicates that the epidemic hits hardest the 25-49 age groups. This age group is the most productive economically Women are fast becoming the predominant group infected and affected by HIV/AIDS. Figure 5 shows that the prevalence rate is higher for women than men in the 15 to 39; 45-49 and 55-59 year age groups, while it is higher for men in the other age cohorts. Women aged between 25 and 29 years continue to be the most affected by HIV infection, with an estimated 34.5% of pregnant women in this age group being HIV positive. Women in the age group 30-34 years follow with a 29.5% prevalence rate, and those aged 20-24 years (29.1%). These three age groups recorded rates above 20%, while the rest of the age groups recorded prevalence rates below. These rates are as follows: 35-39 years (19.8%), 40+ years (17.2%) and < 20 years (14.8%). A host of reasons could explain the vulnerability of women, especially the younger cohorts. Gender differences in economic power and higher incidences of poverty among women are some of the factors responsible for higher incidences among women. Among males, HIV prevalence is highest in the 30 to 34 age group.

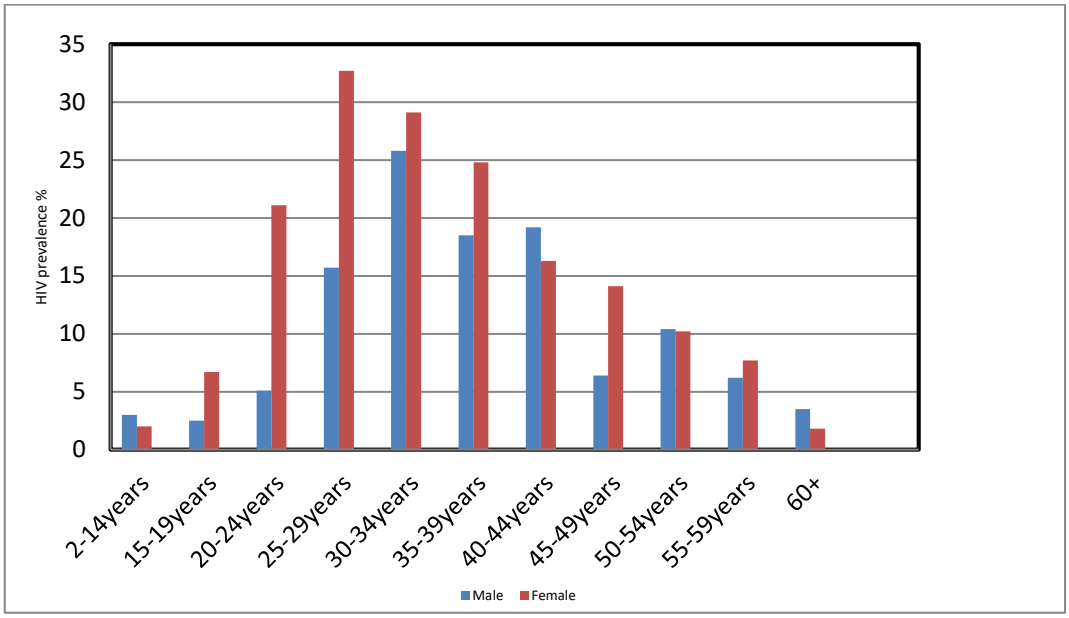
Figure 4: Estimated HIV prevalence (%) by Age



Source: Dorrington, Bradshaw, Johnson and Daniel, 2006.

http://www.mrc.ac.za/bod/DemographicImpactHIVIndicators.pdf

Figure 5: HIV Prevalence by age and gender

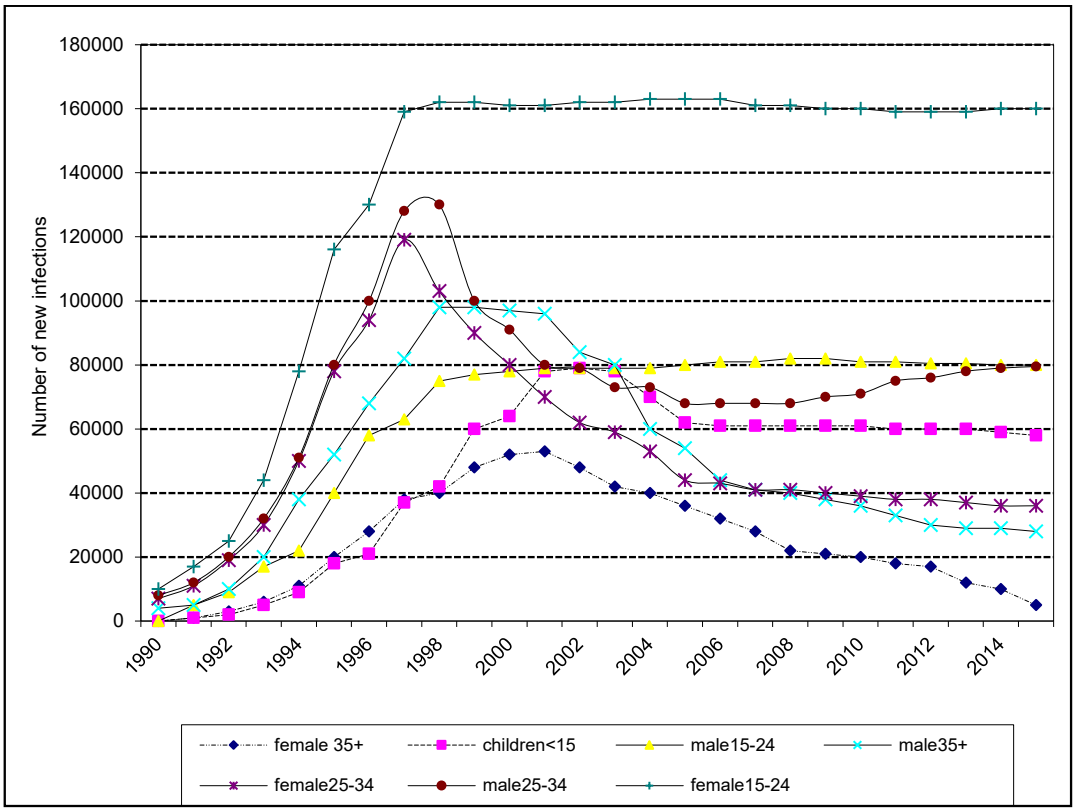


Source: Dorrington, Bradshaw, Johnson and Daniel, 2006.

http://www.mrc.ac.za/bod/DemographicImpactHIVIndicators.pdf

Figure 6 shows the actual and projected number of new infections by gender and age. New infections are highest among the 15-24 females. Although new infections in other age groups peaked around the third quarter of the previous decade, the new infections among the 15-24 females has not followed suit. New infections for males in the same age group -15-24, have stubbornly maintained steady growths, unlike that of older men, which has exhibited a fall after reaching various peaks in the late 1990s. New infections for older women have also shown some rapid decline after peaking in the late 1990s as well.

Figure 6: Projected number of newly infected people by sex and age group, ASSA 2003

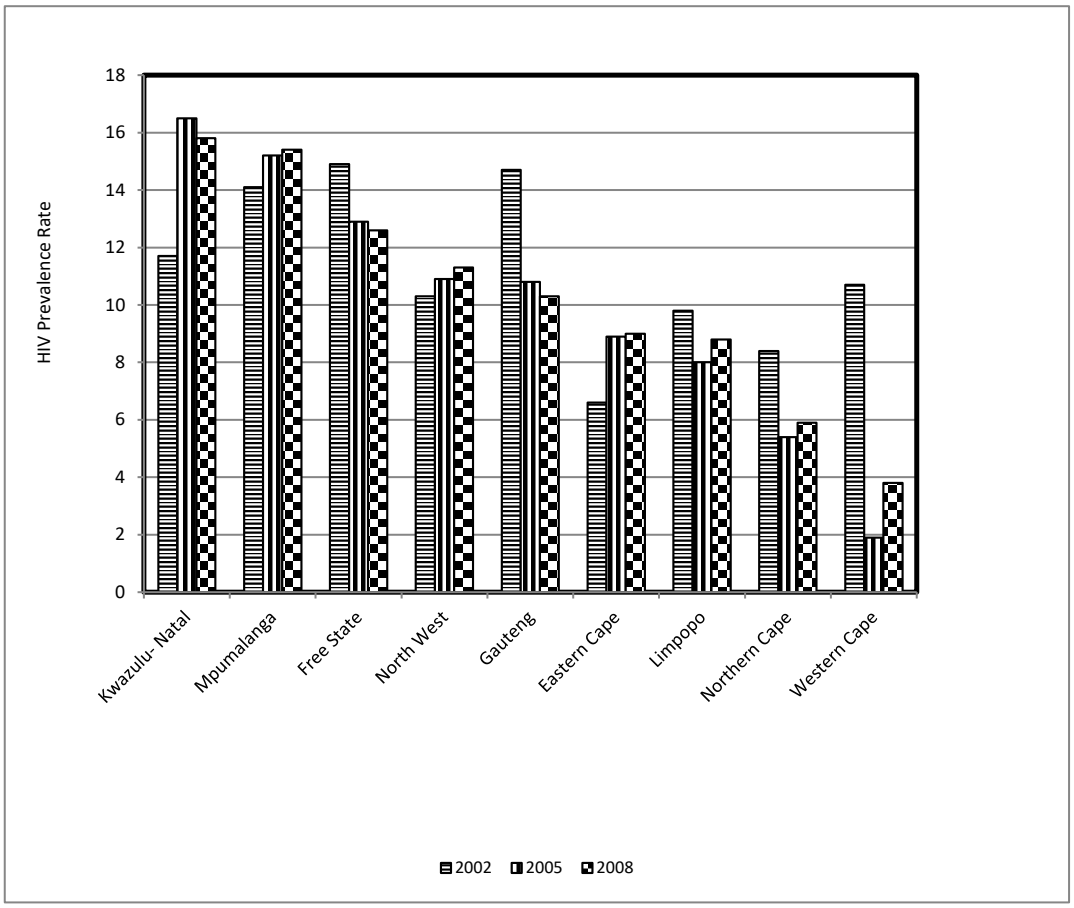


Source: ASSA 2003

2.6. HIV by Province

HIV and AIDS statistics also vary by province (see Figure 7). The province of KwaZulu Natal has the highest incidence, followed by Mpumalanga and then the Free State. The Western Cape has the least prevalence rate.

Figure 7: HIV Prevalence by Province 2002 -2008



Source: Dorrington, Bradshaw, Johnson and Daniel, 2006.

http://www.mrc.ac.za/bod/DemographicImpactHIVIndicators.pdf

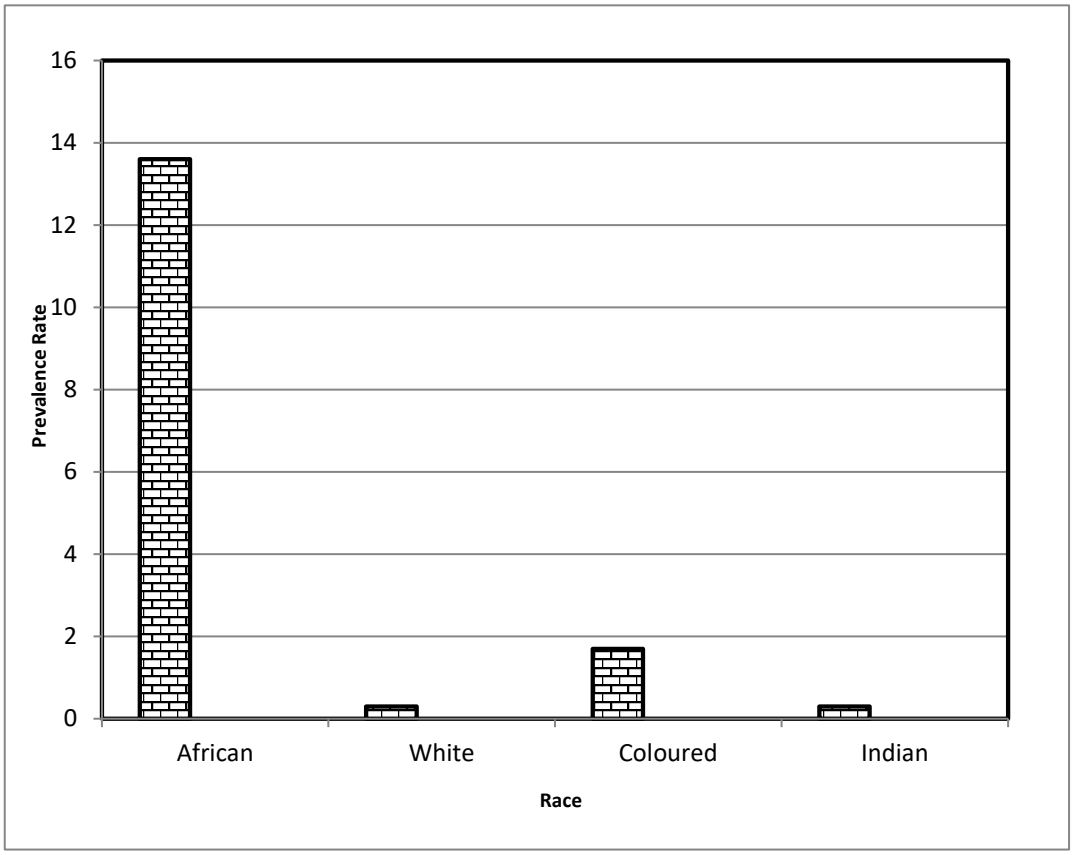
In 2002 every province had more than 6% HIV prevalence, with the Eastern Cape having the lowest percentage and Gauteng and Free State leading the pack. Three years later KwaZulu Natal took the lead, followed by Mpumalanga. The prevalence dropped from 10.8% to 1.9% in the Western Cape and from 14.7 to 10.8% in Gauteng. The decrease in Western Cape and Northern Cape was mainly due to an increase in condom usage. In 2008, more than half (55%) of all South Africans infected with HIV resided in the KwaZulu-Natal and Gauteng provinces.

KwaZulu-Natal still has the highest infection rate at 15.5%. Although the Western Cape has the lowest infection rates, the total number of people with HIV/AIDS in this province doubled between 2005 and 2008.

2.7. HIV by Race

People living with HIV/AIDS are found in every race group in South Africa, although the observed prevalence differs. HIV prevalence in Africans is substantially greater than in any other racial group (see Figure 8). Among Africans, HIV prevalence was about 13.6% of the same population group. The white and Indian population groups have the lowest prevalence rate. The coloured population occupies a distant second position.

Figure 8: HIV Prevalence Rate by Race (2007)



Source: Dorrington, Bradshaw, Johnson and Daniel, 2006.
http://www.mrc.ac.za/bod/DemographicImpactHIVIndicators.pdf

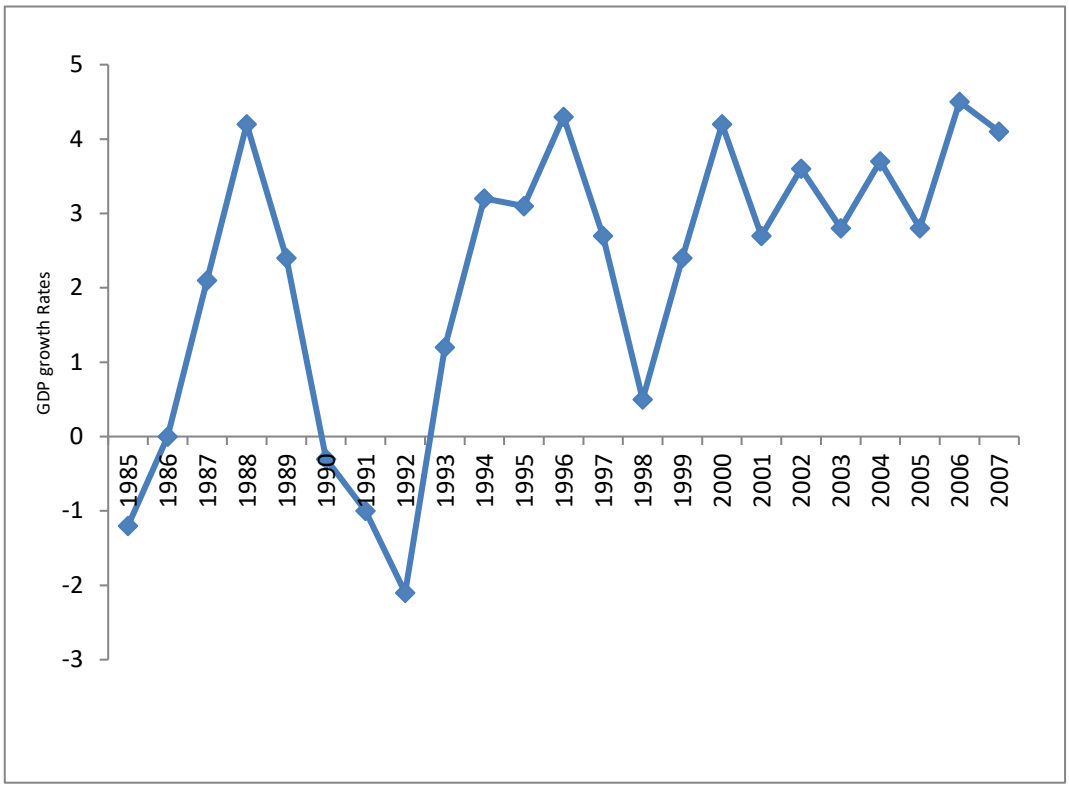
2.8 Trends in Economic Growth and HIV/AIDS

Since the objective of this study is to establish the impact of HIV/AIDS on the growth of the South African economy, this sub-section seeks to establish some relationships between HIV and AIDS and economic growth by simple looking at the historical trends of the two variables. We begin by examining the performance

of the economy, followed by trends in the two variables that are the main subjects of this dissertation.

The performance of the South African economy is summarized in Figure 9.

Figure 9: GDP Growth of South Africa



Source: SARB and STATSSA (2007).

South Africa experienced moderate economic growth between 1987 and 1989. In 1999 the economy lost steam and eventually registered negative real GDP growth between 1990 and 1992. The apartheid era policies which included under investment in human capital, large budgetary outlays for duplicative layers of government and facilities and international sanctions were some of the factors behind the decline in economic activity. In addition, the economy was hit hard by the 1992 drought during this period. In 1994 GDP growth improved once again as it grew by 3.2%. This growth was propelled by the removal of sanctions, restoration of local and foreign confidence in the economy. The growth continued up until it reached 4.3% in 1996. Between 1997 and 1998, the economy slowed down. The slowdown was short-lived as at the end of 1998, it regained its growth pattern. This growth was underpinned by booming exports. During the 1998 to

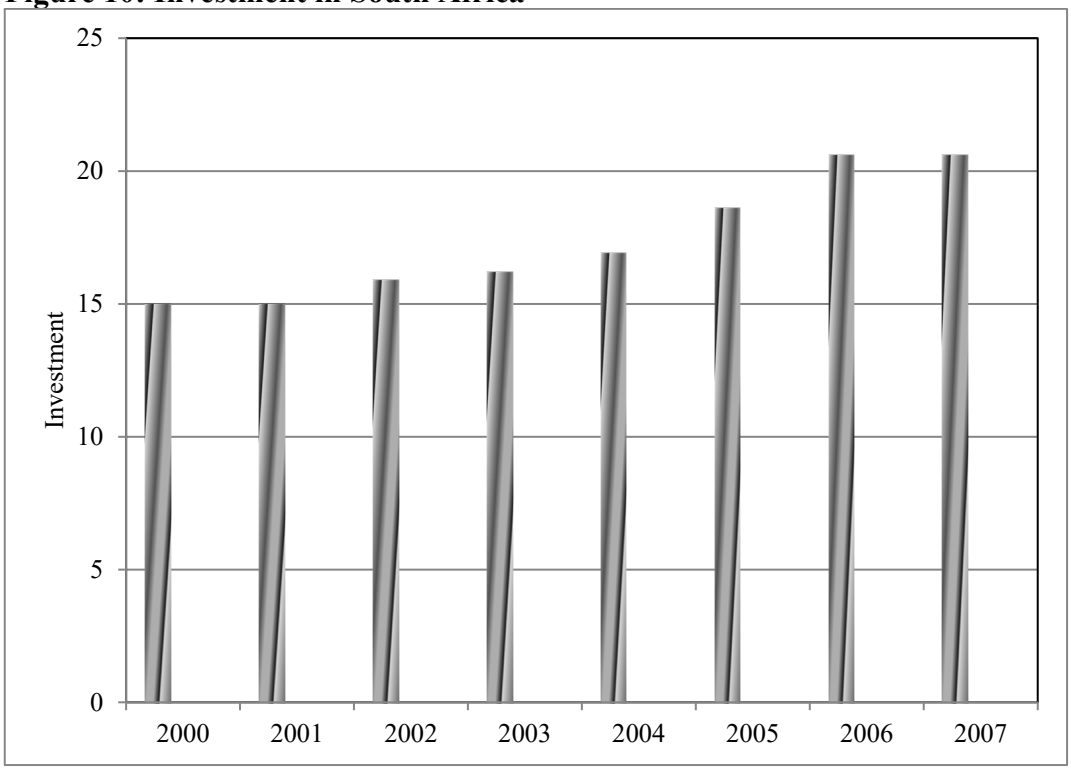
2000 upswing, the country's annual economic growth rate averaged over 4%. In the decade prior to 1994, economic growth averaged less than 1% a year. Since 1999, quarterly GDP growth has been consistently positive and annual GDP growth consistently above 2%. Between 1996 and 2004, GDP growth averaged 3.1%, rising to 4.5% in 2004 and 4.9% in 2006. In 2007 economic growth stood at 4.1%. Towards the end of 2007, the international financial crisis began to severely suffocate the South African economy. In 2008 and 2009, economy growth was further derailed by the global crisis. In these two years the economy recorded growth rates of 3.1% and 1.5% respectively.

Economic growth is influenced by other crucial variables such as investment and public expenditure. In the next two sub-section, we examine the trends, albeit briefly, of these two variables.

2. 9 Investment

Investment plays a major role in economic growth. In the past decade, South Africa has managed to attract significant levels of both domestic and foreign direct investment. Figure 10 tracks investment levels since 2000. Investment levels have remained above 15% of GDP. In 2000 total investment accounted for 15% of GDP and by 2007, this proportion had increased to about 21%. An increase in investment incentives especially after majority rule, the post 1994 good will by the international community and scrapping of economic and political sanctions, as well as the sound and sophisticated infrastructure are some of the factors responsible for such high levels of investment. Growth in investment has continued even beyond 2007 as the country geared itself for hosting the 2010 international soccer matches.

Figure 10: Investment in South Africa

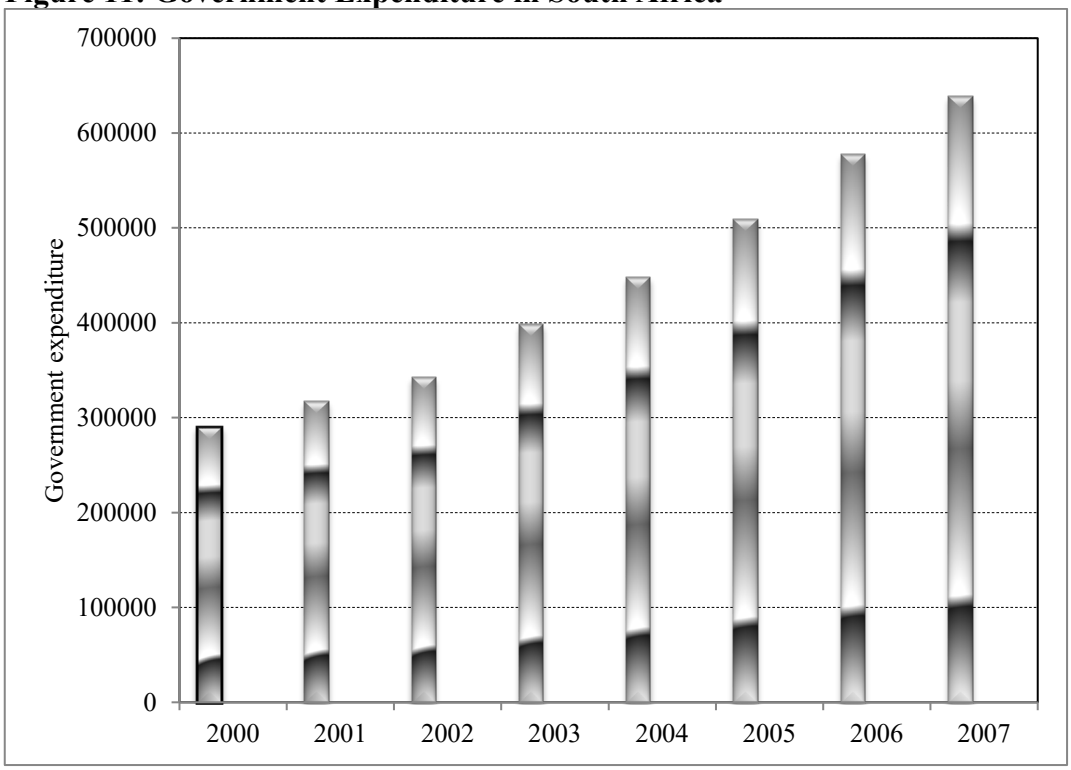


Source: SARB and STATSSA (2007)

2.10 Government Expenditure

Another major driver of economic growth is government expenditure. Government expenditure comprises of social services (education, health, welfare etc), protection services, economic services and infrastructure and administration. Figure 11 traces government expenditure between 2000 and 2007. Government expenditure has followed an upward trend since the 1980s. In the 1990s, government expenditure increased rapidly as the new government sought to address the inequities of the past as well as bring in the majority blacks into mainstream economic activity. All these activities meant more spending by government. Figure 11 shows that government expenditure became steeper after 1994 largely because of the emphasis on the distributive role of the new government.

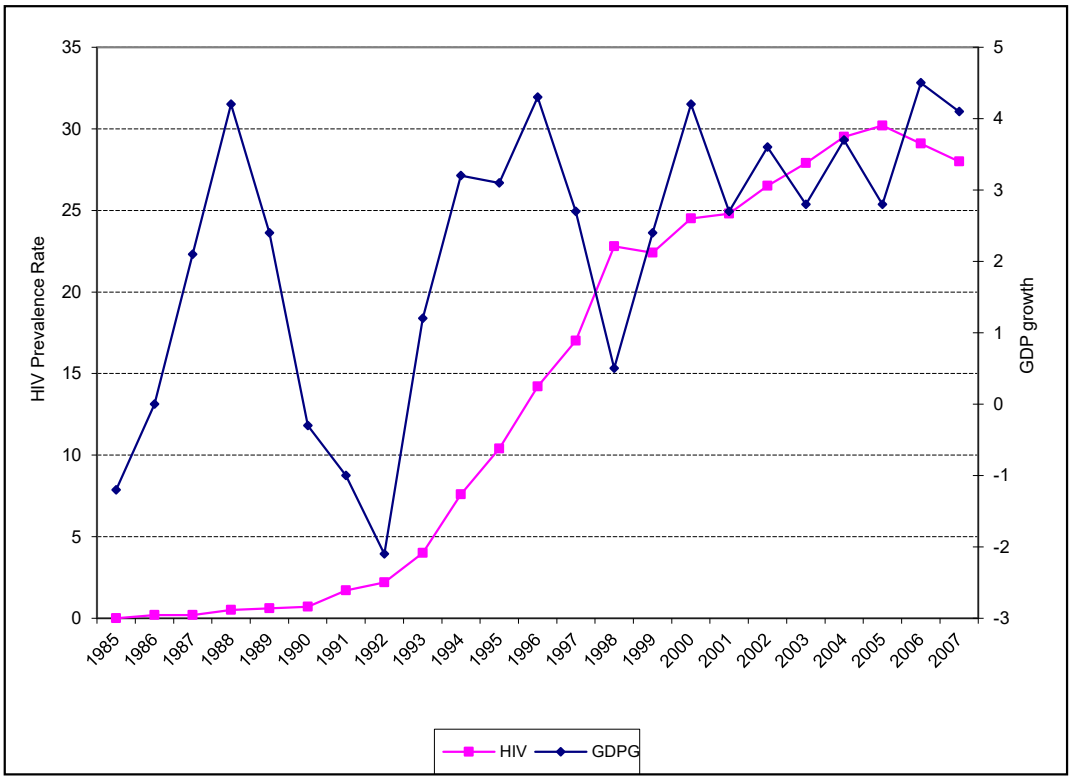
Figure 11: Government Expenditure in South Africa



Source: SARB and STATSSA (2007).

The question that has underpinned this dissertation is whether HIV/AIDS has a negative effect on the growth of the South African economy. The answer to this question will be provided in Chapter 4, after a thorough and systematic examination of empirical evidence. However in the subsequent paragraphs we discuss the relationship between these two variables. Figure 12 provides a pictorial view of the relationship between HV/AIDS and economic growth.

Figure 12: HIV Prevalence and GPD Growth



Source: Department of Health, SARB and STATSSA (2007)

According to Figure 12, the relationship between HIV/AIDS and economic growth is unclear. Economic growth exhibits an erratic growth pattern, while the disease follows an upward growth path. Overall, economic growth has remained subdued, while HIV prevalence is increases rapidly in the 1990s and sluggishly thereafter. The nature of the relationship between the two variables would be cleared in Chapter 4, when we estimate a model that will unambiguously establish the impact of HIV/AIDS on economic growth.

To sum up, the main aim of this chapter was to provide some background information to this study. The key variables that were scrutinized in this chapter were HIV/AIDS and economic growth. Evidence from this chapter definitely speculative and circumstantial. HIV/AIDS statistics presented in this chapter paints a grim picture of the effects of the pandemic on the changes in the socio-economic structure and demography of the entire world and South Africa in particular. At this stage one is tempted to speculate that the impact of the disease on the South African is devastating. Although evidence here on the impact is largely circumstantial, in Chapter 4 of this dissertation, a robust model is

presented to provide some concrete evidence on the impact of HIV/AIDS on the South African economy.

Chapter 3

Literature Review

3.1 Introduction

In this Chapter both theoretical and empirical literature on the impact of HIV and AIDS is reviewed. Since the study seeks to examine the impact of AIDS/HIV on economic growth, it has to be underpinned by growth models. In this regard the theories reviewed include the Solow-Swan, Harrod-Domar, the Endogenous growth and the Keynesian theories of economic growth. On the empirical part the Chapter reviews literature on the impact of HIV and Aids around the world, from the African continent and from South Africa in particular.

3.2 Theoretical Literature

At a theoretical level the impact of HIV/AIDS on the economy can be understood by examining the impact of the disease on the key drivers of the economy. Economic theory postulates that HIV/AIDS attacks directly or indirectly, the core determinants of economic activity or growth. In the subsequent paragraphs we discuss some of these theories.

3.2.1 The Harrod-Domar Model

The Harrod-Domar model was originally developed to analyse business cycles and was later adapted to explain economic growth. The model suggests that the economy's rate of growth depends on the level of savings and the productivity of investment. In this theory, savings provide the funds which are borrowed for investment purposes. The main assumptions of the model are that:

- Economic growth depends on the amount of labour and capital.
- More physical and human capital generates economic growth.
- Net investment leads to more capital accumulation, which generates higher output and income.

- Higher income allows higher levels of savings.

The emphasis of the Harod-Domar model is that economic growth is driven by capital accumulation. Capital accumulation can be physical, human or social capital. In this case HIV/AIDS through the human capital channel, has the potential to influence economic growth.

3.2.2 Endogenous growth theory

Robert Lucas (1998) is the major pioneer of this theory. The Endogenous growth theories focus on technological innovation as being the engine of economic growth. Endogenous growth theories note that government policy to increase capital or foster the right kind of investment in physical capital can permanently raise economic growth.

The Endogenous growth theory emphasises high levels of accumulation of both physical and human capital as vital for economic growth. In our context, physical capital accumulation at household, firm and at national levels is undermined when resources are diverted to the treatment of HIV/AIDS. AIDS also reduces current human capital as well as future stocks through its depletion of human resources.

3.2.3 The Solow -Swan Growth Model

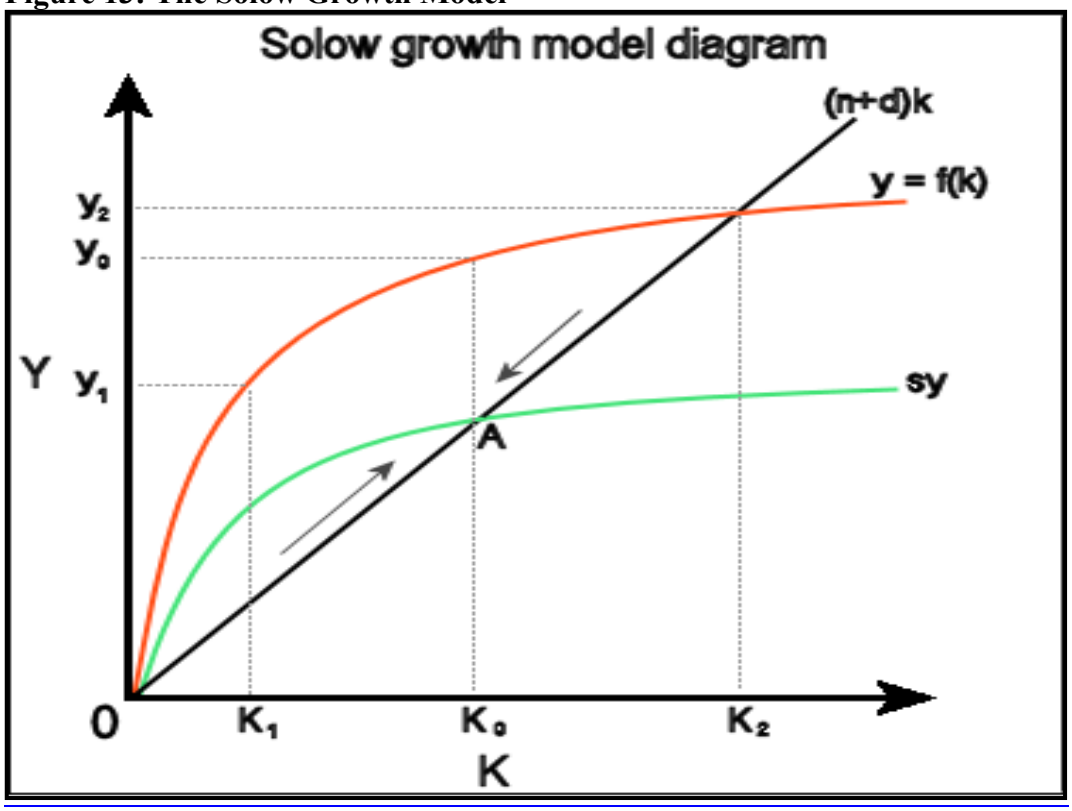
Solow extended the Harrod-Domar model by:

- Adding labour as a factor of production;
- Requiring diminishing returns to labour and capital separately, and constant returns to scale for both factors combined;
- Introducing a time-varying technology variable distinct from capital and labour.

However in the Solow-Swan model, the capital-output and capital-labour ratios are not fixed as they are in the Harrod-Domar model. These refinements allow

increasing capital intensity to be distinguished from technological progress. As to how this model explains economic growth, the diagram below becomes handy.

Figure 13: The Solow Growth Model



The model starts with a neoclassical production function $y = f(k)$, as shown in Figure 13. From the production function, output per worker is a function of capital per worker. The model assumes diminishing returns to capital, as denoted by the slope of the production function.

When $sy > (n+d)k$, in other words, when the savings rate is greater than the population growth rate plus the depreciation rate, when the sy curve is above the $(n+d)k$ curve on the graph, then capital (k) per worker is increasing. This is known as capital deepening. Where capital is increasing at a rate only enough to keep pace with population increase and depreciation, the process is known as capital widening.

The curves intersect at point A, the so called "steady state". At the steady state, output per worker is constant. However total output is growing at the rate of n, the rate of population growth. The optimal savings rate is called the golden rule savings rate. To the left of point *A*, e.g. point k_1, the saving per worker is greater than the amount needed to maintain a steady level of capital, so capital per worker increases. There is capital deepening from y_1 to y_0, and thus output per worker increases. To the right of point A, where $sy < (n+d)k$, point y_2 for example, capital per worker is falling, as investment is not enough to combat population growth and depreciation. Therefore output per worker falls from y_2 to y_0.

In a nutshell, according to the Solow-Swan growth model, savings are important for growth. Savings become the driver of capital accumulation and then economic growth. Any factor that destroys the savings potential of the society destroys the capital accumulation potential of the economy. HIV/AIDS is one such factor that disrupts the savings potential of the society, and thus the capital accumulation of the economy. Physical and human capital formations are by-products of savings. As budgets of firms are overstretched due to AIDS related care, savings by such institutions are adversely affected. In the same vein, individuals increasingly find themselves dissaving as they focus their resources on AIDS treatments and care. On the other hand, as many works succumb to the disease and company profits diminish, less and less tax revenues will accrue to governments. Less revenues coupled with increasing AIDS related expenditures, may give rise to budgetary deficits that have the potential of distorting economic activities of many countries. Besides tax revenue losses, and increasing expenditures, governments will increasingly find themselves hard pressed to save and later-on invest. Overall, with fewer savings that translate itself into lower human and physical capital accumulation; retarded economic growth will be the consequence. In this way HIV/AIDS will have a negative effect on the economy.

3.2.4 The Keynesian Theory

This Keynesian model was developed by John Maynards after the great depression in 1932. He believed that government intervention through changes in fiscal variables is necessary to improve the performance of the economy. Keynes

saw public expenditure and taxation as exogenous factors to be used as policy instruments to influence growth. For example, the Keynesian proposition treats public expenditure as autonomous and exogenously given. Here the causation runs from growth in government expenditure to growth in the national income. Thus, public expenditure becomes a policy variable which can be used to influence economic growth. Relying on this proposition, many developing countries have assigned their public sectors the role of promoting growth and economic development (ibid). Keynes was of the view that government investment on infrastructure would stimulate the economy. HIV and AIDS increases government spending on the health sector. Although such HIV/AIDS induced expenditures can spur economic growth, it has the potential of crowding out other expenditures or the private sector. Such crowding out has detrimental effects on the economy.

In summary, the above four models variously suggest that capital formation, in its three main dimensions; physical, human and social, is the main driver of economic growth. The focus of this dissertation is to examine the impact of HIV/AIDS. HIV/AIDS is believed to undermine capital accumulation both in the short and long run. Physical capital accumulation is believed to be hampered by the disease both at household and at firm level, or at the micro and macro levels. At household, firm and national levels, asset and technological accumulation is undermined as resources are diverted to the treatment of HIV/AIDS. At household level, assets are sold to take care of AIDS related expenses. Thus, the future household capital stock is undermined and thus any future investment is diminished. In Africa, the household level consequences of the pandemic are more discernible in the agricultural sector where households find themselves in a vicious cycle of asset depletion, disinvestment and poverty. In Africa agriculture is perhaps the most vulnerable sector since Sub Saharan economies are largely agricultural driven. Agriculture suffers directly from loss of labour, loss of incomes and remittances for purchasing inputs, and losses of export revenues. The agriculture sector also provides the demand necessary for the development of other sectors. The impact on agriculture inevitably distorts the performance of other sectors since the linkages between agriculture and other economies are very strong. Most industries in Africa are agro-based. Sectors which rely on inputs and

demand from agriculture are severely constrained when the pandemic disrupts agricultural activity. On their own, these sectors also suffer from personnel, skill and demand losses. There is hardly any sector spurred by this pandemic. Even the informal sector is very vulnerable. In the informal sector a loss of one person for example, may lead to an outright closure of the firm, as this person is often the investor, manager, accountant, marketer, etc., all in one.

At firm level, asset and technological acquisition is hampered as AIDS related costs escalate. As expenses related to AIDS such as medical care, recruitment and training, health care insurance, burial etc, escalate profit margins and investment are depleted. At national level, as many people get infected, increasing amounts of resources are diverted to AIDS related health care. This inevitably marginalises capital expenditures. Diminished capital formation at national level in turn stifles investment by other economic agents, such as firms or households.

The other principal driver of economic growth according to these theories is human capital. Human capital includes accumulated investment in such activities as education, job training, skills and experience. AIDS depletes human resources through mortality at an alarming rate. AIDS reduces current human capital as well as future capital stock. Current human capital is diminished as skills and experience disappear through AIDS related deaths. The death of current workers due to AIDS also gives rise to more children being orphaned. These orphans are also vulnerable to being poor or are more likely to receive inferior human capital. In addition, as more people suffer and succumb to AIDS, the diversion of resources to AIDS related care sees more school going children dropping out of school. Evidence shows that and the girl child is more susceptible to this. AIDS also affects not only the quantity of human capital, but also the quality. Quality of human capital inevitably diminishes as more teachers succumb to AIDS or their absenteeism becomes more frequent. Furthermore, as budgetary constraints become more acute, fewer resources are channelled into learning and teaching aids, thus compromising the quality of human capital.

Social capital formation is also a strong determinant of growth (Were and Nafula, 2003). Social capital involves networking, participation in community projects

and activities, etc. AIDS brings about stigmatisation which results in social exclusion and ostracisation of the sufferers. It literally destroys the social fabric. From an economic point of view, social capital is important for the efficiency and productivity of the economy. People who suffer from AIDS suffer from social exclusion and thus cannot participate meaningfully in the social and economic well being of their countries. The pandemic destroys social structures and impairs networks that are key to the promotion and sustenance of economic growth. With dysfunctional social structures and severed networks, a slowdown in physical and human accumulation becomes inevitable[1].

3.3 Empirical Literature

This section pierces together evidence from literature on the impact of HIV/AIDS on the world, African and South African economies. In particular, we focus on the macroeconomic, microeconomic as well as the sectoral impacts of the disease.

3.3.1 Macroeconomic impact

The impact of HIV/AIDS on economic performance is difficult to quantify and separate from other impacts. This problem is further compounded by the porous nature of the data in any country. However, literature is abound with attempts to isolate the impact of the pandemic on growth. Literature also makes it clear the pathways in which HIV/AIDS affects economic development. Perhaps, the most lethal channel in which the pandemic retards economic growth is through the dislocations it causes in the labour market. With a dislocated labour market, the linkages with other markets are severed. In the labour market AIDS not only

[1] *Perhaps one of the important reports of the impacts of AIDS on social capital in Zimbabwe is Mutangadura (2000). Mutangadura's (2000) study of 215 households in Zimbabwe shows that AIDS leads to significant family dissolutions. In this study almost 40% of sampled households were staying with orphans who had lost both parents. Households with an adult female who had succumbed to the disease were more likely to disintegrate than those with a male adult dying of the disease.*

reduces labour supply and productivity, but also destroys the human capital base in its many forms. In the next sub-section, we look at the impact of HIV and AIDS on the labour market.

3.3.2 The impact of HIV/AIDS on labour markets

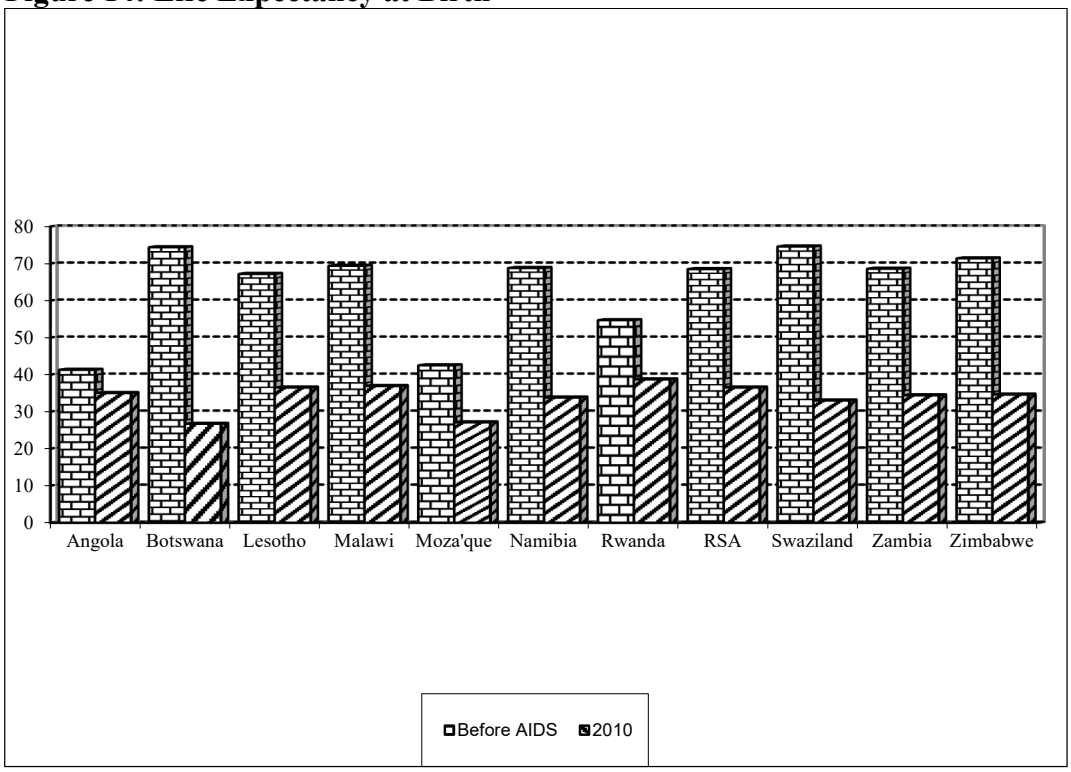
Employment levels will be lower in the AIDS scenario than in the no-AIDS scenario, due mainly to lower levels of economic activity, while the labour force (and labour supply) will be significantly smaller as a result of increased AIDS mortality, which will see the total population shrink. However, population growth will not turn negative, but the epidemic will see population growth slow, particularly in groups facing high prevalence rates and fertility declines (Ford et al., 2002), which again underlines the importance of understanding the mix between HIV prevalence, skill level and labour supply, an area of research that as explained elsewhere remains one of the key gaps in our knowledge about the economic impact of HIV/AIDS. Both the ING Barings (2000) and the BER (2001) models forecast unemployment rates to be lower in the AIDS scenario. However, these outputs of the model do little to elucidate other questions about the impact of the HIV/AIDS epidemic on labour markets. So, for example, there is no real evidence as yet as to the impact of the epidemic on the composition of the labour force in terms of skill levels. Nor do we know what particular occupations may be worse affected by the epidemic than others. (Also see discussion elsewhere on criticisms of demographic assumptions underlying the macroeconomic models reviewed in this paper – pages 9 to 13). Furthermore, a greater understanding (and allowance of these impacts in the macroeconomic modelling frameworks) is required of the extent to which the epidemic will in future years impact on the formation of human capital via lower investment in schooling and higher education and the material, emotional and motivational impact on affected children of the loss of a parent (Russell, 2002).

In addition, a reduction in labour supply leads to higher wages and thus production costs, with dire consequences on inflation (Quattek 2000). The disease further weakens and destroys all mechanisms of regenerating human capital as parents die. This gives rise to a generation of people less endowed in human

capital. According to Franklin (2001), increased morbidity and mortality is resulting in both a smaller and younger economically active population. All levels of society are affected, from the individual through to government, and the resulting economic effect at each of these levels has a compounding negative effect on the macro economy of the country.

Furthermore, evidence of the devastating effects of the disease on the human capital base is clear when we look at deaths due to the disease (see previous Chapter) and reduction in life expectancy (see Figure 14). Figure 14 summarises estimated changes in life expectancy at birth for a number of African countries before the onset of the AIDS pandemic and projections in 2010.

Figure 14: Life Expectancy at Birth



Source: ILO (2000)

In addition, economic theory predicts that the pandemic retards growth in essential exporting sectors, thus reducing overall exports. On the other hand, the disease leads to an increase in strategic imports like health care products. Consequently, balances of payments are put under severe pressure. The budget deficits are likely to escalate as government revenues decline in parallel to

escalating AIDS related expenditures. Debt defaulting become predictable consequences as well. The pandemic also undermines both individual and corporate savings. In the next sub-section we look at the impact of HIV and AIDS on savings and investment.

3.2.3 The impact of HIV/AIDS on savings and investment

The macroeconomic models reviewed in this paper project that domestic savings will decline. ING Barings (2000) list three reasons for the decline in domestic savings:

- lower household savings (due to the fact that the reduction in household consumption is less than the reduction in disposable incomes)
- lower public sector savings (as a result of the higher public sector borrowing requirement)
- lower corporate savings (due to the fact that employers will have to finance higher direct and indirect employee costs from operating surpluses and savings).

Arndt and Lewis (2000) project that AIDS-related government spending from the savings pool will cause total domestic savings to decline from 17% of GDP in 1997 to 14,2% in 2010. According to the ING Barings (2000) model, total domestic savings as a percentage of GDP is forecast to be on average 2 percentage points lower than in the no-AIDS scenario. BER (2001) forecasts that national savings, as a percentage of GDP, will be 0,9 percentage points lower in the AIDS scenario by 2005 (2,7 percentage points lower by 2010; 3,1 percentage points lower by 2015). Arndt and Lewis (2000) forecast the impact of reduced household savings rates on total savings to be relatively small. One reason is that household savings rates in South Africa are already very low and that the white population, who contributes the largest share to these savings, face low HIV prevalence rates (Ford et al., 2002). (The HSRC (2002) prevalence study report higher prevalence rates amongst whites than assumed in other studies and represent the first prevalence rate estimates by race calculated from a national sample of individuals. Hence, the impact of HIV/AIDS on personal savings and therefore on the entire

economy may be underestimated.) Moreover, AIDS-affected households only are assumed to reduce their savings rates (Arndt and Lewis, 2000).

BER (2001) makes similar assumptions and forecasts that the percentage point difference in the personal savings ratio (expressed as a percentage of disposable income) will be as follows: -0,8 percentage points by 2005; -1,5 percentage points by 2010; -0,2 percentage points by 2015. ING Barings (2000), however, predicts relatively large declines in private savings (see Table 6).

Table 6: Percentage difference in real savings in the AIDS and no-AIDS scenarios

Year	Private savings	Public sector savings	Corporate savings
2005	-30.6	-19.1	-1.7
2006-2010	-32.9	-23.2	-2.9
2011-2015	-23.6	-22.7	-7.1

Source: ING Barings (2000).

As argued elsewhere, whether affected households as assumed save nothing is debateable, given existing empirical evidence from household impact studies. In addition, the relatively unrealistic assumptions about changes in government spending (large increases in health care and social expenditure, coupled with higher budget deficits), means that this decline in savings and the associated economic impact therefore is likely to be overestimated. Lower savings rates are likely to have a negative impact on investment, which in turn contributes to a lower level of overall economic activity in the AIDS scenario. ING Barings (2000), however, estimate that the year-on-year real growth in total fixed investment will not decline. The argument here is that the decline in demand for residential buildings is counterbalanced by the fact that firms might switch to more capital-intensive production methods. Increased capacity utilisation thus induces firms to invest more in capital. (Ambert (2002) presents some research as to the impact of HIV/AIDS on the supply-side in the construction sector, whereas Kayamandi (2002) present some modelling results that support assumptions about a decline in demand for housing).

BER (2001) on the other hand projects a much more negative impact on fixed investment (a decline in real gross domestic fixed investment of 1.2 percentage points per annum), because the AIDS epidemic affects the supply potential of the economy negatively. BER (2001) identified the following negative influences on investment: a lower overall level of economic activity; higher interest rate levels; lower corporate profits and savings, as well as a smaller pool of national savings. Higher projected direct and indirect costs due to HIV/AIDS, as well as increased capacity utilisation, are likely to put upward pressure on the PPI, which would result in increases in the CPI. Both BER (2001) and ING Barings (2000) assume a policy of inflation targeting to be in place over the entire projection period. Therefore, higher inflation rates will result in a tightening of monetary policy, resulting in upward pressure on interest rates. Additional upward pressure on interest rates originates from the deterioration in national savings and the overall balance of payments position "(BER, 2001). The fact that increased capacity utilisation might put upward pressure on fixed investment was not considered by BER (2001) in their macroeconomic simulation, because the increase in capacity utilisation is the result of a decline in the economy's supply potential, rather than an increase in actual GDP (demand). BER (2001) also modelled the impact of HIV/AIDS on private residential fixed investment by including a population variable in their econometric function.

The non-black population was used for this purpose, which accounts for the fact that a large proportion of AIDS deaths are unlikely to spill over to a decline in private sector residential investment. AIDS mortality amongst home-owning blacks was therefore implicitly assumed to be similar to that of non-blacks. This of course need not be the case, particularly in the context of evidence of an emerging Black middle class. Furthermore, the models reviewed in this paper do not assume or project much about changes in foreign direct investment (FDI), nor of public sector fixed investment, although BER (2001) states that the Rand value of capital inflows is assumed to remain unchanged for the AIDS and no-AIDS scenarios. However, flows of FDI may decline as investor confidence falls, thus resulting in an underestimation in these models of the economic impact of HIV/AIDS. According to Ford et al. (2002), for example, there is evidence that

perceptions of risk have increased as far as investment in South African assets is concerned, particular in high-risk industries such as mining. They also point out that higher domestic production costs resulting from the epidemic may see a decline in international competitiveness. Other possible reasons for a decline in foreign investment includes decreases in production and the resulting effects on business supply chains, as well as the higher interest rates, lower spending and slower economic growth resulting from the impact of the epidemic on the South African economy (Ford et al., 2002). Hence, macroeconomic models need to at least consider in some way the likely impact of the epidemic of these two drivers of longer-term economic growth.

A shortage of savings has in turn, severe consequences on investment. This is not only a problem with regards to domestic investment, but as Beresford (2001) notes, foreign direct invest is increasingly getting worried on the implications of AIDS in Africa, especially at a time when the continent is seeking to attract international investment. Predictably, foreign direct investment will increasingly bypass economies with acute levels of AIDS as it is not guaranteed of an unhampered flow of labour supply. All the above HIV/AIDS induced forces exert immense pressure on economic sectors and economic fundamentals of any country, with predictable consequences on overall economic development.

Virtually all studies save for one; found that HIV/AIDS has a negative effect on South Africa's growth. To our knowledge there is one study that has surprisingly dismissed the findings that AIDS pushes economic growth backwards. Bloom and Mahal (1997) in a cross country regression of 51 countries found no significant effect on growth. However, this study has some fundamental problems of its own. One problem is that their data comes from several and sometimes inconsistent sources (Conia and Zagonia 2002).

On the other hand of the spectrum, there is growing empirical literature that has found a negative effect of the pandemic on economic development. The magnitudes of the estimates have varied widely depending on the infection rates of a particular country, underpinning assumptions and the method used to obtain the estimates. The other major difference is that the first generation studies found

a smaller effect compared to latter ones. This latter point is not surprising since the pandemic has been worsening in many countries and that the economic consequences of the disease prevail with a lag of almost a decade or thereabout. Evidence from ILO (2004) and Dixon et al (2001) and Bonnel (2000) clearly shows the association between the prevalence rates and the intensity of the declines in economic activity. The ILO estimates indicate that in Africa, losses in annual GDP growth rates (between 1992 and 2002) will be as high as 3% in countries with the highest HIV/AIDS prevalence rates (the likes of Botswana, Lesotho, Swaziland and Zimbabwe). The ILO (2004) also estimated an average annual (between 1992 and 2002) rate of growth of GDP per capita loss attributable to HIV/AIDS of up to 2% in Africa. Dixon et al (2001) in their estimates based on 41 African countries found that an annual average decline in GDP of 1.30% was associated with a prevalence rate of 20%. The study by Bonnel (2000) based on 70-80 developing countries estimated that a 1.20% and 0.80% decline in GDP were respectively associated with HIV/AIDS prevalence rates of 20% and 8%. The important message here is that without efforts to reverse the impact of the pandemic, economies are likely to be ruined.

Empirical evidence from across the world paints a gloomy picture on the consequences of GDP due to HIV/AIDS. Early generation studies in the continent include Over (1992), Kambou et al (1992), Forgy (1993) and Hancock et al (1996). The World Bank estimated a decline in the average growth rate of GDP of 0.8 to 1.4 percentage points per year and 0.33% decline in annual GDP per capita in 30 Sub-Saharan African countries (Over and Mead (1992). Based on a CGE simulation exercise using Cameroonian data, Kambou et al (1992) concluded that the annual growth rate of GDP could have been reduced by as much as 2% during the 1987-91 period because of AIDS. In Zambia, Foggy (1993) had forecast that by 2000 GDP would be lower by 5 to 10% than in a situation without the pandemic. In Kenya, Hannock (1996) had forecast that by 2005 GDP would be 14% lower that it would be without AIDS and GDP per capita would be 10% less in the same period.

Cuddington (1993a & b) and Cuddington and Hannock (1994) predicted that in 2010 Tanzanian GDP would be 16% smaller than in a non AIDS situation. A

UNDP study in Botswana estimates that GDP will be between 24% and 38% lower in 2021 (UNAIDS 2000). Ukpolo, V.(2004) also investigated the relationship between AIDS and economic growth result which is based on poled time series, showed a significantly negative relationship between AIDS and growth. Corrigan P, Glamm and Mendez (2005) investigated the impact of the disease on human capital accumulation and growth through the creation of large number of orphans. They computed the aggregate effect of the epidemic on human and physical capital accumulation and growth and found that growth effects of the epidemic are large.

Kirigia et al (2002) estimated the burden of HIV/AIDS on GDP in the WHO African Region using a production function approach. The economic burden analysis was done using a double-log econometric model and a cross-sectional data on 45 to 46 countries in the WHO African Region. The coefficient for capital (K), education (EN), export (X) and imports (M) were found to be statistically significant determinants of per capita Gross Domestic Product (GDP) at 5% level of significance (using a one-sided t-distribution test). HIV/AIDS morbidity (V) and HIV/AIDS deaths (VD), at the same level of significance, were found to have statistically insignificant impact on GDP. The coefficients of these variables had negative signs as expected.

In South Africa Arndt and Lewis (2000) found that GDP would gradually decline due to the disease to a maximum fall of 2.6%. The BER (2001) forecast that real GDP in South Africa would be; 1.5% lower by 2010 and 5.7% lower by 2015. The ING Barings (2000) estimated that AIDS will retard South African GDP by between 0.3 and 0.4% per year. For South Africa again, Quattek (2000) estimated that from 2006 to 2010 and between 2011 and 2015 that GDP would respectively average between 0.3% and 2% lower than in the absence of HIV/AIDS a year. In a latter study, Bell et al (2003) also found that AIDS will slowdown economic growth of South Africa.

McDonald and Roberts (2002) examined the impact of AIDS on economic growth using African data, using a human capital approach. The econometric results indicate that the epidemic's effects have been substantial; in Africa the marginal

impact on income per capita of a 1% increase in HIV prevalence rate is minus 0.59%.

Arndt and Lewis (2000) forecast that for South Africa's GDP and per capita income will, respectively, be 20% and 8% lower in 2010 than in a non AIDS scenario. In Botswana and Swaziland, Rosen et al (2004) forecast that by 2015 these economies would respectively grow by 2.5% and 1.1% less than they would without the AIDS scourge. These countries are by far among the worst affected by the pandemic across Africa.

Robalino, Voetberg and Picazo, (2002) did a study on the macroeconomic impacts of AIDS in Kenya. A stochastic model of growth was used. The results of this estimation suggested that allowing the HIV/AIDS prevalence rate to grow without control would have serious macroeconomic impacts. Conservative estimates of GDP losses for the period 2000–2020 range between 20 and 30% (in present value) and these losses occur as not only the labour force shrinks and labour productivity falls, but because it becomes socially optimal to reduce the savings rate of the economy and slow-down the accumulation of capital.

Anand et al (1999) researched on the impact of HIV and AIDS on the national economy of India using a human capital approach and they found that the cost of treatment of Aids and the loss in productivity were the two major components of the cost of HIV. Bonnel (2000) examined the relationship between HIV and AIDS and economic growth using global data. The conclusion of this study was that the disease causes a vicious circle, whereby HIV/AIDS reduces economic growth and increases poverty, which in turn accelerates the spread of HIV.

In Table 7 we summarise the economic consequences of HIV/AIDS on African economies. These figures are quite startling and show that every effort to contain the spread and impact of the disease in necessary. The cost of treatment of AIDS and loss in productivity were the two major components of the cost.

Table 7: A Summary of the Consequences of HIV/AIDS on African Economies

COUNTRY	REFERENCE	Average reduction in annual GDP (rate)
Cameroon	Kambou et al (!992)	1,9
South Africa	Arndt and Lewis (2000)	1,4-2,6
South Africa	BER (2001)	0,1-0,9
Representative African Countries	Ainsworth and Over (1994)	0,1-0,8
South Africa	Quattek (2000)	0.3-0.4
Botswana	BIDPAV(2000b)	8(over ten years)
Botswana	Jefferis and Greener (2000)	1-2
Representative Sub-Saharan African countries	Over (1992)	0,15-0,33
Tanzania	Cuddington (1993)	0,10
Malawi	Cuddington and Hancock (1994)	0,25
51 developing and industrial countries	Bloom and Mahal (1997)	Insignificant
70-80 developing countries	Bonnel (2000b)	1,20 (in case of prevalence of 20%), 0.80 (as in SSA, prevalence 8%
41 African countries	Dixon et al (2001)	1,30 (in case of prevalence of 20%

3.3.4 The Impact of HIV/AIDS on Household Economies

Perhaps the most serious, immediate and devastating impacts of HIV/AIDS can be witnessed at household level. Households find themselves socially and economically disintegrating as a result of the pandemic. Although it is difficult to distinguish the impact of AIDS from other impacts, generally there are four principal pathways in which HIV/AIDS affect household economies.

One fundamental path is the loss of income, especially if the patient or deceased is a breadwinner. Loss of incomes often impoverishes the household (World Bank, 1999: 36).Other studies, most notable Oni et al (2002); Booysen et al (2002); Steinberg et al (2002); Yamono et al (2003); Wyss et al; Mushati et al (2003); Floyd et al (2003) and Namosya-Serpell (2001) found that AIDS makes households to be vulnerable to being poor in various countries in SSA. The Henry Kaiser Funding Foundation and Health Systems Trust (2002) found that in Burkina Faso AIDS will increase the number of people living in abject poverty from 45% in 2000 to 51% in 2015. In Zambia a survey of 232 urban and 101 rural households by Namosya-Surpell (2003) found that the transition from a state on non-poor to relative poverty was more pronounced where the father died. In the same study it was found that almost two-thirds of the households affected by the pandemic had their incomes falling by 80%. In Cote d'Ivoire, Be'chu (1998) found that HIV affected households had half of the average incomes. In Botswana household incomes for the poorest quarter of households were expected to fall by 13% in 2015 (ibid). Principally, this is due to some household members disengaging in income generating activities due to illness or taking care of the sick relatives.

Another avenue is by substantially increasing household expenditures. This in turn marginalises household savings and investments, and ultimately, future potential earnings are diminished. In Tanzania, Mead et al (1996) found that 8% of total household expenditures that had an adult death in the past 12 months went to medical care and funerals compared to 0.8% for households without an AIDS related adult death. Mullins (2001) found that pressure is placed on the household budget as cash is used to pay for medication, and time of family members is diverted away from other activities, such as farming, to caring for the sick. .In Cote d'Ivoire, Be'chu (1998) found that households with members suffering from AIDS spent approximately twice the amount spent by control households. Of this expenditure, 80% went to the AIDS patient and only 20% went to other family members. Desmond et al (2000) further argued that large funerals are an important statement. However, the transportation and feeding of guests and the cost of the coffin can drive families into debt and financial devastation. In Uganda and

Ethiopia, Demeke (1993), found similar results, respectively. The increase in expenditure forced consumption expenditures to fall by 44% in the following year (ibid).

Households generally receive a further knock through the loss of production. In Rwanda studies show that households with an AIDS patient spend on average 20 times more on health care than households without an AIDS patient (UNIADS 2001a:7). Such expenditures marginalise other productive expenditures. In the Kagera region of Tanzania, reduced expenditures due to AIDS forced food production to drop by 41% (UNAIDS and UNICEF, 1999:4). In Burkina Faso, 20% of rural families have reduced their agricultural work or even abandoned their farms because of HIV/AIDS. In Ethiopia AIDS affected households were forced to spend 11-16 hours per week performing agricultural work, compared with an average 33 hours for non AIDS affected households.

Household labour supply is vulnerable as well, as relatives take care of sick ones. Their labour is then unavailable to engage in productive activities such as subsistence agriculture. UNAIDS (2000: 32) shows that in Tanzania a woman with a sick husband spends 60% less time on agricultural activities. This huge loss in time definitely reduces productivity and income, thereby condemning the household to poverty.

Assets which may be used in production are also vulnerable as they are sometimes sold to augment AIDS related expenditures. AIDS also affects human capital investment at household level. Children are forced to drop out of school to take care of the sick. Children may also dropout from school because of diminished financial resources. The girl child is more likely to drop out of school. Dropping out of school means that even in future, members of such households will always be vulnerable to poverty. HIV/AIDS has the potential to widen the gap between the rich and the poor due to HIV infected people withdrawing savings, selling assets, or borrowing from micro-finance organisations to boost the coping capacity of households. This has negative implications for future economic potential of non-infected people. The loss of adults in their productive prime reduces the capacity of communities and simultaneously, extra costs are imposed

upon these same communities. Similarly, reduction in expenditure on basic needs and substituting cheaper, less nutritious food for the usual staples invariably introduces problems (Desmond et al, 2001). This may lead to general poor health even among non-infected members of communities. Samson (2002) assessed the impact of HIV/AIDS on household and children. The study shows that HIV/AIDS impoverishes affected/infected households.

Wyss, Hutton, N'Diekhor, (2004) assessed the economic costs of AIDS at the household level in Chad, one of the poorest countries in the world. Costs were evaluated through a standard questionnaire. Household expenditures of AIDS cases were much higher than controlled for households mainly due to health related expenditure.

Alkenbrack et al. (2008) explored the effects of HIV and AIDS on household economics and the social wellbeing of children in HIV-affected families in Cambodia. They found that despite similar overall expenditures, HIV-affected households incurred proportionately larger expenditures on medical care and funerals. Income among case households was lower than comparison households. HIV-affected households were more likely to sell off assets, borrow from family members, take out loans, and ration medical care and food for children. Children in HIV-affected households reported eating fewer meals in a day, increased frequency of hunger, and increased household and employment responsibilities compared with comparison children. School enrolment rates were similar between pairs of households.

Oni et al. (2002) assessed the economic impact of HIV/AIDS on rural households in Limpopo Province of South Africa using data obtained from 680 rural households. They established empirically that HIV/AIDS affected households have lower annual income, are smaller in size, have lower savings, and spend more on transportation, funerals and health care, but less on housing, remittances and education when compared with unaffected households.

Bloom and Mahal,(1997), a novel approach to assess the impact of HIV/AIDS on individuals' healthcare utilization and spending in the Oyo and Plateau states of

Nigeria and income foregone from work time lost. They found that HIV is associated with significantly increased morbidity, healthcare utilization, public health facility use, lost work time and family time devoted to care-giving. Direct private healthcare costs and indirect income loss per HIV-positive individual were approximately 56% of the annual income per capita of the affected households. Approximately 40% of these costs were income losses associated with sickness and care-giving. 10% of the cost of HIV is accounted for by public subsidies for health. The largest single cost, representing 54% of the total economic burden of HIV, is for out-of-pocket expenses for healthcare.

In Table 8 we summarise the findings of the studies on the impact of HIV/AIDS at household level.

Table 8: A Summary of the Findings of the Impact of HIV/AIDS on Households.

COUNTRY	REFERENCE	Rural Middle class	Rural Lower class	Urban Upper class	Urban Middle class
Burkina Faso	Black Michaud (1997)	25-50			
Cote d'Ivoire	Bechu (1999)				10
Cote d'Ivoire	Black-Michaud(1997)	0-33			
Kenya	Leighton (1997)	58-78		54-66	47-49
Malawi	Jones(1997)	3			
Malawi	Jones(1997)	6			
Namibia	Beresford (2001)		10		
South Africa	Morris et al (2000)		9		
Tanzania	Mutangadura et al (1999b)	10			
Tanzania	Moshi (1995)	45			
Zimbabwe	Kwaramba (1997)	37-61			
Zimbabwe	Robert and Rau (1997)				20
Zimbabwe	Ncube (1999)		10		
Cote d'Ivoire	Pegatienan and Blibolo(2001)			18	18
Kenya	K'Oyugu and Muita (2001)	-79			
Thailand	Janjaroen et al (2001)	41	41		
South Africa	Prov. Survey (2001)	39	39	41	41

Source: ILO (2000)

3.3.5 Sectoral Impacts of HIV/AIDS

The sectoral impacts of HIV are equally devastating. In this section we discuss and provide evidence on the various sectoral impacts. The focus is on agriculture, business enterprises, education, and mining and health sectors.

3.3.5.1 Impact on Agriculture and land use

As over 70% of the African population leaves in rural areas, the impact of the pandemic is tremendous in this sector. Evidence on the ground shows diminishing output as farm workers die or as they are frequently out of work nursing for the sick. The loss of bread winners due to AIDS deprives rural areas with remittances, with dire consequences on investments in farm inputs. As farm workers get decimated and farm inputs dwindle, a shift from cash to subsistence cropping is another outcome. The obvious casualty has been food insecurity and a fall in rural incomes. Falling incomes are leading to an increase in school drop out rates and an increase in child labour in the agricultural sector. To cope with this, rural households are being forced to sell their limited assets and run down their savings, and are consequently drifting quickly into poverty. This scenario is more evident in Swaziland, a small country with one of the highest prevalence rates in the world (Bloom and Mahal (1997),). Such evidence could easily apply to any rural sector of any Sub Saharan African country.

The impact and implications of HIV/AIDS on land and food security at the household have bee found in South Africa's KwaZulu Natal (KZN) Province. The changes in population structure in KZN due to the disease have had great negative impacts on agricultural production and food security (Mullins 2001). Ill health and time spent in caring for the sick, reduces time spent on farming, leading to under-utilisation of resources and reduced productivity. This has resulted in the changing land use patterns as households move away from more to less labour intensive, and often less nutritious, types of crops. Land is even left fallow or abandoned. Other households resort to renting or selling their land in order to raise extra income to meet additional household expenses due to HIV/AIDS, thus increasing their vulnerability and reducing their sustainability in the long term. Forced

removal of widows from land and property-grabbing have also become issues of concern (Mullins 2001).

Households with a stronger economy and a wider range of options, including land, to draw upon during crises are therefore less vulnerable at each stage of the continuum of HIV/AIDS illness (asymptomatic; early illness; chronic illness; critical illness; death; survivors) than their poorer counterparts. Indicators in this regard are the absence of physical assets, business income and access to credit or savings (Mullins 2001).

Tibaijuka (1996) examined the impact of Aids on the economic welfare of peasants in the Kagera region of Tanzania. The adverse impact on household and community welfare was considerable because of; (i) the production forgone as labour was constantly reallocated to care and mourn Aids victims; (ii) declining farm productivity as assets and working capital are sold to pay medical bills; and (iii) rising dependency burdens.

Agbola et al (2004) investigated the impact of HIV/AIDS on the South African agricultural sector. The analysis showed that South African agriculture bears the heaviest brunt of the HIV/AIDS epidemic and this is likely to have a significant impact on household spending patterns, human capital base, food security, nutrition and overall economic growth of the South African economy.

Table 9 shows some of the adverse effects on agriculture output on HIV/AIDS in Swaziland.

Table 9: Impact of HIV/AIDS on the Household and Farm

	No Deaths	Non Aids Related Deaths	AIDS–related deaths
Impact on household and farming patterns			
Reduction in Area under	7.8%	18%	38.5%
Cultivation Increase in health care costs	10%	13.9%	22.1%
Reduction in Crop yield	14.8%	21.3%	47.1%
Change in cropping pattern	20%	30.3%	42.3%
Children dropout of school due to lack of fees	16.1%	25.4%	44.2%
Diversion of labour to care for sick member of family	-	23%	30.8%
Loss of remittances due to death of member of household	-	19.7%	38.5%
Impact on farm produce			
Maize	35.06 bags	16.05 bags	19.01 bags
Cattle	13.610 herds	9.583 herds	4.027 herds
Impact on land cultivation			
Percentage of land cultivated	84.2%	50%	34.2% reduction due to AIDS

Source: Ministry of Agriculture and Co-operatives, Federation of Swaziland Employers and United Nations Theme Group on HIV/AIDS. August 2002

An Africa wide survey conducted by United Nations Department of Economic and Social Affairs (2003), found that food insecurity in HIV/AIDS affected communities is high. The study observed that there has been a shift from cash cropping to subsistence farming. The change in production patterns from cash

crops to subsistence is also reported in the Nakyerira region of Uganda, where farmers abandon coffee production to cultivated cassava and banana (Kormawa 2003). In Burkina Faso's Boulkiende and Sanguie villages, there has been a reduction in food production and net revenues from agriculture have plummeted considerably. The same study reported that in Swaziland food production dropped by 54% in HIV/AIDS affected households, while in Ethiopia, the number of hours per week devoted to farming dropped to 33.6hours in AIDS non-afflicted households and to between 11 and 16 hours in afflicted households. In Kenya households suffered a 68% reduction in net agricultural food production. According to ECA (2006), Mushala (2002) and Jayne et al (2004) food production also drops due to AIDS inflicted pressures to sell farm inputs and assets. Mushala reported a 54.2% reduction in maize production in Swaziland due to HIV/AIDS. In Namibia it was found that widows were selling their livestock and losing land due to dispossession (ECA 2006). In Swaziland, Mushala (2002) estimated that HIV/AIDS related costs led to a 29.6% reduction in the number of cattle kept as they were sold to offset increased costs. In a study of Eastern and Southern Africa, Jayne (2004) found that AIDS was causing a shortage of agriculture labour. Yamano and Jayne found out that the death of a household head is associated with a 68% reduction in the net value of the household's crop production. However, there are gender disparities in the nature of the impacts. For instance female adult mortality is associated with an adverse effect on grain crops, whereas male adult mortality has a stronger effect on cash crops such as coffee, tea and sugar.

In commercial agriculture the story is not different. Labour shortages impact negatively on exports and consequently give rise to foreign exchange shortages. A shortage of labour also triggers a shift from labour intensive production techniques to capital intensive methods, which exacerbates the unemployment problem. Above all, disruptions in output from the agricultural sector tend to short-change all the linkages that agriculture has with the rest of the economy, especially industry.

3.3.5.2 Economic impact of HIV/AIDS in the mining sector

The mining sector is a key source of foreign exchange for many countries. Most mining is conducted at sites far from population centres forcing workers to live apart from their families for extended periods of time. They often resort to commercial sex. Many become infected with HIV and spread that infection to their spouses and communities when they return home. Highly trained mining engineers can be very difficult to replace. As a result, a severe AIDS epidemic can seriously threaten mine production. It is estimated that approximately 284,000 men were employed in the mining sector in 1996, 122,000 of whom were foreigners. These men live in single quarters and are not allowed to bring their families with them, creating a high risk for HIV transmission. Apartheid also made any South African miners migrants once they went beyond the "borders" of the homelands. The National Union of Mineworkers of South Africa introduced an education campaign about HIV/AIDS in the late 1980s, and has advocated the provision of family accommodation. Even with these programs, the Union estimates that there could be between 12,000-14,000 AIDS-related deaths per year by 2010.

3.3.5.3 The Impact of HIV/AIDS on Business Organisations

HIV/AIDS impacts on the businesses institutions and their environment, in terms of their sustainability, effectiveness and ability to cope with changed demands. As infection rates increase, absenteeism and staff productivity decrease. This couples with increasing financial costs to institutions in retraining staff to replace those who fall ill and die, severance and hiring, loss of time to care for sick relatives and attend funerals, drain on medical funds, increased death benefits and pension pay-outs. Staff turnover increases as staff gets sick and need to be replaced, and competition for skilled staff increases as the pool of skilled and experienced individuals is reduced (Mullins 2001).Government budgets will be under increasing pressure from ministries such as health and welfare. Communities' contributions to basic services are likely to decline and the vast numbers of orphans may not be able to afford any expenditure for services (Badcock-Walters & Whiteside 2000).

The business enterprise gets a knock from the AIDS/HIV pandemic in complex pathways from both the supply and demand fronts. HIV/AIDS changes production patterns and relationships. From the supply side the pandemic deprives enterprises of the essential inputs: labour and capital. It causes a huge shortage of labour. In Botswana, Kenya, Malawi Mozambique, Namibia South Africa, Uganda and Zimbabwe, an ILO study estimated that in 2020 the labour force of these countries will be 10 to 20% lower than in a non AIDS scenario (ILO, 2000). We can perhaps see the devastating effects of the by looking at changes on life expectancy at birth. The fall in life expectancy besides signifying labour shortages, it also points out to the disappearance of skills and experience, all essential assets in the production process and economic growth. Hacker 2006 found that the cost of new HIV infections for firms in 2002 was estimated at $36.4 billion, including $6.7 billion in direct medical costs and $29.7 billion in productivity losses.

Rosen et al. (2001) estimated the cost of HIV/AIDS to businesses in southern Africa using company-specific data on employees, costs, and HIV prevalence. HIV prevalence in the workforces studied ranged from 7.9 to 25.0%. HIV/ AIDS among employees added 0.4-5.9% to the companies' annual salary and wage bills. The present value of an incident HIV infection ranged from 0.5 to 3.6 times the annual salary of the affected worker. Costs varied widely across firms and among job levels within firms. Key reasons for the differences included HIV prevalence, levels and stability of employee benefits, and the contractual status of unskilled workers. Some costs were omitted from the analysis because of lack of data, and results should be regarded as quite conservative. They concluded that AIDS is causing labour costs for businesses in southern Africa to rise and threatens the competitiveness of the African industry.

Fox et al. (2004) estimated the impact of HIV/AIDS on individual labour productivity during disease progression using a retrospective cohort design study of tea estate workers who died or were medically retired because of AIDS-related causes between 1997 and 2002 in western Kenya. The results of this study showed high levels of productivity loss. These results provide amply evidence of the impact of HIV/AIDS on labour productivity. As workers often bring unrecorded 'helpers', the actual differences may be greater.

Enterprises that are more vulnerable are those which employ costly and difficult to replace workers, especially skilled and professional workers. So enterprises that employ unskilled labour are less vulnerable compared to those that employ professionals and skilled personnel. The financial sector is a good example. Labour intensive enterprises are vulnerable to the pandemic through high turnover, absenteeism, and rising medical expenses and .other labour costs. In such a situation we are likely to see an increase in substitution away from labour intensive to capital intensive production techniques. In addition, those enterprises that pay huge social benefits such as sick leave, medical treatment, funeral expenses and health related redundancy are vulnerable. The impact of the pandemic on personnel costs has been estimated in various studies. Moore (1999) forecasted that in South Africa AIDS related personnel costs would amount to 15% of the wage bill by 2010. Rosen (2004) estimated that the actual costs due to HIV/AIDS in some 6 South African companies studied ranged between 0.4 to 6% of the wage bill, depending on skill level of the employees and medical or death related benefits of the employees. In a study of two companies in Cote d'Ivoire, Aventin and Huard (2000) found that HIV/AIDS related costs accounted for between 0.8 to 2% of the wage bill. The escalation of AIDS related costs is increasingly forcing companies to shift the burden of medical costs to workers (Hacker 2006).

Medical benefits levels are increasingly being cut sometimes in the form of contracting out certain tasks or replacing permanent employees with fixed term contract workers or casual employees. Some employers find themselves employing extra employees to compensate for the impact of HIV/AIDS on productivity, absenteeism and mortality. Table 10 (top panel) gives some indication of this contingency measure that South African businesses go through. From Table 10 in the mining sector 30% of the companies engage in this "work-shadowing" survival strategy. Increasingly companies are also forced to substitute away from labour based production methods to capital based techniques. Table 10 (bottom panel) illustrates this point using a South African case study. This is more pronounced in the manufacturing and mining sectors. Figure 15 shows that the

pandemic is having an adverse effect on current and expected business plans and activities.

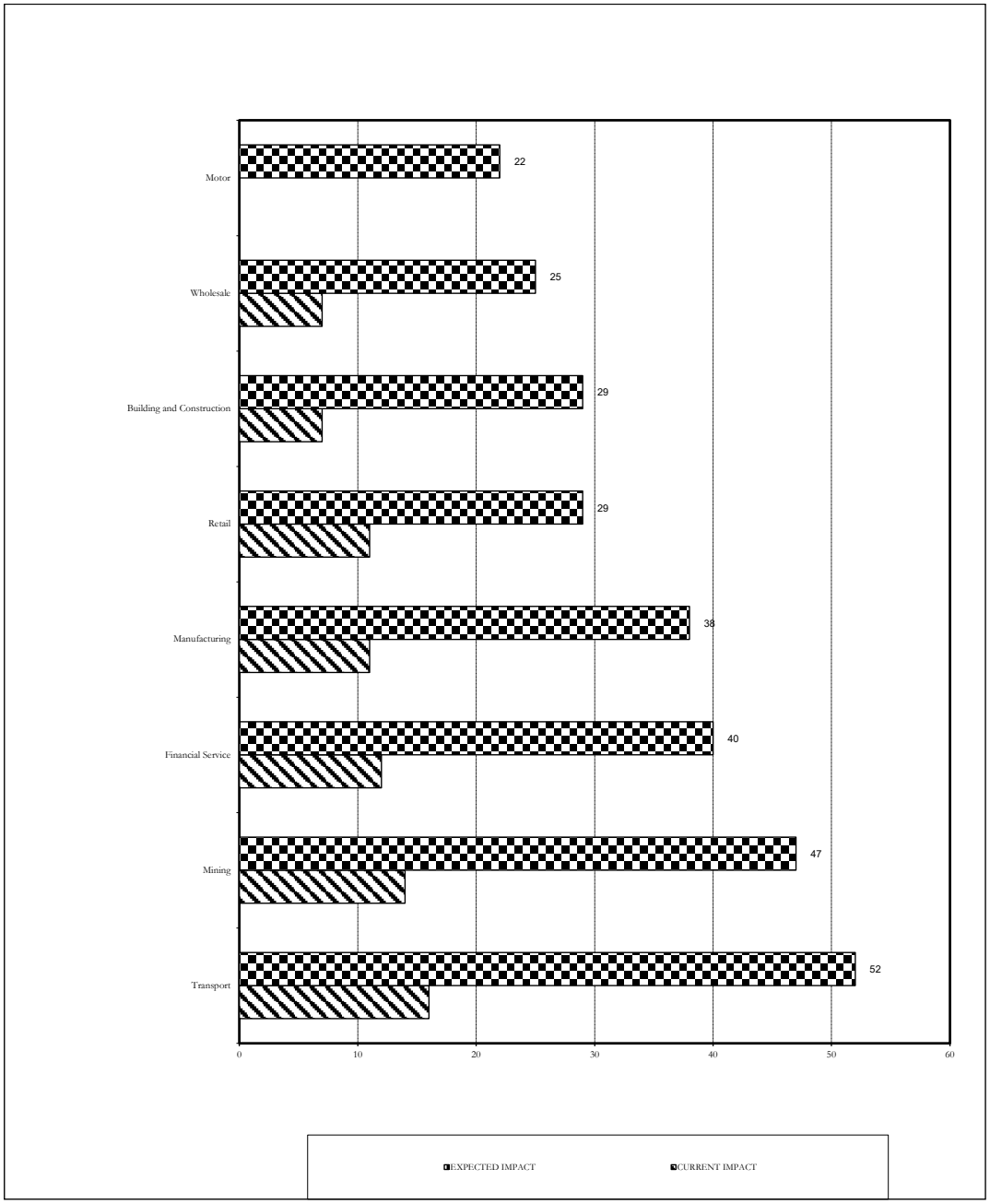
Besides affecting the labour component, the capital side is affected in two principal ways. Every enterprise requires investment to maintain or increase its capital stocks. To invest, the enterprise has to consider how risky the project is and the expected rate of return. HIV/AIDS increases the risk and may also lower the profitability of a project. In a nutshell, what this means is that investors are going to invest less in economies with high prevalence rates.

Table 10: Percentage of companies reporting that they foresee appointing extra employees to compensate for the impact of HIV/AIDS on productivity, absenteeism and mortality (i.e. work shadowing) – Sectoral- Breakdown

Manufacturing	Building & Construction	Retail	Wholesale	Motor	Mining	Financial Services
18%	12%	7%	6%	13%	30%	8%
Percentages of companies reporting that they are investing in machinery or equipment to reduce their dependence on labour because of HIV/AIDS – Sectoral Breakdown						
17%	10%	5%	9%	3%	23%	4%

Source: BER (2004)

Figure 15: Percentage of companies reporting that HIV/AIDS is having a significant adverse impact on their business: Current vs Expected- Sectoral Breakdown



Source: BER (2004)

At enterprise level AIDS/HIV also affects productivity. Productivity is affected through employing sick workers, low morale, absenteeism, high turnover, overworked and exhausted workers, and decreased availability of skilled workers (World Bank 1999).

The costs related to disease have different impacts depending on the nature and size of firm. BER (2004) provides some important insights into the different impacts on different business sizes. The impacts are ranked in order of importance (1 most important and 5 least) (see Table 11). Clearly for all firms, HIV/AIDS results in lower productivity, increased absenteeism and an escalation of employee benefit costs. Lower productivity is a problem in small to medium firms while higher benefit costs affects large enterprises more. Comparative studies of East African businesses have shown that absenteeism can account for as much as 25-54% of company costs (ECA, 2000).

Table 11: Ranking of Importance of HIV/AIDS-related Costs

Order of Importance	Number of Employees			
	Less than 100	100 to 500	More than 500	All Companies
1	Lower productivity and increased absenteeism	Lower productivity and increase absenteeism	Higher employee benefit costs	Lower productivity and increase absenteeism
2	Loss of experience and vital skills	Higher employee benefit costs	Voluntary counselling and testing or HIV/AIDS awareness program	Higher employee benefit costs
3	Higher labour turnover rates	Loss of experience and vital skills	Lower productivity and increase absenteeism	Loss of experience and vital skills
4	Higher employee benefit costs	Higher labour turnover rates	HIV/AIDS treatment including ARVs	Higher labour turnover rates
5	Higher recruitment and training costs	Higher recruitment and training costs	Research into the impact of HIV/AIDS	Higher recruitment and training costs

Source: Bureau of Economic Research (2004) and Haacker (2006).

Table 12 below shows the HIV/AIDS related actual costs to companies as well as costs per employee. It is clear from this Table that the AIDS pandemic is increasing labour costs for businesses across Sub-Saharan Africa. With such high costs, profit margins inevitably shrink, thus reducing any possibilities of expansion.

Table 12: Annual Costs of AIDS

Company Name	Total Annual Cost of AIDS	Annual costs of AIDS per employee
Botswana Diamond Valuing	US$ 125,941	US$ 237
Botswana meet commission	US$370,200	US$268
Cote d 'Ivoire food processing firm	US$33,207	US$120
Cote d 'Ivoire textile firm	US$32,667	US$29
Cote d 'Ivoire packaging firm	US$10,398	US$125
Kenyan automobile firm	US$21,312	US17$
Kenyan transport firm	US$61,132	US$28
Muhoroni Sugar, Kenya	US$58,303	US$49
Kenyan lumber firm	US$40,630	US$25
Uganda Railway Corporation	US$77,000	US$300

Source: Bollinger and Stover (1999).

On the other hand, the pandemic has the potential of reconfiguring the demand side. High prevalence and morbidity changes product demand patterns. Demand for products used in AIDS related medical care and treatment rise at the expense of other consumer and capital goods. At the same time, goods with high income elasticity (e.g. luxury goods markets) are likely to suffer. This discussion implies that some enterprises benefit while some sink as a result of the pandemic. Furthermore, labour shortages cited above cause wages to increase. Wage increases are then passed over to consumers as general increases in the prices of goods and services. Price increases, in turn depress overall demand for goods and services. Thus the entire economy suffers.

Small or informal enterprises are also vulnerable to the disease, despite being overlooked in many instances. Their contribution to the economies of Africa is substantial. Although these enterprises are not entirely homogenous, their high vulnerability arises especially from the fact that one person serves in different capacities. He/she can be the accountant, salesman, marketer etc. His/her death may lead to the collapse of the enterprise.

3.3.5.4 Economic Impact of HIV/AIDS on the Transport Sector

The transport sector is especially vulnerable to AIDS and important to AIDS prevention as well. Building and maintaining transport infrastructure often involves sending teams of men away from their families for extended periods of time, increasing the likelihood of multiple sexual partners. The people who operate transport services (truck drivers, train crews, sailors) spend many days and nights away from their families. Most transport managers are highly trained professionals who are hard to replace if they die. Governments face the dilemma of improving transport as an essential element of national development while protecting the health of the workers and their families. In KwaZulu-Natal, there are two major trucking routes, as well as two major harbour areas. Commercial sex workers are prevalent in this area, as they have clients in both the transport and harbour workers. There is also cross-border traffic among KwaZulu-Natal, Swaziland, and Mozambique; both of these countries have relatively high prevalence rates. KwaZulu-Natal has some of the highest prevalence rates in South Africa (Ramjee et al, 2000).

3.3.5.5 Impact of HIV and AIDS in the Education Sector

Economic prosperity of a country depends partly on the calibre of its human resource endowment. Human capital is a key driver of economic development. Human capital entails better education at all levels, on the job training, abilities to take advantage of new technologies and ideas. Education empowers people with productive assets that guarantee incumbents a higher future income stream. It makes individuals to be more productive and broadens their opportunities. Thus, the performance of any economy can be derailed if the human capital is destroyed. HIV/AIDS destroys the existing human capital base as well as its formation. Various model estimates and surveys in the continent indicate that this key driver of economic growth is taking a knock of unprecedented proportions from the pandemic. This has increased the vulnerability of African economies.

There are three transmission mechanisms in which the impact of HIV/AIDS through education impacts on the economy at large. This could be through the depletion of educators; negating new human capital formation as learners are decimated or when less resources are available for further education for orphans; and research and development processes are resource-marginalised or when skilled manpower to undertake such activities are depleted.

The loss of educators in Africa has been very severe. As early as 1998 survey of the impact of AIDS on education in Zambia showed that of about 1.7 million primary school learners, 56000 of them lost a teacher to AIDS (World Bank, 1999). The loss of teachers in 1998 in Zambia as a result of the pandemic was equal to about two-thirds of the annual output of newly trained teachers. In Sub-Saharan Africa, the same study found that 860000 children had at least a teacher succumbing to AIDS (Ibid). Worst affected countries were South Africa, Kenya, Zimbabwe and Nigeria. In Malawi 10% of the educators had succumbed to AIDS by 1997 and the same World Bank study had projected a loss of 40% education personnel by 2005. In the KwaZulu Natal province of South Africa, Badcock-Walters et al., in a random sample of 100 schools, they found that the mortality of teachers rose by almost 50%, from 406 in 1997 to 609 in 2001. Besides, the depletion of educators, manpower hours are also lost in large numbers as educators are increasingly being absent from work. According to Tarfica (2000) an infected teacher is likely to lose six months of professional time before developing full-blown AIDS and an additional 12 months after developing full-blown AIDS.

On the other hand, the formation of human capital is also affected in many ways. The school drop out rates increase with HIV/AIDS. In the Rakai district of Uganda, total primary school enrolments dropped from 1534 in 1989 to 950 in 1993 (Katahoire, 1993). This 40% drop in only 4 years was largely attributed to the AIDS shock. The World Bank (1995) has reported that in Tanzania, school attendance by students 15-20 years old was cut by half in households that lost an adult female due to AIDS. In Zimbabwe, Mutangadura (2000) found that 31% of household in their sample had at least a child not attending school following the death of a mother. In Zambia 55% of AIDS affected households in the Mansa

district were unable to meet the costs of their children's education owing to AIDS (Kasawa 1993). In Kampala, (Uganda) 47% of households with orphans did not have enough money to send children to school, compared to 10% in non AIDS orphaned households (Muller and Abba, 1990). In Tanzania orphanhood lowered the odds of attending school by 45% to 64% (Suliman, 2003) In the Copper-belt region of Zambia, 42.4% of school going age non orphans were not attending school while 53.6% orphans were not attending school (Rossi and Reijer, 1995). Similar results were reported in Malawi and Uganda (Bennel, Hyde and Swainson, 2002) and in Burkina Faso and Zimbabwe (Nyamukapa, Gregson and Wambe 2003).

It will reduce the flow of skilled labour and increase the flow of unskilled and dependent labour, with resultant implications for land and agriculture. The decline in experienced teachers means a decline in that guiding and influencing community life. Child labour on the land and in the home might also increase (Badcock-Walters 2001).The quality of students graduating from secondary and entering tertiary institutions may reduce. The output of tertiary graduates will be reduced in number and quality as a result of reduced enrolments in a deteriorating basic education system. The consequent injection of skills and professional capacity into the economies of the region may be short lived, given the evidence in the region that life expectancy after infection is between six and eight years (Badcock-Walters & Whiteside 2000).

These discrepancies in orphans and non orphans will inevitably manifest in disparities in future opportunities among these two groups of children. On the whole, high school drop out rates and erratic schooling patterns will water down all African efforts of achieving high and sustainable levels of human capital investment. The growth potential of African economies will not be fully realised.

3.3.5.6 Impact of HIV and AIDS on the Health Sector

Another important link in the economy that has real suffered a big blow is the health sector. A stressed healthy system and an unhealthy health sector labour force do not augur well for any meaningful economic activity. As health is a form

of human capital, its disruptions will inevitably dislocate all the fundamental links in the economy. Thus a stressed sector is putting fragile economies of the African continent under immense stress as well. The HIV/AIDS pandemic is affecting the performance of health systems by increasing demand or expenditure, and by reducing the supply of services by its impact on the numbers and performance of the health workforce. The demand for health services is overstretched and health expenditures are marginalising other investments.

The disease causes health related expenditures to marginalise other expenditures both at individual or national levels. The disease causes the escalation of demand for health related goods and services. The increased demand is met with shrinking incomes. This leads to households to sell assets or cut other expenditures. Steinburg et al (2002) found out that household with an HIV/AIDS patient spent a third of their budget on health care compared to about 4% in a non HIV/AIDS situation. These findings also emerge from the World Bank (1999) study.

Evidence on the continent on the negative impact of the disease on the health sector personnel is overwhelming. Shisana et al (2002) researched the impact of the disease on the health sector personnel in South Africa. This study found that 15.7% of health workers employed in the public and private health facilities in the Free State, Mpumalanga, KwaZulu Natal and the North West province, were HIV positive in 2002. In Zambia it was estimated that between 1991 and 92, 39% of the midwives and 44% of the nurses were HIV positive (United Nations Department of Economic and Social Affairs Division, 2004). Assuming an absence of antiretroviral therapy, this means that the future of the health system in these provinces is bleak.

The costs of health care have also increased dramatically in the continent. In the mid 1990s it was estimated that the treatment of people with HIV/AIDS consumed 66% and almost 25% of the Rwandan and Zimbabwean health budget respectively. In another study it was estimated that by 1997, 7 of the 16 African countries had their HIV/AIDS related budgets exceeded 2% of their GDP (Anartfi, 2003). Considering that total health budgets for most African countries are 3-5% of their GDP, it is clear that HIV/AIDS expenditures are increasingly

crowding out other expenditures and investments (Ibid). Other health indicators also point out to this shift or crowding out. In Kenya', Kenyatta hospital, 39% of the beds was occupied by HIV positive patients. In Burundi's Prince Regent Hospital the figure was 70% (UN AIDS Report, 2000).

Hassig et al (1988) compared the economic impact of HIV infection among patients at Mama Yemo Hospital, Kinshasa, Zaire. He found out that direct costs during hospitalization did not differ ($60.30 for HIV seropositives, $56.50 for HIV seronegatives), but pre-hospitalization expenses were significantly higher in the HIV-seropositive group ($170 for HIV seropositives, $110 for HIV seronegatives). Years of productive life lost due to death were also significantly higher for HIV seropositives versus HIV seronegatives (30.6 versus 21.3 years).

3. 3.6 Impact of HIV and AIDS on Government spending

Government expenditure will be higher as a result of the HIV/AIDS epidemic. This is mainly due to an increasing demand for public sector health care services, as well as increased social spending, especially in terms of expenditure on social grants (e.g. to provide care for the high number of children that will be orphaned as a result of increased mortality). In fact, all four models assume relatively substantial increase in public expenditure on health care and in the case of some models on social grants. These increases in government expenditure can be financed in several ways, i.e. either through higher budget deficits, expenditure switching within the health department, by sacrificing other expenditure, or by forfeiting public sector capital expenditure (ING Barings, 2000). The ING Barings (2000) model assumes higher budget deficits. ING Barings (2000) assumes a flexible budget deficit, meaning that government expenditure does not decline in line with government revenue (and that tax rates are not increased). The pro-cyclical effects of fiscal discipline, which would lead to a further reduction of the GDP growth rate, are therefore avoided –this would come at the expense of a higher public sector borrowing requirement and lower government savings. BER (2001), given current budget constraints and the conservative fiscal stance of government, assumes (more realistically it might be said) that government would finance half of the increased health expenditure by cutting back on other forms of

expenditure and that marginally higher tax rates will generate extra revenue to fund HIV/AIDS-related expenditures and will reduce the upward pressure on the budget deficit. The main budget deficit has declined from 3.8% of GDP in 1997/98 to 1.5% in 2001/02 (National Treasury, 2003: 54). Projected future budget deficits will remain low, although set to increase marginally to between 2 and 2.5% over the next three financial years (National Treasury, 2003: 53). According to the projections contained in the ING Barings (2000) and BER (2001) models, the budget deficit will deteriorate as a result of increased government expenditure, due to higher direct and indirect employee costs, increased demand for health services and increased welfare grants. Lower tax revenues, as a result of a lower level of economic activity, as well as lower personal and corporate income tax receipts, will also impact negatively on the budget deficit (BER, 2001; ING Barings, 2000).

According to Van Rensburg et al. (2002), social expenditure by government has continued to increase in the recent past, reflecting a continued concern with improved social delivery. Trends in social expenditure also suggests that government will be reprioritising expenditure so as to cope with the HIV/AIDS epidemic, with increasing allocations going towards the Departments of Health and Social Development, which will have to cope most directly with the impact of the epidemic. However, future increases in these allocations, apart perhaps from allocations to Social Development, are relatively small in real per capita terms.
In terms of HIV/AIDS-specific budgetary allocations, though, allocations have increased substantially over past financial years, both in nominal and real terms and both in aggregate and per capita terms (Van Rensburg et al., 2002), while projected allocations for future years will continue to increase substantially (Hickey, 2002), amounting to an additional R3.3 billion over the MTEF period (National Treasury, 2003: 158). (However, any analysis of the budgetary implications of HIV/AIDS-related public expenditure needs to weigh up the cost of doing nothing against the benefits of spending more public resources in certain areas, which as Skordis and Nattrass (2002) has shown may result in net savings to the budget). On aggregate, the increases in public health care expenditure assumed in these models are therefore overoptimistic in light of the current government's stance on fiscal discipline and has as yet not materialised (Van den

Heever, 2003). In addition, as emphasised by Van den Heever (2003), these models employ a relatively wide range of estimates of the cost of AIDS care, i.e. ranging from R3500 to R16 900 per patient, which is likely to translate into substantial variability in 20 the projections future increases in public health care expenditure and therefore in the projections of the different macroeconomic models. Assumptions about increase in public health care expenditure are also based on assumptions regarding patterns of health care seeking behaviour, which according to Van den Heever (2003) have little empirical basis. Van den Heever (2003) also argues that the uptake of social grants in the face of the HIV/AIDS epidemic has probably been underestimated. While the latter criticism may see the economic impact of HIV/AIDS underestimated (greater expenditure on grants will result in more crowding-out of other expenditure and/or higher budget deficits), unrealistic assumptions regarding increases in public health care expenditure (based on the recent stance of government in this regard) means that the economic impact of the epidemic is overestimated (the question of how government opt to finance the planned roll-out of ARV treatment has important implications for this assumption in the current models).

In their current form, these macroeconomic models does not assume any role for foreign capital or donor money in funding HIV/AIDS-related public expenditure (Van den Heever, 2003), which represent relatively substantial funding resources (Van Rensburg et al., 2002), while such allocations, via the Global Fund for HIV/AIDS, Tuberculosis and Malaria for example, is likely to play a substantial role in future years in funding HIV/AIDS care and support programmes in future years. Such funding implies less crowding out of other public spending and less chance of deficit increases, thus resulting in an overestimation of the economic impact of the epidemic.

3.4 Conclusion

The main objective of this chapter was to give an overview of empirical and theoretical literature on the macro and microeconomic impact of HIV and AIDS. Various theories and empirical work using different methodologies was reviewed. Some studies went beyond simple estimating the impact of the disease by forecasting the impact of HIV and AIDS in the next coming years. This brief

literature survey suggests that HIV/AIDS has by far, a negative effect on economic growth, regardless of the methodology employed. However, what is worth noting from all these studies is that the exact magnitude varies from country to country and its purely an empirical issue. For South Africa, we cannot speculate on the exact magnitude of the impact, but it is an empirical issue which warrants our investigation. This study hopes to add the South African side of the story to this growing body of literature on the economic consequences of the disease.

Chapter 4

Methodology and Model Estimation

4.1 Introduction

This Chapter is underpinned by the literature reviewed in Chapter 3. This present Chapter focuses on the methodology and the model estimation. The first sub-section reviews the different methodologies used by various researchers when they examine the impact of HIV and AIDS in various economies. The second sub-section uses previous literature to formulate and subsequently estimates an error correction model.

4.2. Methodology

Studies on HIV both from within and outside the African continent have taken three methodological directions. The first set of studies comprises of the Computable General Equilibrium type. The CGE framework involves making simulations of the impact of AIDS on the economy as a whole. CGE models are useful in showing the sectoral impacts of the disease. However, these CGE models provide only a snap-short view of the economy; they ignore the dynamic, distributive and cumulative impacts of the disease. In fact a general weakness of the CGE models is that they are based on a large set of assumptions (albeit some of the assumptions are unrealistic) about the economy. These CGE models assume structural parameters that are not econometrically estimated, but instead use assigned values derived from literature. Examples of Computable General Equilibrium (CGE) models include Kambou et al (1992) and Arndt and Lewis (2000).

The second group of studies are surveys. The survey type of studies focus on the impacts of the disease on samples of households or firms. Often these studies compare an AIDS scenario with that without. If the outcomes are different, then the difference is attributed to the impact of HIV/AIDS. A classic example is the World Bank (1997) study which compared the ownership of assets in households

with and without an adult death in Uganda, and Tanzania. They found that households with a case of a disease death are more likely to dispose of their assets than households without. Other studies falling in this category include Mutangadura (2000); Moshi (1995); Kwaramba (1997); Robert and Rau (1997); Ncube (1999); and K'Oyugu and Muita (2001). Survey studies generally have a number of drawbacks. Their main problem revolves around the sample. The sample sizes are generally small to allow generalisation. Survey studies are also limited by their inflexibility as they require a study design that has to remain unchanged throughout the data collection. Researchers often get biased results as it may be difficult for participants to recall some of the information. Another problem with survey studies is quantifying and separating HIV/AIDS impact from other impacts that may have some bearing on economic activity.

The third type of models is partial equilibrium or econometric models. These include time series, cross section and panel data regressions. Examples of partial equilibrium macro models include Over (1992), Cuddington (1993a, 1993b and Cuddington and Hannock 1994; Ainsworth and Over ((1994), Bureau of Economic Research (BER) (2001) and Quattek (2000). These models represent the growth process with some production function, e.g. Cobb-Douglas in Cuddington 1993a and Over (1992), or some other growth models, (e.g. the endogenous Solow type growth models are common) with HIV/AIDS mortality rates being one of the exogenous variables. The role played by human capital, in addition to physical capital, in modelling economic growth has been widely recognised both in theoretical and in these models. The human capital has often meant education and skills development (e.g. Ncube, 2003). In recent years, literature has acknowledged that human capital is more complex than that. What is emerging in literature is that human capital should include health capital as well. More and more studies are introducing models that take into account health capital as one of the drivers of economic growth. The inclusion of AIDS has been factored in through the health capital variable.

Although robust results have been found especially on the HIV/AIDS variable, these econometric models have suffered, besides their partiality, from inadequate and porous data sets. In addition, especially the cross country and panel data

models, the data has been sourced from various sources which poses obvious problems of data inconsistency. Serious problems in these estimations emanate also from errors in variables. This applies both on the dependent variable (economic growth) and the HIV related variables (mortality, prevalence etc). On economic growth, many countries' national accounts are found wanting on this variable. On the other hand, data on HIV/AIDS indicators are often derived from relatively few observations and with large, margins of error. Another problem with these studies is the homogenisation of labour. The maximisation of labour ignores the differential susceptibility and vulnerability of labour to the disease. Thus in a nutshell, discerning the finer impacts of the disease on the labour market is impaired by this assumption. Finally, lack of time sufficient time series data has greatly affected the robustness of the results.

This research will follow time series econometric modelling methodology in estimating the impact of HIV and AIDS on the South African economy. The study employed an error correction technique.

4.3 Model Specification

The study has adopted and modified existing growth model. It has adopted the Keynesian model of growth and included HIV/AIDS as one of the independent variables. HIV/AIDS captures another aspect of human capital. This study follows researchers like Over (1992), Cuddington (1993a, 1993b and Cuddington and Hannock 1994; Ainsworth and Over ((1994), Bureau of Economic Research (BER) (2001) and Quattek (2000). Their models represent the growth process with some production function, e.g. Cobb-Douglas in Cuddington 1993a and Over (1992), or some growth models, (e.g. endogenous Solow type growth models) with HIV/AIDS mortality rates being one of the exogenous variables.

This study estimated the growth model represented by:

$$GDPG = f(HIV, Inv, GEexp) \quad \ldots\ldots 4.1$$

where,

- *GDPG* is used as a proxy for economic growth
- *HIV* is the HIV Prevalence
- *Inv* is Investment
- *GExp* is Government Expenditure

The model to be estimated takes the following functional form;

$$GDPG_t = \alpha_0 + \beta_1 HIV_t + \beta_2 Inv_t + \beta_3 GExp_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 4.2$$

where α_0, β_1, β_2 and β_3 are the coefficient to be estimated, HIV_t, Inv_t and $GExp_t$ are as defined above. ε_t is the stochastic error term.

In log form equation 4.2 can be written as follows;

$$GDPG_t = \alpha_0 + \beta_1 lnHIV_t + \beta_2 lnInv_t + \beta_3\, lnGEexp_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots 4.3$$

4.4 Expected Relationships

From the theory and the empirical literature, we expect $\beta_1 < 0$. In other words, *HIV and AIDS* and Economic growth are expected to have a negative relationship. As labour for example, is infected or affected, their productivity decreases, with negative consequences on economic growth.

The coefficient β_2 is expected to be greater than zero. A positive relationship is expected between investment and *GDP* growth. Investment, be it on human or physical capital or infrastructure contributes positively to economic growth. When investment increases it tends to spur economic growth.

The coefficient β_3 is expected to either be greater or less than one. The relationship of government expenditure and economic growth depends on what the government is spending on. When government invest on education that may lead to a country having more skilled labour. This then, improves economic growth, but if the government spending is largely on transfers, e.g. grants, then economic growth may be curtailed. One way of explaining the negative

relationship is that government spending may crowd out or crowd in private investment. Crowding in implies that government spending grows the economy while crowding out means government spending stifles economic growth.

4.5 Definitions of Variables and Data Sources

Gross Domestic Product (GDP) of a country is the market value of all final goods and services produced within a country in a given period of time. In this case the GDP growth rates will be used in our estimation. The time series data for GDP was obtained the SARB (2007).

HIV/AIDS refers to the human immune virus and the acquired immune deficiency syndrome. This is the disease that has affected all societies in the world. In South Africa over 5.7 million people have been infected with this virus. In our study we use the prevalence rate to capture the impact of HIV/AIDS. The data for HIV/AIDS were sourced from various STATSSA publications.

For Investment, we used total capital formation, which includes both public and private investment. This investment also includes both the domestic and foreign investment. The data for this variable was sourced from various South African Reserve Bank publications.

Government Expenditure includes various forms of government spending. This variable was sourced from SATSSA publications.

In addition, our model included money supply as a measure of financial development, and education[2]. The above variables were subjected to stationarity and cointegration tests. In the subsequent sections we look at these tests.

[2] However these two additional variables were found to be insignificant in the general model and were dropped completely in the specific model which is discussed in subsequent sections.

4.6 Stationarity and Cointegration Tests

The growing interest in economic dynamics has given a new emphasis to time series econometrics. Econometric modelling techniques of time series data range from Classical Linear Regression Modelling (CLRM) to cointegration regression modelling. The former approach assumes variables are stationary. This technique is susceptible to spurious results. Cointegration is the most preferred process for multivariate models as it eliminates the danger of estimating a spurious regression.

4.6.1 Stationary Tests

Stationarity refers to testing and making sure that the series are integrated of the same order. The assumption of the classical regression model necessitate that the variables be stationary and that the errors have a zero mean and a finite variance. According to Granger and Newbold (1974) the presence of nonstationary variables might cause a spurious regression, which means high R^2 and t-statistics that appear to be significant but the result will be having no economic meaning. Therefore the time series data that is used to run econometric regression should be tested for stationarity. To test for the order of integration we use the Dickey Fuller (DF) and Augmented Dickey Fuller (ADF) tests.

4.6.1.1 Dickey Fuller (DF)

The Dickey Fuller involves estimating one (or more) of the equations below (equations 4.4-4.6) using OLS in order to obtain the estimated value of γ and the associated standard error. It also involves comparing the resulting t-statistics with the appropriate value reported in the Dicey Fuller tables which allows the researcher to determine whether to accept or reject the null hypothesis $\gamma = 0$.

The Dickey Fuller (1979) consider three different regression equations that can be used to test for the present of a unit root which means three models can be estimated for each variable and these are without both a constant and trend, with

a constant and no trend, and with both a trend and a constant. These equations are represented by 4.4, 4.5 and 4.6 respectively.

The equation with no constant and no trend is represented by;

$\Delta y_t = \gamma y_{t-1} + \varepsilon_t$ *4.4*

The equation with a constant but no trend is given by;

$\Delta y_t = a_0 + \gamma y_{t-1} + \varepsilon_t$ *4.5*

Lastly, the equation with both a trend and constant takes the following form:

$\Delta y_t = a_0 + \gamma y_{t-1} + a_{2t} + \varepsilon_t$ *4.6*

The difference between the three regression concerns the presence of the deterministic elements α_0 and $a_{2t,}$ where *t* is the trend. The parameter of interest in all the regression equations is γ, if $\gamma = 0$, the y_t sequence contains a unit root. The methodology to get of estimation and getting the critical values for the t-statistics is the same regardless of which of the three forms of the equation is estimated.

4.6.1.2 Augmented Dickey- Fuller Test (ADF)

Not all time series variables can be well represented by a well defined the first-order autoregressive process. The ADF test is the stricter version of the DF test. The ADF also estimate three models for each variable, that is;

$\Delta y_t = \gamma y_{t-1} \sum_{i=2}^{p} \beta i \Delta y_{t-i+1} + \varepsilon_t$.....4.7

i.e model with no constant and no trend

$\Delta y_t = a_0 + \gamma y_{t-1} \sum_{i=2}^{p} \beta i \Delta y_{t-i+1} + \varepsilon_t$.....4.8

i.e. model with constant and without trend

$\Delta y_t = a_0 + \gamma y_{t-1} a_2 t \sum_{i=2}^{p} \beta i \Delta y_{t-i+1} + \varepsilon_t$ 4.9

i.e. model with constant and trend

In these models:

$$\gamma = -(1 - \sum_{i=1}^{p} a_i)$$

and

$$\beta = -\sum_{j=1}^{p} a_i$$

In this ADF equations the coefficient of interest is *γ*, if *γ = 0,* the equation is entirely in first differenced and so has a unit root. If the coefficients of a difference equation sum to 1, at least one characteristic root is unity. On the equations if *∑ai = 1, γ=0* and the system has a unit root.

The DF and ADF tests are reported in Table 13 below.

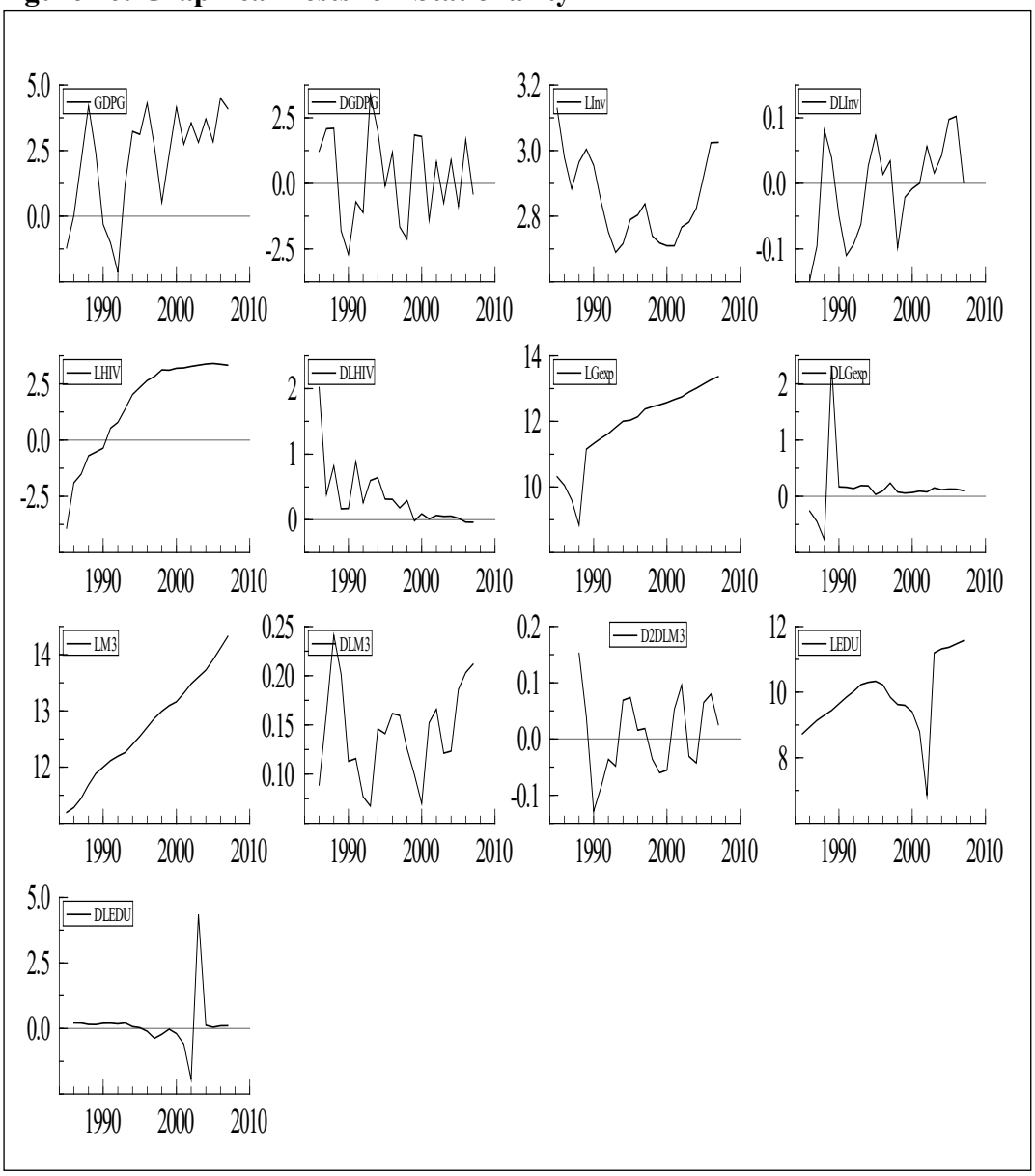
Table 13: Stationarity Tests

	Dickey Fuller			Augmented Dickey Fuller			Order of Integration
	No Constant & No Trend	With constant & No Trend	With Constant & Trend	No Constant & No Trend	Wit Constant & no Trend	With Constant and Trend	
LM3	14.19	-0.7381	-1.007	2.468	0.1367	-3.549	I(2)
DLM3	-0.13	-2.422	-2.38	-0.5384	-3.273	-3.19	I(1)
D2LM3	-3.58**	-3.45*	-3.754*	-4.769**	-4.618**	-5.237**	I(0)
LEdu	0.3505	-2.357	-2.716	-0.5339	-1.845	-2.159	I(1)
DLEdu	-5.863	-5.829**	-5.695**	-3.993**	-4.017**	-3.938*	I(0)
LGExp	1.084	-1.092	-2.73	1.38	-1.183	-2.432	I(1)
DLGExp	-1.076	-2.614	-4.012*	-0.2145	-1.893*	-3.06	I(0)
LInv	-0.3863	-2.087	-1.213	0.2638	-1.783	-1.393	I(1)
DLInv	-3.303**	-3.198*	-3.252	3.769**	1.713	4.158*	I(0)
LHIV	0.8144	-5.756**	-3.016	0.5008	- 4.039**	- 0.6386	I(1)
DLHIV	-5.372**	- 6.350**	- 9.707**	-2.437*	- 2.246	-3.542	I(0)
GDPG	-1.037	-2.508	-2.839	-1.24	-2.962	-3.849*	I(1)
DGDPG	-4.073**	-4.009**	-3.904*	- 3.741**	-3.648*	-3.515	I(0)
Critical Values at 5%	-1.957	-3.004	-3.633	-1.958	-3.011	-3.645	
Critical values at 1%	-2.676	-3.767	-4.441	-2.682	-3.785	-4.469	

The stationarity tests reported in Table 13 indicate that all the variables became stationary after first differencing except for money supply (*M3)* which is stationary after the second differencing. In other words all the variables are integrated of order one, serve for M3 which is integrated of order 2.

The stationarity of the variables were further examined using graphs (see Figure 16).

Figure 16: Graphical Tests for Stationarity



The graphs in Figure 16 confirm the results in Table 13. The graphical results confirm that the series for *HIV, Investment, Government Expenditure, Education* and *GDP* are not stationary in levels but become stationary after first differencing. *M3* is also not stationary at levels but become stationary after second differencing.

4.7 Cointegration

Cointegration is a technique for establishing the existence of a long run relationship between variables. If variables in a model are cointegrated, it means they are integrated of the same order, but within them exist a linear combination of at least one or more variables that are integrated of order zero. Cointegrating variables share a common stochastic trend (Stock and Watson, 1998).

To test for cointegration, the Engle-Granger (1987) testing procedure and the Johansen and Juselius (1990) technique can be used. Engle-Granger seek to determine whether the residual have an equilibrium relationship or are stationary. Johansen and Juselius (1990) developed two variants of the reduced rank tests for determining the cointegration space. The two log likelihood tests are the maximum eigenvalue (λ-max) and the trace statistics (λ-trace). In our case we shall employ the superior Johansen and Juselius cointegration tests.

The Johansen-Juselius tests are represented by equations 4.10 and 4.11 respectively.

$\lambda_{max}(r,r+1) = T\sum_{i=r=1}^{n} In(1-\lambda_i)$ ……4.10.

$\lambda_{trace}(r) = T\sum_{i=r=1}^{n} In(1-\lambda_i)$ ……4.11.

where: λi is the estimated values of the characteristics roots (also called eigenvalues) and the T is the number of usable observations.

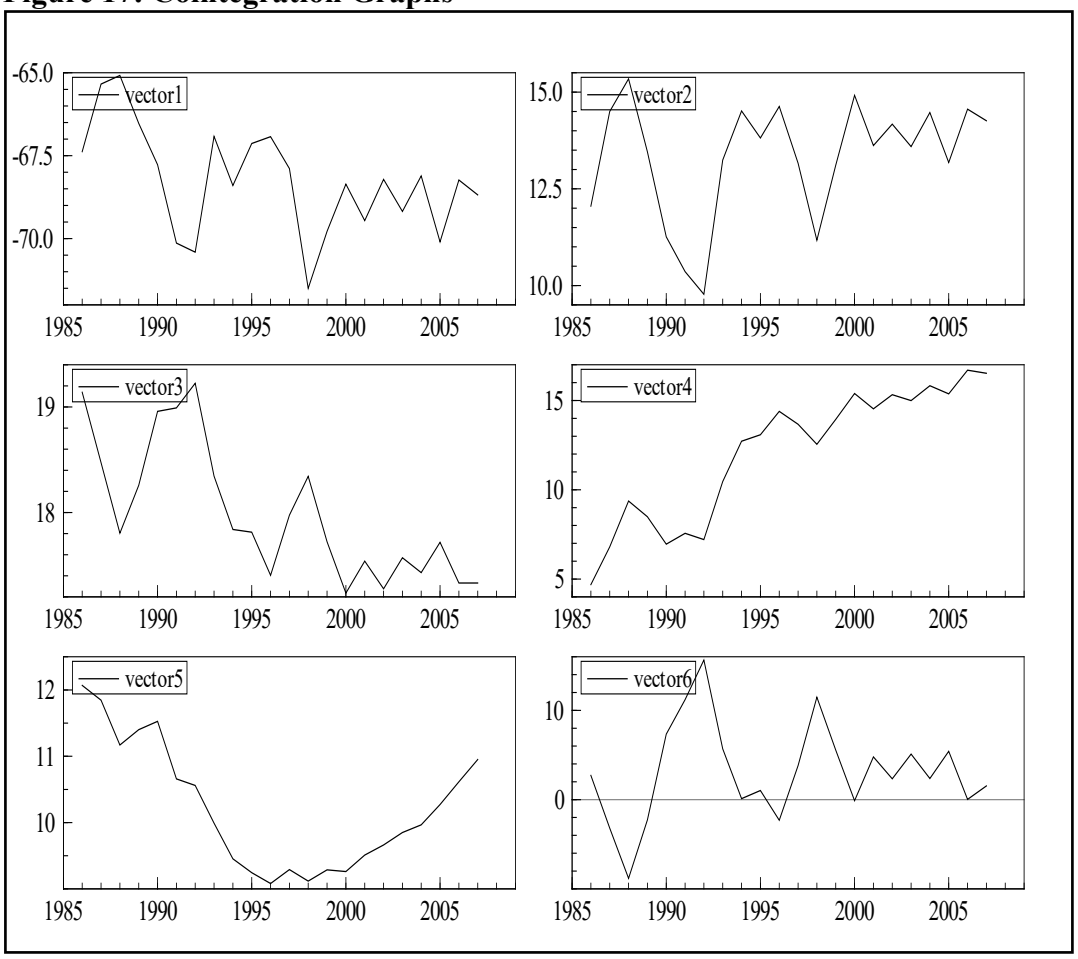
Table 14 summarizes the cointegration results for the growth model.

Table 14 Cointegration Analysis 1986 to 2007

		Maximum Eigenvalue		Trace Statistic	
Ho: rank=p	λi	-Tlog(1-λi)	95%	-Tlog∑(1-λi)	95%
p=0	0.8935	49.27**	39.4	129.4**	94.2
p≤1	0.7443	30	33.5	60.13	68.5
p≤2	0.6574	23.56	27.1	40.13	47.2
p≤3	0.5610	18.11	21.0	26.56	29.7
p≤4	0.2792	7.204	14.1	8.452	15.4
p≤5	0.0552	1.248	3.8	1.248	3.8

The result of the test in Table 14 shows that there is one cointegrating vector for the maximum eigenvalue tests and the trace statistics. We examine some graphs for the cointegrating vectors as well. The graphs are shown in Figure 17.

Figure 17: Cointegration Graphs



The graphs in Figure 17 clearly and unambiguously suggest a single cointegrating vector. Vector one in Figure 17 is found to be stationary and thus cointegrating. Having established a single cointegrating relationship in all our tests in the growth model, we then estimate error correction model. The next sub-section deals with the process of estimating an error correction model.

4.8 Error Correction Model

If the gap between the long – run and short run rates is large relative to the long-run relationship, the error correction model must be applied. Thus the model to be estimated is shown as 4.12.

$GDP_t = f\ (HIV_t, GExp_t, Inv_{t,}, ECTt\text{-}1) + \varepsilon_t$ ……4.12

where:

- $GDPG_t$ is economic growth
- HIV_t captures the HIV/AIDS prevalence rate
- $GExp_t$ is government expenditure
- Inv_t is total investment
- ECT_{t-1} is the error correction term and,
- ε_t – stochastic error term

The error correction term is generated from the Beta matrix found (for the growth model) in our estimation of the cointegrating vectors. The error correction term is generated as follows:

$$ECT_{t-1} = GDPG_t - 0.255lnHIV_t - 6.32lnInv_t + 2.596lnGExp_t \ldots\ldots\ldots\ldots\ldots 4.13$$

After generating the error correction term, we included this new variable into our growth model 4.3. The modelling technique used here is general to specific. The general model is whereby we estimate a model with all the possible explanatory variables included in our model with all possible lags. In our case we included 5 possible independent variables and lagged all of them once. From this general model we subsequently and consistently eliminated the least significant variables until we remained with a model exhibiting significant variables only. The variables that were eliminated were M3 and Education. The latter model (specific) is presented in Table 15 and the general model is presented in the Appendix. In this regard our analysis will focus on the results of the specific model that is reported in Table 15.

Table 15: Estimated results for the growth model[3]

Variables	coefficients	t-values
Constant	6.8498	1.595
$DLInv_t$	0.217**	4.683
ECT_{t-1}	-0.10701	-0.882
$DLGexp_{t-1}$	-0.9463*	-2.032
$DLHIV_{t-1}$	-0.3168*	-2.619

R^2 = 0.79

F(4, 14) = 12.114 [0.0002]

SE = 0.07390

DIAGNOSTIC TESTS

AR 1- 2F(2, 12)	=	0.2352	[0.7939]
ARCH 1 F(1, 12)	=	2.7675	[0.1221]
Normality (2)	=	0.1201	[0.9417]
RESET F(1, 13)	=	0.0740	[0.7024]

4.9 Discussion of results

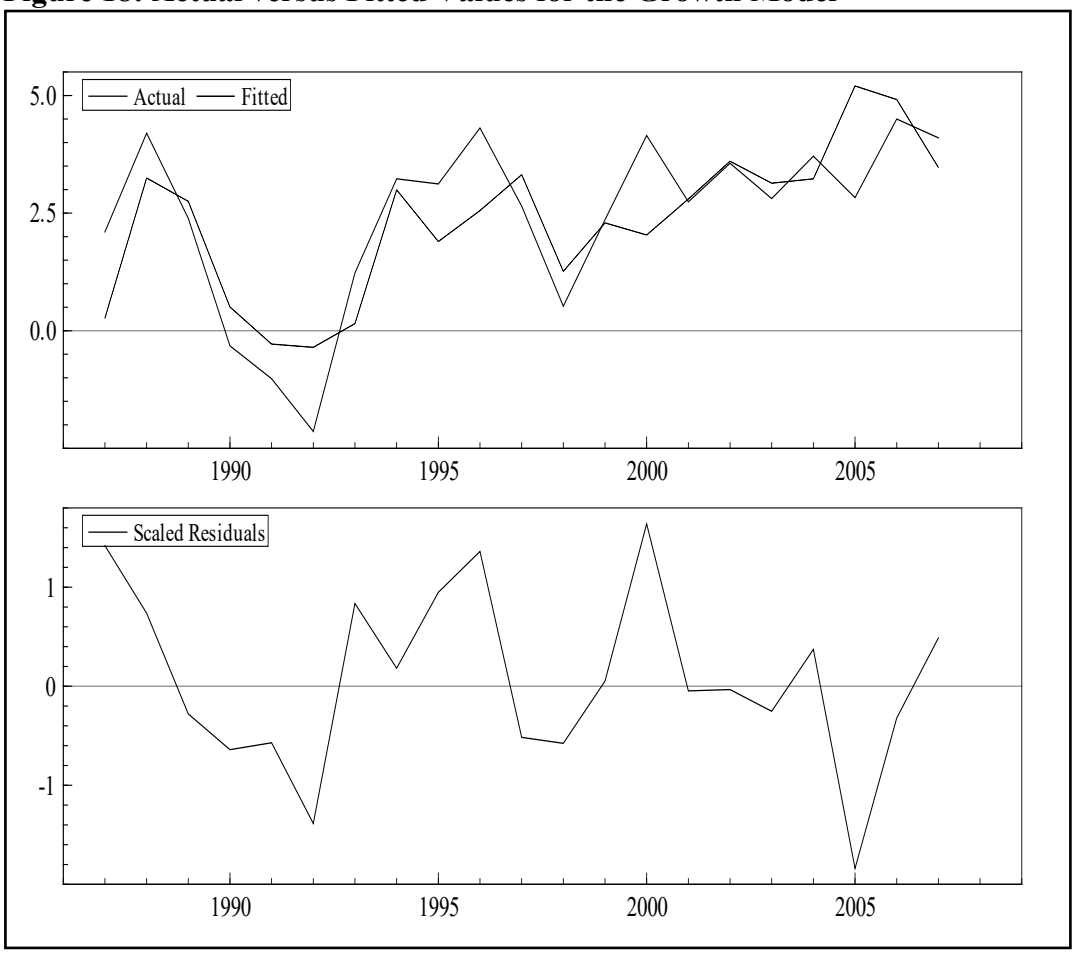
The estimated model exhibits robust results. The signs of all the coefficients conform to economic theory, and the signs are as expected. The R^2 is big which means that the explanatory variable explains 77% of GDP growth. The Standard error is low, also suggesting a sound model. The robustness of the model is also signified by a significant F-value.

[3] *Where * shows significance at 10%, ** significance at 1%. SE is the Standard of Error of the regression, DW is the Durbin Watson statistics, AR is the Langrange Multiplier test for autocorrelation, ARCH is the Engle Arch test for autocorrelated squared residuals, Normality is the Jarque-Bera test for normality of the residuals and RESET is a general test for model misspecification*

The diagnostic test at the bottom of Table 15 demonstrates that the model is robust as well. The diagnostic test indicates that the residual are not autocorrelated as shown by the AR- test. The ARCH test suggests that the residual are not heteroscedastic either. In addition, the residuals are normally distributed as shown by the normality test. Finally the model is well specified as shown by the RESET test.

To further examine the robustness of the model we graph the actual and fitted values of the growth function as well as the scaled residuals (see Figure 18). The actual and fitted values seem to be moving together harmoniously while the scaled residuals are somewhat stationary. In essence these graphs indicate a good model.

Figure 18: Actual versus Fitted Values for the Growth Model



We now turn to the estimated coefficients. Investment is significant at 1% as shown by a high t- value. The result shows a positive relationship between

investment and economic growth. This result conforms to economic theory and previous literature. The result indicates that a 1% increase in investment leads to 0.2% increase in economic growth. Investment is crucial in every economy. It is important to encourage local investment and at the same time make efforts at attracting more foreign investors.

The sign of the coefficient of government expenditure is negative. This variable is significant at 10%. A 1% increase in government leads to a 0.94% decrease in economic growth. It important for government to spend so that the economy grows. But it is important for the government to balance spending that is pro-growth and that which stifles growth. Our results indicate that the balance is not well established as the sign of the coefficient suggest some spending that is detrimental to growth.

The variable of interest in this study is HIV/AIDS. The sign of the coefficient of this variable is negative and in line with our expectations and augurs well with economic theory. The coefficient is negative and statistical significant at 10%. The result suggests that a 1% increase in the number of people infected will lead to a 0.3% decrease in economic growth. Our results augur well with our hypothesis specified earlier in the study. This is one disease that has hit hard the world and South Africa is one country that has the highest numbers of people infected and deaths. HIV/AIDS kills the young active skilled labour, which may decrease the productivity in firms and the economy as a whole. HIV increases government expenditures on health facilities which is somehow a drawback for the economy.

The error correction term measures the speed of adjustment. It has the right sign. However the coefficient is statistically insignificant. Although it is statistically insignificant, it nonetheless exhibits a slow speed of adjustment. This implies that there are impediments to adjustment in the South African economy.

Chapter 5

Conclusions and Policy Recommendations

In less than two decades, more than 65 million people have contracted the HIV virus, globally. Sub Saharan Africa is the epicentre of the disease. Almost 65% of the worlds' people living with HIV are in this region. In contrast, Sub Saharan Africa has a population which is slightly above 10% of that of the world. Since the detection of the disease some three decades ago, at least 20 million Africans have succumbed to the disease.

South Africa has the greatest number of people living with AIDS in Africa. About 5.7 million South Africans are infected, while the daily infection rates currently stands at 1500 individuals. HIV/AIDS is widely acknowledged as a major risk of doing business in South Africa, along with other notable risks such as asset security, exchange rate volatility, crime and infrastructure risk. The timeframe in which the epidemic has gained a foothold has been remarkably short: in 1990, South Africa's HIV prevalence was less than 1%. And by 1997, the prevalence rate had climbed to 17%. Three years later in 2000, the national prevalence rate was estimated at 24%. In 2005, the national rate stood at almost 30%. The question that emerges from this dire South African picture is: What are the consequences of the disease on the South African economy? The purpose of this research was to provide an answer to this question and in particular, examine the impact of HIV and AIDS on the South African Economy.

The study reviewed theoretical literature as the Harrod–Domar, Endogenous Growth Theory, Solow-Swan and the Keynesian models of economic growth. These theories guided this research. These theories underpinned our explanations for economic growth e.g. how variables like investment, HIV and AIDS and government expenditure impact on economic growth. The picture of the impact of these variables was also established from a review of various studies. Empirical literature reviewed concluded that HIV and AIDS has a negative impact on households, firms, different sectors and the economy as a whole.

To establish the impact of HIV/AIDS on economic growth, a growth model was estimated. The study modified existing growth models by combining them and formulating a unique growth model. The model estimated had GDP as the dependant variable and investment, government expenditure, money supply, education and HIV prevalence rate as the independent variables.

The data to estimate this model was sourced from the SARB quarterly reports and STATSSA. This data was subjected to stationarity tests and all variables were found to be stationary after first differencing except for M3 (the measure of money supply) which became stationary after second differencing.

The model was also subjected to cointegration tests. The Johansen and Juselius tests was employed to test for cointegration. Our results indicated that there was one cointegrating vector. After establishing cointegration, an error correction model was estimated. A general to specific modelling technique was used. In the specific model HIV, Investment and Government expenditure were found to be significant. The M3 and Education were found to be insignificant. The regular and diagnostic tests show that the model estimated was robust.

The results suggested that both foreign and local investors should be encouraged to invest in the country so as to boost economic activity. In addition, the results suggested that the government should have a limit in its spending, since an increase in expenditure can lead to a decline in economic growth. Quite significant to this study is the HIV/AIDS variable. The coefficient of this variable suggests that the disease has a negative impact on the economy. A 1% increase in the prevalence rate diminishes economic growth by 0.3%. This result implies that if efforts to alleviate the impact of the disease are not strengthened, the disease could retard economic growth.

5.2. Policy Implications

The results of this study have many policy implications. Our results suggest that policy makers should encourage investment by providing incentives to both domestic and foreign investors. In addition, the government must balance its spending, as some spending may discourage growth. The government needs to prioritise pro-growth expenditure.

On HIV/AIDS, it is our recommendation that government (local and national), NGOs and private community should strengthen programmes that are designed to limit the impact of HIV on the population and in particular the labour force.

5.3 Recommendations for Future Researchers

Our research was limited in some respects. In our model we did not test the variables for weak and strong exogeneity. Software issues were the cause for this. Thus it is important for future researchers to test for weak and strong exogeneity on independent variables. The researchers are also encouraged to investigate and compare the impact of HIV/AIDS at the provincial levels as different provinces run their economies semi-autonomously. Such an analysis will shed some light on why some provincial economies are not affected as others, if this is the case.

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Appendix

Table A1 General GDP Growth model

Variable	Coefficient	Std.Error	t-value	t-prob	PartRý
Constant	0.99791	14.810	0.067	0.9485	0.0008
$DLEDU_t$	-0.22010	0.39549	-0.557	0.5980	0.0491
$D2DLM3_t$	-7.9826	13.409	-0.595	0.5734	0.0558
DLGexp	-1.1603	1.2683	-0.915	0.3955	0.1224
$DLHIV_t$	1.4791	2.3064	0.641	0.5450	0.0641
$DLInv_t$	20.795	11.352	1.832	0.1167	0.3587
ECT_{t-1}	-0.036936	0.37411	-0.099	0.9246	0.0016
$GDPG_{t-1}$	0.34419	0.73796	0.466	0.6574	0.0350
$DLEDU_{t-1}$	0.12073	0.39765	0.304	0.7717	0.0151
$D2DLM3_{t-1}$	14.247	10.941	1.302	0.2406	0.2203
$DLGexp_{t-1}$	-1.4199	0.85381	-1.663	0.1474	0.3155
$DLHIV_{t-1}$	-2.3111	1.8260	-1.266	0.2526	0.2107
$DLInv_{t-1}$	-10.846	19.970	-0.543	0.6066	0.0469

Table A2 Data for estimation

Year	Gexp	HIV	Inv	GDPG	M3	EDU
1985	35385	0.0	22.8	-1.2	72553	6157
1986	42320	0.2	19.7	0.0	79315	7601
1987	50719	0.2	17.9	2.1	93285	9327
1988	58672	0.5	19.4	4.2	118750	10886
1989	69918	0.6	20.2	2.4	145271	12625
1990	82695	0.7	19.2	-0.3	162652	15408
1991	97314	1.7	17.2	-1.0	182615	18886
1992	111977	2.2	15.7	-2.1	197221	22505
1993	135629	4.0	14.7	1.2	210994	27737
1994	163425	7.6	15.1	3.2	244150	29756
1995	168962	10.4	16.3	3.1	281156	34878
1996	186581	14.2	16.5	4.3	330448	38037
1997	236531	17.0	17.1	2.7	387631	46658
1998	255284	22.8	15.5	0.5	439480	50417
1999	270166	22.4	15.2	2.4	485419	50819
2000	289289	24.5	15.0	4.2	520665	53451
2001	316931	24.8	15.0	2.7	606276	58891
2002	342728	26.5	15.9	3.6	715817	64585
2003	398274	27.9	16.2	2.8	808047	72879
2004	447583	29.5	16.9	3.7	914150	82566
2005	508913	30.2	18.6	2.8	1101130	86460
2006	577812	29.1	20.6	4.5	1349293	95517
2007	638281	28.0	20.6	4.1	1667580	105889
2008	647143	28.2	21.2	4.2	1675624	107326