



# Projections of demographic trends in Uganda 2007-2017

## Volume I

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## FOREWORD

The Uganda Bureau of Statistics was established in 1998 as a semi-autonomous Government agency responsible for coordinating, monitoring and supervising the National Statistical System. The Bureau continues to support Government's results-based agenda by providing statistics needed for planning, monitoring development performance and progress in the implementation of major national development policies and initiatives.

In its continued commitment to make statistics a 'public good', the Uganda Bureau of Statistics (UBOS) generates and publishes population projections to inform the national development policies and targets as outlined in the Poverty Eradication Action Plan (PEAP). This report focuses on demographic trends in Uganda taking into account HIV/AIDS. The report provides the projected population of Uganda broken down by sex, age and geographical distribution. In order to make readers appreciate better the projections, the report also has information on the socio-economic profile of Uganda, need for demographic projections, projection methods, assumptions and scenarios, and the impact of AIDS on the population size and composition. Illustrative uses of the projections results in planning for Millennium Development Goals (MDGs) are also included.

In order to support the decentralized planning policy, UBOS produced detailed projections at district level broken down by sex. These will be published in separate report (vol. II). Further, sub county population projection estimates have also been produced in collaboration with staff from the District Planning Units.

The process of development of this report on projections of demographic trends in Uganda is a result of many consultative discussions. The Uganda Bureau of Statistics wishes to recognize the fundamental input of all stakeholders who participated in the production of this report. The Bureau is grateful to the many institutions and individuals who contributed in various ways to the success of generating these projections. They include those who participated in making assumptions and actual projections and providing the input data: Ministry of Health-AIDS Control Programme, Uganda AIDS Commission, the World Health Organisation and the Institute of Statistics and Applied Economics. We also acknowledge the input of various officers from the Ministry of Health, Institute of Statistics and Applied Economics and the Population Secretariat. The contribution of several UBOS staff who actively participated in the production of this report is appreciated.

We are particularly grateful to the United Nations Development Programme (UNDP) for the financial and technical support. The United Nations Fund for Population (UNFPA) is also greatly acknowledged for the financial input to the production of this report. Uganda Bureau of Statistics further wishes to recognize and appreciate the technical support from Prof. Eric .O. Ujdo and for his dedication towards ensuring that this report is written.

The Bureau appeals to the people of Uganda to make maximum use of the population projections as a basis for evidence-based policy debate and design; decision-making at every level of society; investment and business transactions; and for many other purposes.

**John B. Male - Mukasa**

**Executive Director**

## EXECUTIVE SUMMARY

Population projections are essential for planning at the national, regional and district levels in the private and public sectors. In order for planners and policy makers to efficiently allocate the scarce resources, they need to know the future size and structure of the country's population as well as their characteristics.

Two population projection scenarios have been made including the high and low scenarios. The low variant scenario is essentially an AIDS impact scenario while the High variant projection does not explicitly take into account HIV / AIDS in the assumptions. Thus the low variant projections are considered to be the more probable situation. However, by comparing the results of the low variant projections with those of the High variants, we are able to examine the projected impact of HIV/AIDS on the population size and structure.

In the High Variant the population of Uganda is estimated to be 43.4 million in 2017 while in the low Variant projections it is estimated at 40.6 million. On this basis, AIDS is projected to reduce the size of the population of Uganda's population by 2.8 million persons (7%) by 2017.

The annual number of births is projected to increase to 1.9 million in 2017. The HIV epidemic seems not to have a significant impact on the number of births through out the projection period. However more deaths (531,000) are recorded in the low variant than in the high variant, which is attributed to the impact of HIV/AIDS. The gap between the low and high variant is narrowing probably due to the introduction of ARVs.

The population of Uganda is youthful and will continue to be throughout the projection period due to the prevailing high fertility. The projected median age of the population by 2017 is 15 years. The size of the working age population in Uganda is projected to increase steadily from about 14 million in 2007 to about 21million in 2017. The population of school going age (6-18 years) is generally increasing over the projection period irrespective of the existence of HIV/AIDS. The primary school age population (6-12 years) would increase from an estimated 6.3 million in 2007 to approximately 8.9 million in 2017 and the size of the secondary school age population (13-19 years would increase from an estimated 4.7 million in 2007 to approximately 6.6 million in 2017.

With the prevailing HIV/AIDS epidemic the dependency burden is generally high but given the lowering fertility and increase in the number of persons in the working age group (15-64 years), it is projected that the dependency burden would smoothly reduce from 110 for every 100 working persons in 2007 to 103 dependants for every 100 working persons in 2017.

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# CHAPTER 1: BACKGROUND

## 1.1 General Information about Uganda

### 1.1.1 Location and Size

Uganda is located in East Africa and lies across the equator, about 800 kilometres inland from the Indian Ocean. It lies between 1° 29' South and 4° 12' North latitude, 29° 34' East and 35° 0' East longitude. The country is landlocked, bordered by Kenya in the East; Sudan in the North; Democratic Republic of Congo in the West; Tanzania in the South; and Rwanda in South West. It has an area of 241,038 square kilometers, of which the land area covers 197,323 square kilometres.

### 1.1.2 Administration

The country is currently divided into 80 districts. The districts are sub divided into lower administrative units. These are counties, sub-counties and parishes. Overtime, the numbers of districts and lower level administrative units have continuously increased (see table 1) with the aim of making administration and delivery of services easier. The total number of districts increased from 56 districts at the time of the 2002 Population and Housing Census to 80 in 2007 This however, had a negative element in that most of the districts do not have time series data and hence it is not possible to do a district level trend analysis and demographic behaviour.

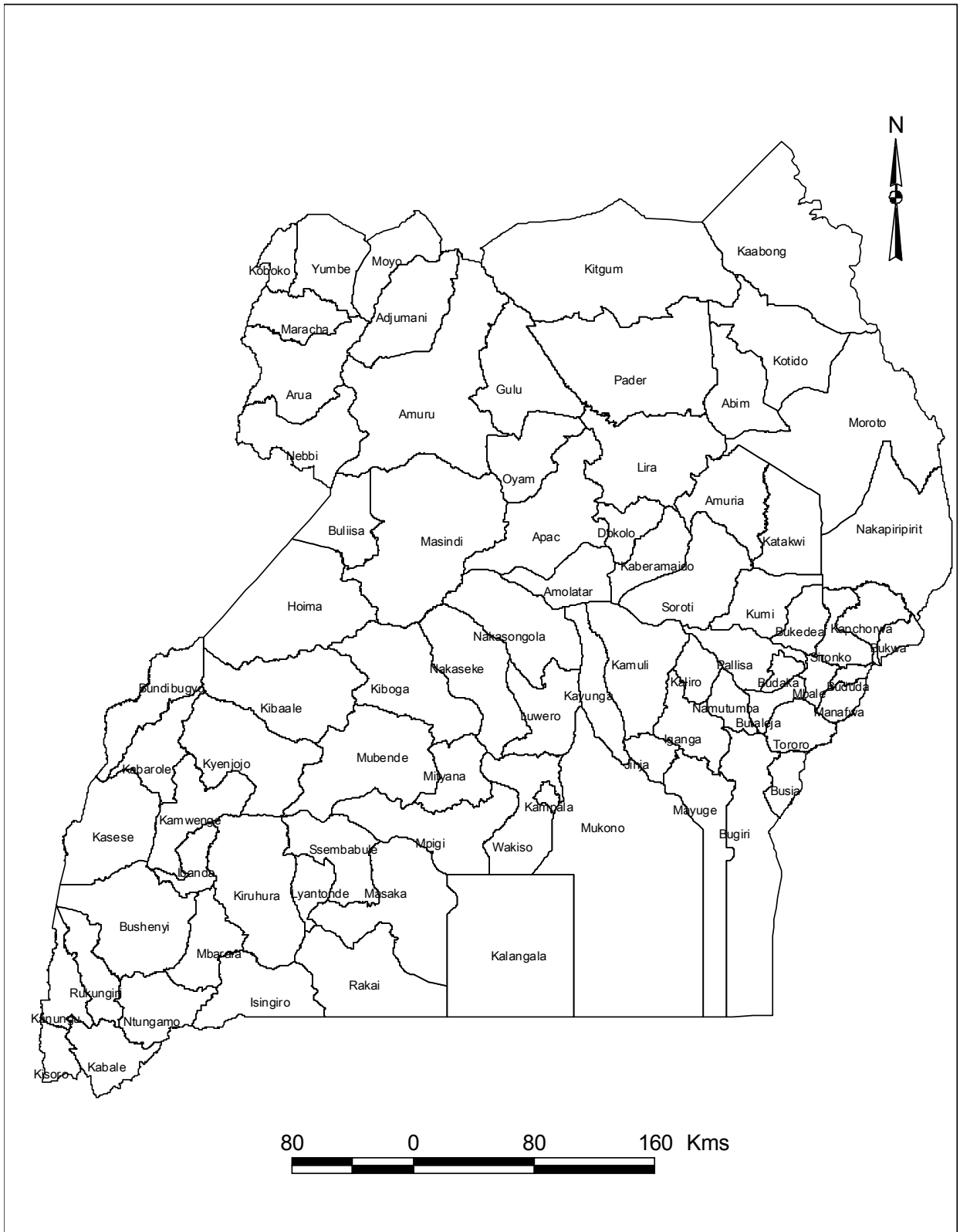
**Table 1: Number of Administrative Units by Census 1969 – 2002**

Level of Administrative Unit	Census Year			
	1969	1980	1991	2002
District	21	33	38	56
County	111	140	163	163
Sub-county	594	668	884	958
Parish	3,141	3,478	4,636	5,238

In addition to the administrative system, Uganda has a parallel Local Governments System at different levels. These are LC V (District); LC IV (County / Municipality); LC III (Sub – County); LC II (Parish); and LC I (Village). The role of the local governments is to implement and monitor government programmes at the respective levels.



**Figure 1: Map of Uganda showing the Districts as of June 2007**



### **1.1.3 Geography**

The country enjoys equatorial climate with plenty of rain and sunshine moderated by the relatively high altitude. In most parts of the country, the mean annual temperatures range from 16<sup>0</sup> C to 30<sup>0</sup>C. Nevertheless, the Northern and Eastern regions sometimes experience relatively high temperatures exceeding 30<sup>0</sup> C and the South Western region sometimes has temperatures below 16<sup>0</sup> C.

The Central, Western and Eastern regions have two rainy seasons, from March to May for the first rains, and the second rains from September to November. The Northern region receives one rainy season from April to October, and the period from November to March has minimal rain. Most of the country receives between 750 mm and 2100 mm of rain annually. The country has loamy soils with varying proportions of sand and clay. In addition, it has varying vegetation with tropical rain forest vegetation in the South and savannah woodlands and semi arid vegetation in the North.

### **1.1.4 Education**

Uganda's education system is both formal and informal. Under the formal system, the four – tier educational model is followed. This has seven years of primary education, four years of ordinary level secondary education, two years of advanced level secondary education and the tertiary level of education. Each level is nationally examined and certificates are awarded. University education is offered by both public and private institutions.

The Universal Primary Education (UPE) programme was introduced in 1997 to offer free education at the primary level while Universal Secondary Education (USE) was introduced in 2007. The government also sponsors about 4,000 students every year through the public universities. The private sponsorship scheme is also operational in the public universities. University education can also be obtained from any of the private universities in the country. In addition, a large number of institutions both private and public also offer tertiary education.

To compliment the formal education, there exists informal education to serve all those persons who did not receive formal education. Under the informal system, a range of practical/hands-on skills are imparted to those who have not gone through or only partially gone through the formal system of education. The majority in the informal system are the young adults and/or drop out and disadvantaged children. The Functional Adult Literacy (FAL) programme in the Ministry of Gender, Labour and Social Development targets older people who did not get chance to go through formal training.

### **1.1.5 Macro economy**

In early 1980s, Structural Adjustment programs were introduced which led to strong economic growth of GDP. Hence, the period that followed showed a remarkable increase in productivity and output. This was given impetus by macroeconomic stability resulting from the macroeconomic reforms. This led to the economy reverting to its high GDP growth rates and low and stable inflation and interest rates from the 1990's to present. The PEAP target was for a GDP growth rate of 5.2 percent in 2003, and an average of 7 percent thereafter.

The economy of Uganda is primarily based on the agricultural sector, with over 70 percent of the working population being employed by the sector. Agricultural exports account for over 45 percent of the total export earnings with coffee, tobacco and fish continuing to be the main export commodities that bring in foreign exchange.

In the last 5 years, the telecommunication sector has been the fastest growing sector of the economy, and this is due to the expansion programs and increase in coverage by the major telecommunication companies in the country which have led to increased numbers of subscribers and providers of the services.

## **1.2 The Need for Demographic Projections**

Population projections are essential for planning at the national, regional and district levels in both the private and public sectors. In order for planners and policy makers to efficiently allocate the scarce resources, they need to know the future size and structure of the country's population as well as their characteristics. Planning for any sector of the economy therefore requires information about the future size and structure of the population in the area.

Although demographic information can be obtained from censuses and surveys, they often do not meet all the needs of planners for the following reasons: Censuses are carried out every ten or five years in different countries and because the census, results are often released at least about two years after enumeration, the information from censuses though informative are technically out of date even at the time of being released. This is because, at the very minimum, planners require information about the current size and structure of the population, and not two or three or five years ago. However censuses are expensive exercises to conduct therefore, it is not possible to carry out census every year to meet the planning needs of policy makers.

Although different kinds of sample surveys are carried out during the intercensal period, they may also not meet the needs of planners because, they may not be carried out on annual basis due to cost and logistics. Also, sample surveys are carried out for specific objectives which may not coincide with the needs of some planners. In addition they often times lack district specific estimates. Population projections constitute a tool for providing demographic information about the present, the future at national and sub-national levels that is not available from censuses and surveys. In Uganda, the last census was carried out in September 2002 yet planners need demographic information as of now and beyond. Population projections can estimate the probable size and structure as well as the characteristics of Uganda's population beyond the most recent census year. Population projections provide an indication of likely changes in the future size and age-sex structure of the school going age population.

The principal uses of population projections relate to both government and private sector planning. The Ministry of Education and Sports reports on future trends in numbers of pupils in order to assess the demand for and supply of educational resources in the future.

The Ministry of Health has the responsibility of providing health services to various segments of population. The children of Immunisable age (less than 5 years) and women of reproductive age (15-49 years) are among the target population. The sectoral projections for children aged, less than 1 year, and those aged less than 5 years therefore provide useful information to estimate the amount of required antigens for the children. Similarly, projections for women aged 15-49 are useful to the Programme Managers for Reproductive Health to plan for those who may require maternal and child health services. These may include the number of women who require antenatal care services, tetanus toxoid injections, etc. Similarly, the Ministry of Gender Labor and Social Development is mandated to cater for Women, Youth , Adolescents and Older Persons. Sectoral Projections will therefore provide the likely changes in the future size and age structure for programme intervention, targeting women, children youth adolescents and older persons. These may include, the introduction of youth friendly services in a given locality, or programme area. The projections therefore provide useful data that is used to measure the amount of resources required for programme intervention for the different components.

With the devolution of the planning function to LCs, the demand for population data for lower level planning is rising. Population figures at District level are used for resource allocation. The need for projections at lower levels therefore is important for District level planning and has remained the major source of data for District Planning.

Population projections are also useful in assessing whether a country is on track in achieving national and international development targets such as the Millennium development goals to which

a country has committed itself to achieving. Most of the indicators in monitoring progress in the development targets need population figures as denominator. Indicators derived from the population projections may provide informed basis for a country to decide whether or not to continue without revision, revise, accelerate or scale up its current developmental programmes. This is also important in the context of HIV/AIDS which is part of the 6<sup>th</sup> Millennium Development Goal (combat HIV/AIDS, malaria and other diseases). Since AIDS also has direct impact on mortality and its age-sex pattern, AIDS related deaths alter the age structure of the population.

## **CHAPTER 2: SOURCES OF DATA AND EVALUATION OF THE BASE DATA**

### **2.1 SOURCES OF DATA**

There are various sources of information that can be used for making population projections. These include censuses, sample surveys and the vital registration.

#### **2.1.1 Population Censuses**

The main data sources when establishing benchmarks for economic and social indicators for Uganda are censuses and surveys. Prior to 1900, there was limited information on Uganda's population.

Decennial population censuses have been conducted in Uganda since 1911. The 1911, 1921 and 1931 Population Censuses were mainly administrative in nature, and separate enumeration procedures were made for the African and non-African population in the country. The population census results of 1911, 1921 and 1931 revealed populations of 2.5, 2.9 and 3.5 million persons respectively.

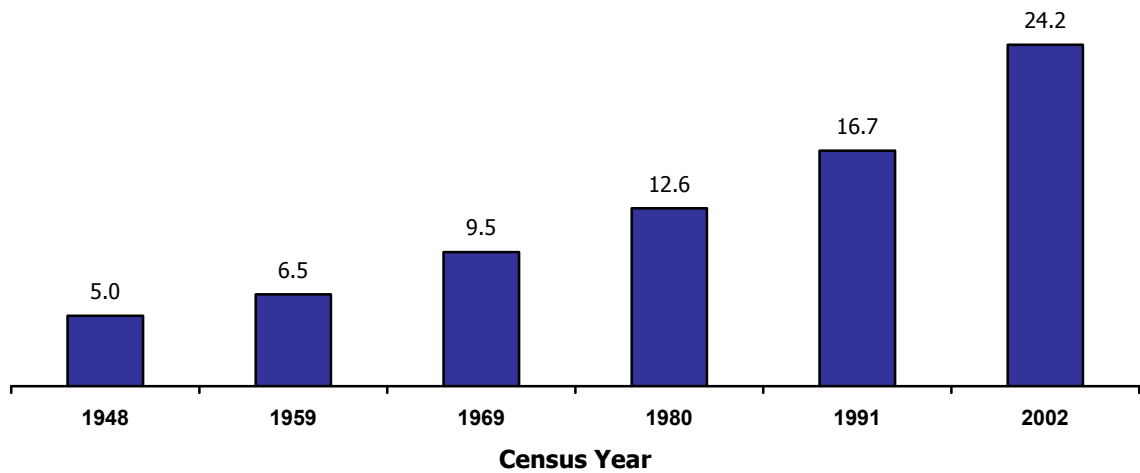
The 1948 Population Census was the first scientific census to be carried out in Uganda. This was followed by the 1959 Census. The two censuses enumerated the African Population and the non African populations separately. The enumerated was followed by sample censuses to provide detailed data on selected characteristics.

The first post independence census was conducted in 1969 followed by those of 1980, 1991 and 2002. The methodology used during these censuses was similar, as people were enumerated where they spent the census night (De facto Census) and conducted simultaneously for Africans and Non-Africans.

The 2002 Population and Housing Census was the most comprehensive census ever conducted in Uganda. The census collected data on the demographic and socio-economic characteristics of the population; household and housing conditions, agriculture; activities of micro and small enterprises; and the community characteristics.

For purposes of making population projections, the 1991 and 2002 census are used as the base population from which the projections are made.

**Figure 2: Population of Uganda (million), 1948 – 2002**



### **2.1.2 Sample Surveys**

The Uganda Bureau of Statistics undertakes regular household surveys which primarily focus on socio-economic issues. It also undertakes national service delivery surveys regularly whose focus is mainly on service delivery including agriculture, health services, road infrastructure, education as well as security. It also carries out the Uganda Demographic and Health Surveys. Of these surveys, the most pertinent to population projections is the demographic and health survey.

To date, Uganda has carried out four Demographic and Health Surveys in 1988/9, 1995, 2000/1, and 2006. The UDHS provides information on household characteristics, fertility levels and preferences, awareness and use of family planning methods, childhood mortality, maternal and child health, maternal mortality, breastfeeding practices, nutritional status of women and young children, malaria prevention and treatment, women's status, domestic violence, sexual activity, and awareness and behavior regarding AIDS and other sexually transmitted infections in Uganda.

The Ministry of Health carries out HIV surveillance surveys dating back to 1989. In collaboration with the Bureau of Statistics the Ministry of Health carried out a population based HIV/AIDS Sero Behavioral survey in Uganda in 2004.

The surveys have been used as a basis for most of the assumptions made especially on fertility, mortality while the sero-behavioural survey provides information on the HIV prevalence.

### **2.1.3 Vital registration**

The registration of Births and Deaths in Uganda started in 1903 and, was compulsory for persons of European, American and Asian origin but remained optional for other ethnic groups. In 1973 it was made compulsory for the entire population under. In the late 70s and 80s the system degenerated.

Efforts to reactivate it started with a pilot exercise which was initiated by UNICEF in 2000 in collaboration with the Government of Uganda in two districts of Arua and Busia. The exercise used a slightly different approach where the Birth and Death Registration was to be carried out at the LC1 level. The lessons learned were then used to implement the activity in another 20 districts under the GOU-UNICEF Country Programme 2001-2005. TO date the exercise is running in 23 of the 80 district.

In 2002, the government of Uganda through the Uganda Bureau of Statistics kick started the revival of registration of births and deaths throughout the entire country. This was initiated alongside the 2002 Population and Housing census. However due to lack of subsequent supporting facilitation, the process was not successful. An assessment carried out by UBOS in 2006 on the current Birth and Death Registration System revealed under coverage in the focus districts.

Therefore data from the Birth and Death Registration System, was not used in the generation of population projections.



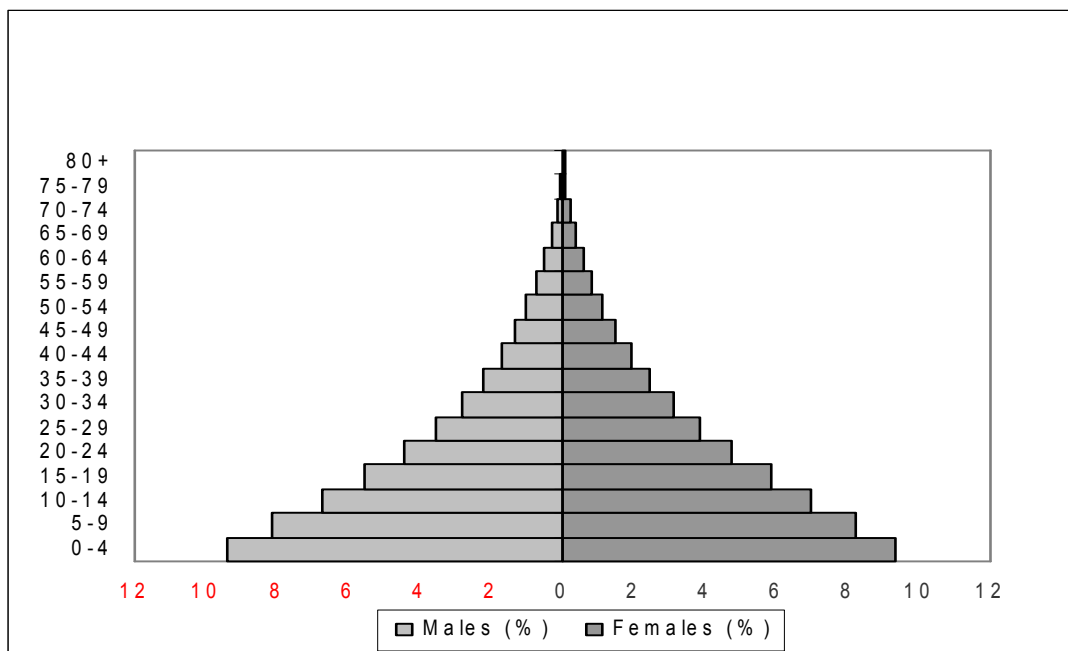
## 2.2 Evaluation of the Base Data

The base population used in generating the present projections is the 1991 Census population of Uganda. This section provides a brief evaluation of the age-sex distribution, fertility and mortality estimates from the census including the 2002 census that gives a more recent picture of Uganda's population structure. The results of the present projections need to be interpreted in the context of this evaluation.

### 2.2.1 Age-sex distribution of Uganda's Population

The 2002 Census is the most recent population and Housing census and hence is the source of information on age sex distribution of the population in Uganda. Figure 3 shows the age-sex distribution of the population as reported in the 2002 census (adjusted to mid-year). The population pyramid is typical of a population with high fertility and mortality as depicted in the broad base of the pyramid and rapid tapering off with increasing age.

**Figure 3: Reported age-sex distribution, 2002 Census**



A quick look at the five-year age-sex distribution did not reveal major deviations arising from age errors as five-year age distributions tend to have a smoothing effect on single year age-distributions. However, a close examination of the age-sex ratios in table 3.1 showed fluctuations that could not be explained by demographic factors and were therefore attributed to the quality of the age-reporting arising from differential age shifting by sex and hence necessitating graduation of

the reported age-sex distribution. The reported and smooth age-sex distributions are shown in Table 2.

**Table 2: The 2002 Population adjusted to mid-year (with Reported and Adjusted sex-ratio)**

Age group	Reported			Adjusted by Sex- ratio		
	Male	Female	Sex-ratio (M/F)	Male	Female	Sex-Ratio (M/F)
0 to 4	2,251,119	2,249,512	100.1	2,271,720	2,249,074	101.0
5 to 9	1,965,194	1,968,147	99.8	1,953,906	1,975,157	98.9
10 to 14	1,719,584	1,713,089	100.4	1,626,562	1,679,821	96.8
15 to 19	1,292,794	1,353,721	95.5	1,335,492	1,405,634	95.0
20 to 24	962,077	1,169,927	82.2	1,073,371	1,148,244	93.5
25 to 29	820,908	935,805	87.7	852,992	924,990	92.2
30 to 34	696,449	700,443	99.4	675,320	740,648	91.2
35 to 39	487,022	521,895	93.3	532,977	590,057	90.3
40 to 44	393,574	421,418	93.4	416,554	464,796	89.6
45 to 49	257,338	285,020	90.3	320,586	360,069	89.0
50 to 54	221,759	260,883	85.0	241,165	272,368	88.5
55 to 59	148,671	174,604	85.1	175,763	199,443	88.1
60 to 64	171,848	189,552	90.7	121,356	138,277	87.8
65 to 69	114,895	110,939	103.6	77,067	88,146	87.4
70 to 74	102,305	113,814	89.9	43,653	50,115	87.1
75 to 79	54,255	51,234	105.9	20,174	23,254	86.8
80 and over	87,401	99,991	87.4	8,537	9,902	86.2
<b>Total</b>	<b>11,747,193</b>	<b>12,319,994</b>	<b>95.4</b>	<b>11,747,193</b>	<b>12,319,994</b>	<b>95.4</b>

### 2.2.2 Smoothing the base age-sex distribution

Smoothing the age-sex distributions was carried out by comparing the logit transformations of the reported cumulated age-sex distribution with an appropriate stable population. The stable age distribution was constructed using the gross reproduction rate of 3.5 as obtained for Uganda, and the female life table Uganda prepared for 1991. This stable age distribution was closest among the various model distributions available in North family of model tables. The graduation method used is described in the UN Manual X was then used.

### 2.2.3 Quality of the fertility data from the 1991 census

Table 3 shows the Total Fertility Rates (TFR) estimated from Uganda's censuses as well as observed total fertility rates from its Demographic and Health Surveys. As seen in the table, the observed total fertility rates from the recent demographic surveys are inconsistent with those from the recent censuses (albeit, the difference is very small). From a methodological stand point, the rates from the censuses should not be compared with those from the Demographic Health Surveys because the latter were derived by direct methods whereas those from the census were derived by indirect methods. Udjo (1991, 1996, 1998, and 2003) in the analyses of birth histories from Demographic and Health Surveys in different settings has highlighted patterns of errors in such data and has shown that fertility reports from such reports often require adjustments using indirect methods.

**Table 3: Total fertility rates (TFR), 1969-2002 from Uganda censuses and Demographic Health Surveys (UDHS)**

Date of Census/ Survey	TFR	Method	Data sources
1969	7.1	Indirect	Census
1988	7.1	Direct	UDHS*
1991	7.1	Indirect	Census
1995	6.9	Direct	UDHS*
2000	6.9	Direct	UDHS*
2002	7.0	Indirect	Census
2006	6.7	Direct	UDHS

\* Survey did not cover the entire country

Source: 2002 Uganda Population and Housing census: Analytical Report

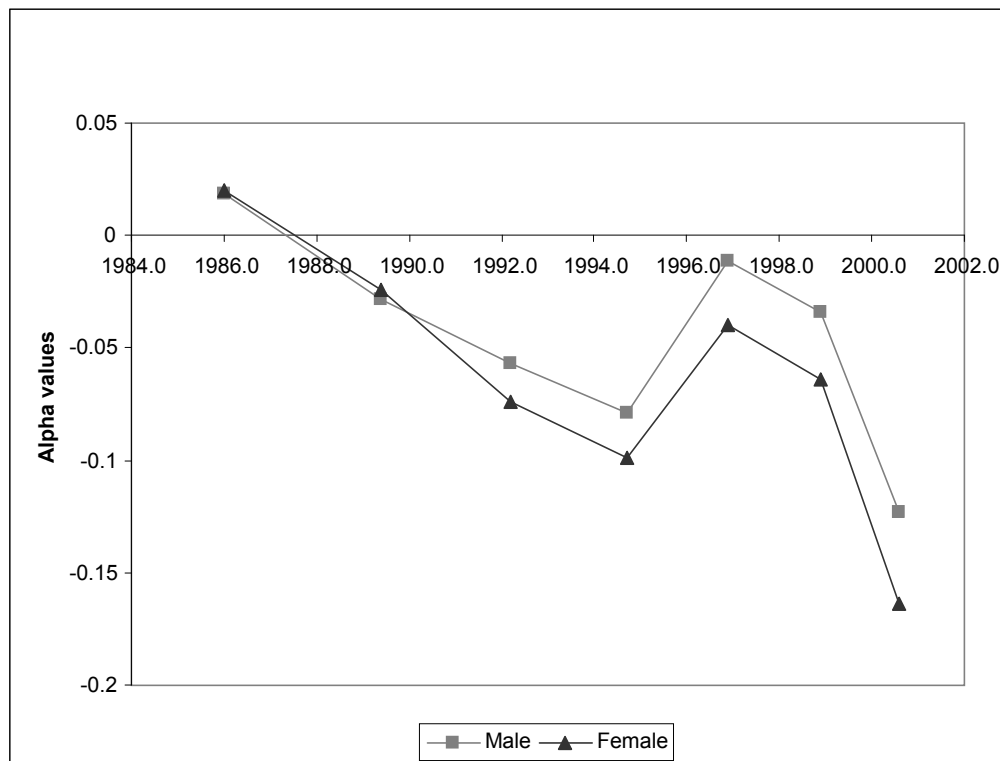
An evaluation of the fertility data in the 1991 census was carried out using the relational Gompertz model. (Brass 1974). The Relational Gompertz model provides a tool for assessing the quality of fertility data and adjusting for errors in the data on children ever born and births within the last months derived from birth histories in sample surveys or retrospective reporting on life time fertility as well as current births in censuses. The application of the method to children ever born as reported by women of reproductive age at the time of the 1991 census shows that there is a narrow range of variation in the estimates of TFR. This implies that the 1991 census data provide plausible estimates for TFR in the population.

## 2.2.4 Quality of the mortality data from the Ugandan censuses

The Brass method (or its variants) was used in evaluating and estimating childhood mortality. A fine-tuned model by Fernandez (1985, 1989) of the original Brass method was applied in the present study.

The reported child survival status provides an indication of the quality of the mortality reports during the 1991 census. Figure 4 shows the results of the application of Brass method to the childhood survivorship reports during censuses. As seen in the graph, the reports suggest that childhood mortality declined sharply during the period 1986 to 1994 and then increased sharply during the period 1994 to 1996. There was an apparent sharp decline during the period 1996 to 2000. The apparent sharp decline in the more recent period may be partly attributable to omission of dead children by some women in their report. At face value and using a one-parameter system, the  $\alpha$  values in Figure 4 would suggest that infant mortality rate in 2000 was in the region of 63 per thousand live births and life expectancy in the region of 54 years (both sexes). Note however these figures are only indicative. Better estimates are obtained by combining childhood and adult survivorship reports.

**Figure 4: Trends in childhood mortality**



## **CHAPTER 3: PROJECTION METHODS ASSUMPTIONS AND SCENARIOS**

### **3.1: Projection Methods**

Methods of population projections may be classified as mathematical and cohort component methods. The choice of method usually depends on the available data. Mathematical methods require relatively less data than cohort component methods. Mathematical methods entail fitting one of several mathematical curves to the total population observed in one or two censuses to derive a projected total population at some future date. This class of methods yields reasonably good results for short-range projections (not more than ten years) and is very useful for projecting populations at sub-national levels. However, the results obtained from this approach may have very large errors for medium to long-range projections (10-25 years, and more than 25 years respectively) because the assumptions underlying mathematical methods may not hold in the medium to long term. In general, mathematical methods provide information about the future size of the population but not the structure of the projected population.

In view of this, the preferred method of population projections is the more complex cohort component approach if the data required are available. The cohort component method entails projecting separately, the components of population change namely; mortality, fertility and net migration (see Shryock, Seigel and Associates, 1976). In populations where HIV prevalence is greater than 1%, the mortality is projected to include the impact of HIV/AIDS as in United Nations projections.

Due to data constraints a combination of both the cohort component and mathematical methods were utilized in the projections described below. The cohort component was used to project the national population. However, the necessary input information about the components of population change are not readily available at the sub-national level compared to the national level. Thus, exponential growth curve method was employed in projecting the populations at the sub-national levels (i.e. for the statistical regions as well as the districts). The geometric curve method was chosen because the population does not grow in a linear manner but rather in more of a geometric manner.

### 3.1.1 National Projections

At the National level, the cohort component method was employed by the use of the SPECTRUM software\*. Essentially, the cohort component method is a 3-stage process:

- i) Assumed age-sex specific survival ratios derived from a life table are applied to the age-sex distributions (persons aged 0-4, 5-9, 10-14 .... 80+) of the population at time t, to estimate the number of survivors at time t+n taking into account HIV/AIDS.
- ii) Assumed age-specific fertility rates during the period, t, t+n are then applied to the projected number of women in the reproductive age group during the period t, t+n to estimate the number persons by sex aged 0-4 at time t+n. This is further adjusted for mortality (using appropriate survival ratios derived from a life table).
- iii) Projected number of net migration is then added or subtracted from each age-sex group based on an estimated age-sex distribution of net migrants.

### 3.1.2 Regional Projections

The statistical regions populations were projected by fitting a geometric curve to the census populations of 2002 as follows.

$$P_t = P_0 e^{rt}$$

where

$P_t$  is the projected population of the statistical region in 2002, 2003... 2017.

$P_0$  is the population of the statistical region in September 2002

$r$  is the average growth rate between 1991 and 2002.

$t$  is the interval either between 1991 and 2002

It was assumed that the annual growth rate between time t and t+n would be the same as the average annual growth rate between January 1991 and September 2002 for each of the regions. To ensure that the regions add up to the national value, prorating was used.

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\* The version used was V3.12 developed by the Futures Group.

### **3.1.3 District and Sub-county Projections**

For the districts, the method used for the statistical regions was used and to ensure that the district totals add up to the region value and subsequently the national level, prorating was done. At the sub county level, the ratio method was used making the assumption that the proportion of the district population that lived in a given sub county at the census time remained constant through out the projection period.

The same criteria used for the sub county projections was for the special interest age groups except for a few like the women of reproductive age group these were done using the SPECTRUM.

## **3.2 Projection Assumptions**

The assumptions about future fertility, mortality, and net migration as well as HIV prevalence that drive the projections are based on analysis of historical trends in these components of population change. Note that projecting HIV prevalence, which is then incorporated into the projections involves a separate methodology. Stover Futures group describes the detailed methodology of incorporating the impact of HIV/AIDS.

Preston et al (2001) describes the projection of the mortality component for any age group except for the youngest and oldest. Preston et al (2001) also describes the projection of the fertility component (i.e. those aged 0-4 in a five-year age group projection) at time  $t+n$ . Since not all the births will survive to the end of the projection interval, the projected number in the youngest age group by sex is obtained differently from the other age groups.

### **3.2.1 Base Population**

The start year of the projections is 1991 while the terminal year is 2017. The base population of the projections is the number of persons enumerated as of the 1991 Population and Housing Census adjusted to mid-year; that is from 11<sup>th</sup> January to 1<sup>st</sup> July 1991.

Choice of 1991 as the base year instead of the most current census was based on the fact that the software used for the projections when taking account of the HIV epidemic assumes that in the base year there are zero HIV positive cases and therefore HIV has no impact on the population. And this is not true for Uganda because in 2002 HIV had already affected the population. To avoid

this situation, 1991 was considered because HIV had not yet started having a significant impact on the population.

### **3.2.2 Sex ratio at birth**

Vital registration provides the most appropriate source of information on sex ratio at birth. As noted in chapter 2, the coverage of vital registration in Uganda is still very limited. The UDHS 2006 estimated the sex ratio at birth was estimated at 102.6 males per females, and this was assumed to remain so through out the projection period.

### **3.2.3 Net Migration**

Where as the Population and Housing Census has fairly reliable information about migration into Uganda. There is no reliable source of information about migration out of Uganda. It is therefore not possible to ascertain the net effect of migration on the population

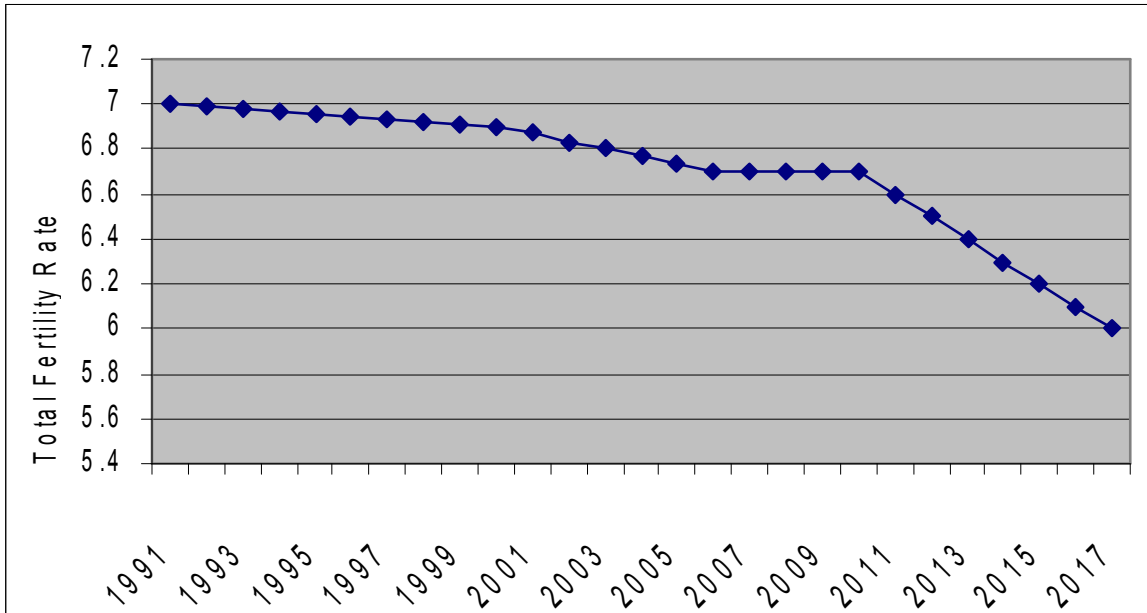
In the absence net migration data, assumptions about net migration were based on estimates by the United Nations for Uganda. The United Nations estimated net migration during the period 1995-2000 as a net loss of 9,000. However, this figure was not broken down by age and sex. Considering that the only available data is not disaggregated by sex, which is a requirement for the values to be used in the component projections, and considering that the value is very small, it was deemed appropriate to regard the net migration as zero. This is further strengthened by the fact that the annual net international movement across gazetted border posts is less than 50,000 persons annually for the past 5 years.

### **3.2.4 Fertility**

The 2002 census showed that fertility in Uganda has remained fairly constant for over 3 decades. However, the UDHS of 2006 showed that a decline was beginning to be realized. It was assumed that the decrease in total fertility rates (TFR) would continue till the end of the projection period. The TFR was therefore assumed to decline from 7.0 in 1991 to 6.7 in 2006, and remain constant until 2010 and then steadily declined to 6.0 in 2017. (See figure 5A).



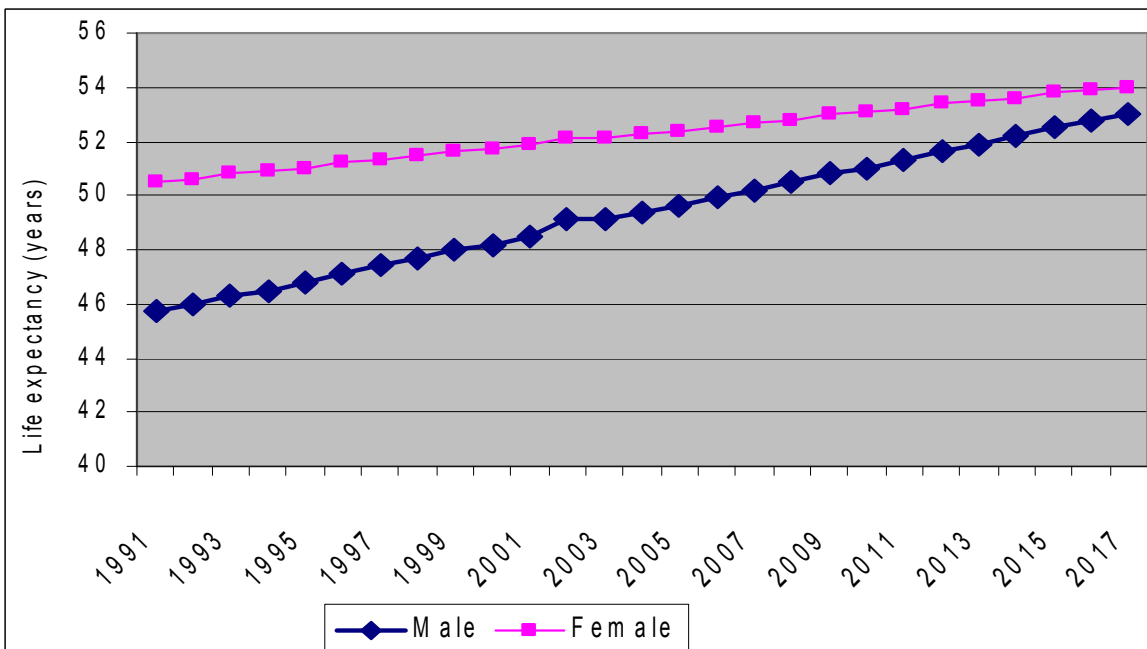
**Figure 5A: Fertility assumption made**



### 3.2.5 Mortality

For purposes of population projections, life expectancy at birth is used as a measure of mortality. The life expectancy at birth was projected to increase from 50.5 for females and 45.7 for males in 1991 to 54 and 53 in 2017 respectively. This was based on the fact that the UDHS 2006 had shown improvement in infant and child mortality. (See figure 5B).

**Figure 5B: Mortality assumption made**



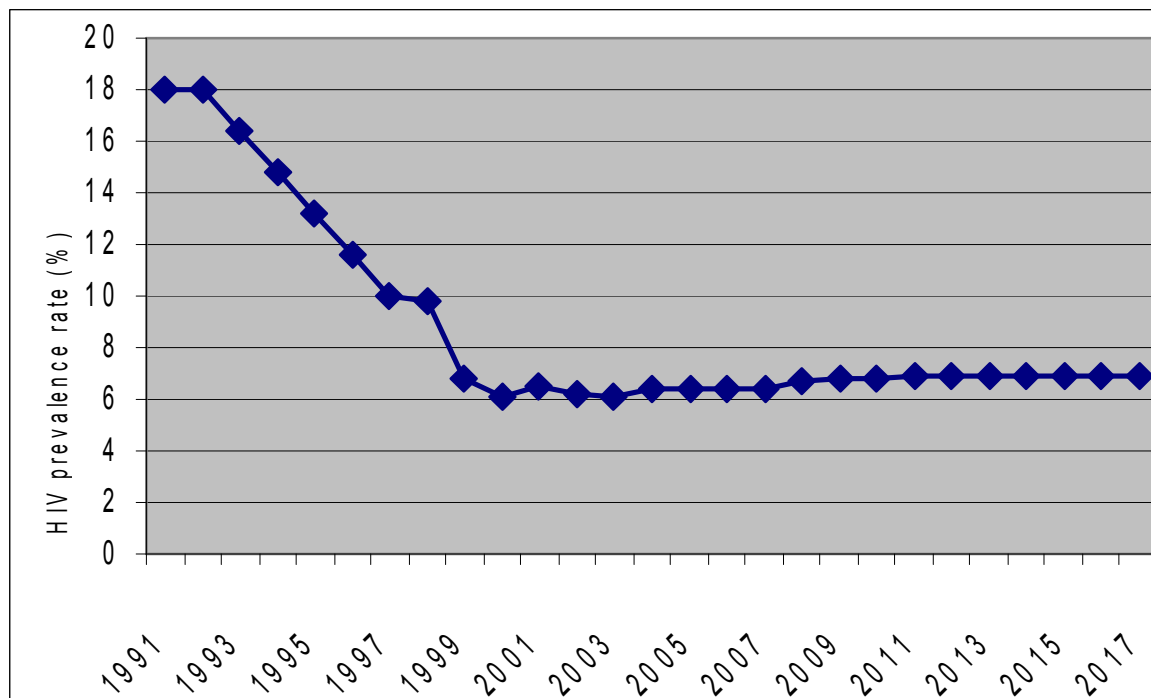
### 3.3 Projection Scenarios

Since no one can predict the future population of any country with absolute certainty, and therefore in accordance with conventional practice, different scenarios embodying different sets of assumptions are developed to derive the projections. The assumptions were developed based on analyses of historical demographic trends in the country with regard to fertility, mortality and net international migration, which were then used to project separately into the future resulting in two series of projections namely high and low variant projection scenarios, with the major variation being in the assumptions about HIV/AIDS.

#### 3.3.1 Low variant

The Low variant is essentially an AIDS impact scenario. It explicitly included HIV/AIDS in the projections. The prevalence rates from the sentinel sites were used up to 2003 showing a declining rate and from 2004, a prevalence rate of 6.4 was assumed to be constant up to 2007 from them the projected prevalence was used as assumed constant from 2011 to 2017. Given the current roll out of antiretroviral therapy on a large scale it is expected that they would initially increase HIV prevalence as new infections will still occur and as those already infected live longer if on antiretroviral therapy. (See figure 5C).

**Figure 5C: HIV/AIDS assumption made**



### **3.3.2 High variant**

The fertility and mortality assumptions are the same as those in the low variant except that there is no HIV incorporated into the projection so there we can clearly isolate the impact of the HIV epidemic on the population.

### **3.4 Model Life tables**

A model life table is required to project the number of survivors from time  $t$  to  $t+n$  based on life table survivorship function. For both variants, the model life table that best fit Uganda's estimated life expectancies at birth as well as infant mortality rates for the base year of the projection was the UN East Asia pattern and hence was used for the projections. This model life table is characterized by high male death rates at older ages relative to their death rates at younger ages and very high sex ratios of mortality at the older ages (UN, 1982).

However, conventional model life tables including the Coale-Demeny Regional (1983), UN (1982), and Brass standard life tables (1968) do not take into account the "hump" described above because these standard mortality schedules were developed prior to the HIV/AIDS epidemic. SPECTRUM has got an AIDS Impact Module (AIM) that is inbuilt in the software, using AIM together with an appropriate life table incorporates HIV in the projections.

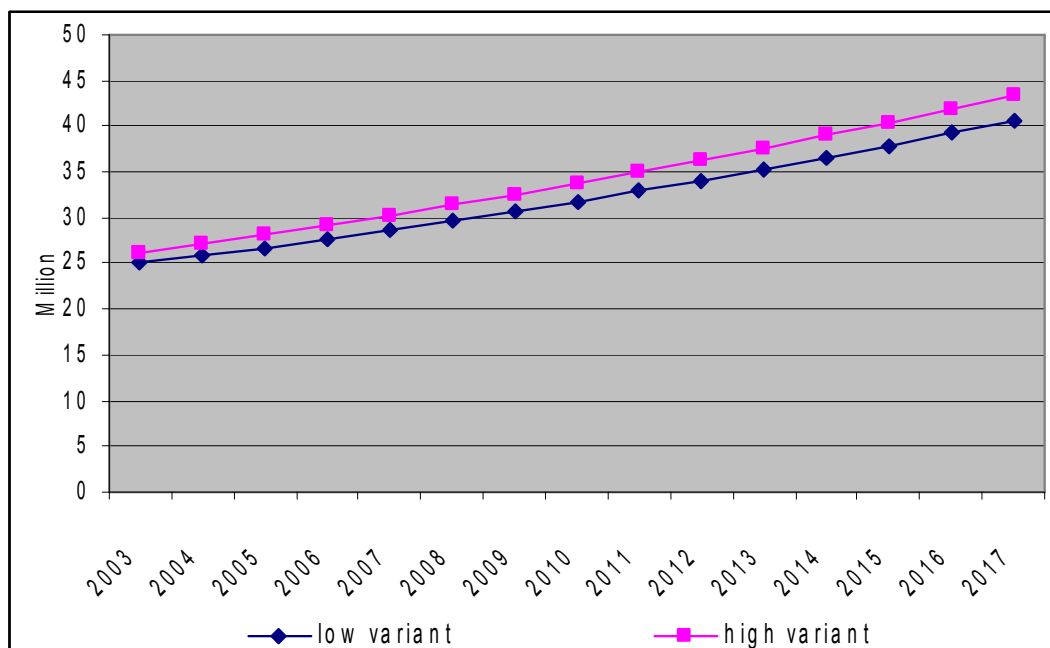
## CHAPTER 4: PROJECTION RESULTS

### 4.1 Population size and Dynamics

#### 4.1.1 Population size

Figure 6 shows the projected mid year population size in millions for each year from 2003 to 2017. The population of Uganda is estimated to increase from 28.6 million in 2007 to 40.6 million in 2017 in the Low Variant, while in the High Variant it is estimated to increase from 30.2 million in 2007 to 43.4 million in 2017.

**Figure 6: Annual mid Year Population Size**



#### 4.1.2 Population Dynamics

##### a) Births

The total Annual births are projected to increase from 1.4 million in 2007 to 1.9 million in 2017. However, the Crude Birth Rate (CBR) is expected to reduce from 48% to 45%. (See Appendix table 1).

##### b) Deaths

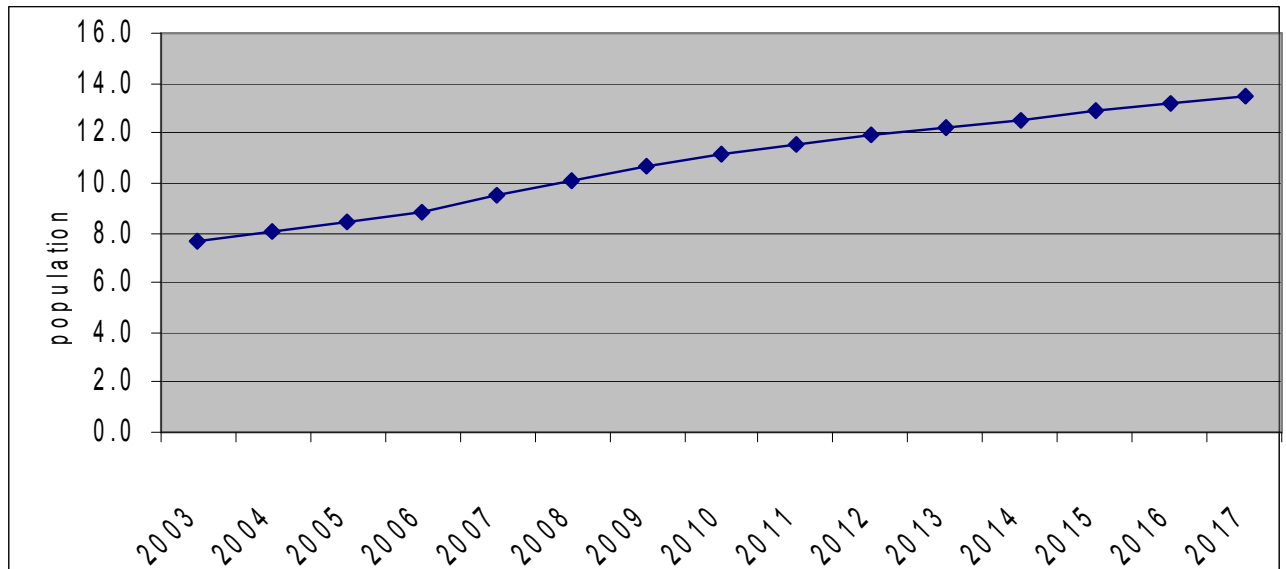
The total number of deaths is projected to increase from 459,000 in 2007 to 531,000 in 2017. Although the numbers of death are increasing, the Crude Death Rate (CDR) is projected to

decrease from approximately 16.1 per thousand persons in 2007 to approximately 13.1 per thousand persons in 2017. Correspondingly the Infant Mortality Rate (IMR) is projected to decrease slightly from an estimated 90 per thousand live births in 2007 to about 82.7 per thousand in 2017. The life expectancy is consequently projected to increase from 43.3 years in 2007 to 47.9 years in 2017.

### C) Population Growth Rate

The size and structure of a country's population are primarily driven by the components of population change (fertility, mortality and net migration). Figure 7 shows the growth of the population in absolute numbers i.e the difference between births and Death. The figure therefore indicates that the total is actually increasing every year and the growth is bigger for each passing year.

**Figure 7: Population growth in absolute numbers, (100,000s)**



The annual rate of population growth provides an overall measure of the balance among these components at an aggregate level. The annual population growth rate is projected to increase from an estimated 3.3% per annum in 2007 to 3.5% per annum in 2011 and then starts to decline back to 3.3% per annum in 2017.

### 4.2 School Age Going Population

Population growth rates also have implications for the future size of the school going age population. If historical trends of the components of population change were to continue, and taking into account the impact of HIV/AIDS epidemic, the size of the primary school age going

population (6-12 years) in Uganda would increase from an estimated 6.3 million in 2007 to approximately 8.9 million in 2017 and the size of the secondary school-going age population (13-19 years) in Uganda would increase from an estimated 4.7 million in 2007 to approximately 6.6 million in 2017.

#### **4.3 Population youthfulness and ageing**

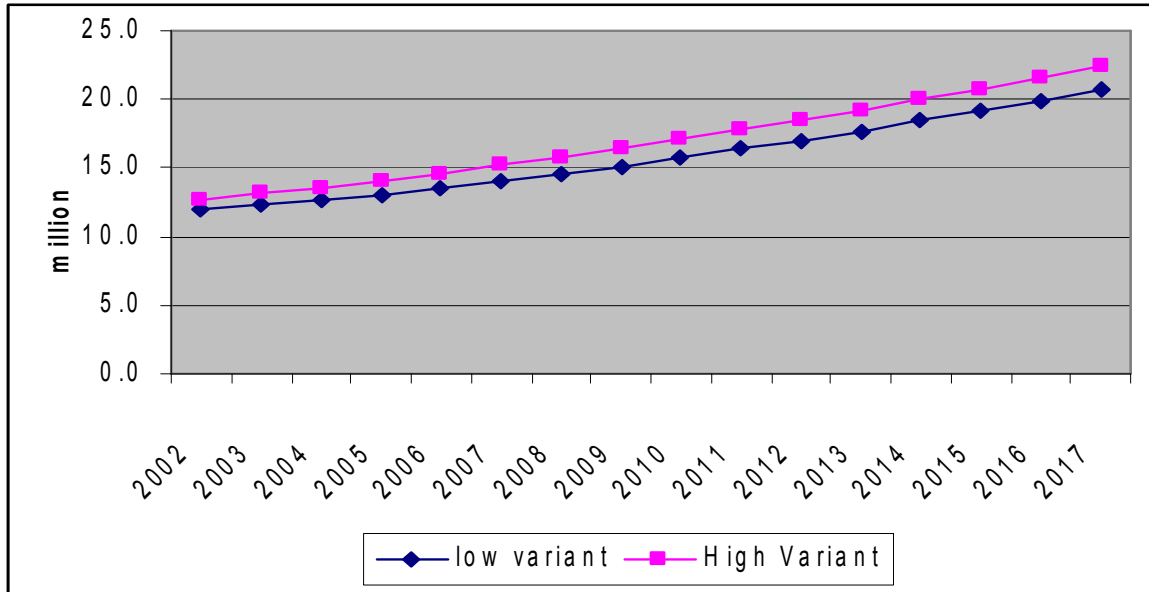
One of the summary indicators of the youthfulness and population ageing is the median age of the population. According to Shryock, Siegel and Associates (1976), populations with median ages below 20 years may be described as 'young', while those with median ages of 30 years or above as 'old' and those with median ages of 20 to 29 years as 'intermediate' age (Udjo, 2006). Using the above criteria the population of Uganda is projected to be youthful throughout the projection period with or without AIDS (See Appendix 1). The projected median age of the population by 2017 is 15 years and this value is typical of populations with high but slow decline in fertility.

Older persons in Uganda are those persons aged 60 years or more. It is projected that the size of the Older persons (persons 60 years and older) in Uganda would increase from an estimated 1.29 million in 2007 to approximately 1.83 million in 2017 (Low variant).

#### **4.4 Changes in the Working Age Population**

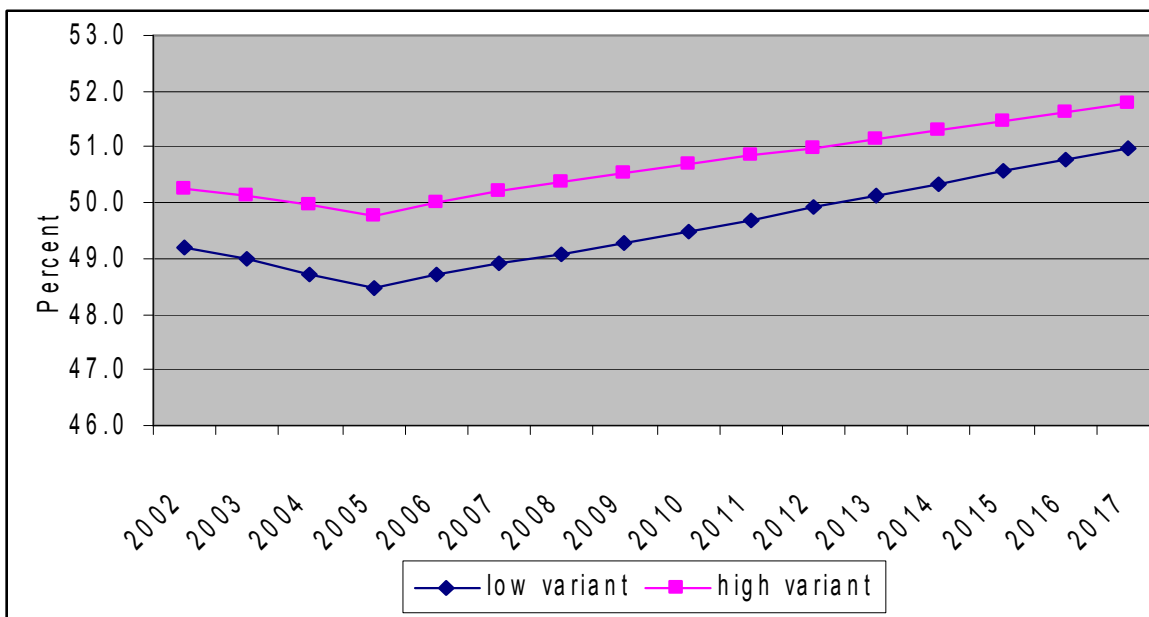
Projections of the size of the working age population (aged 14-64 years) provide an indication of the potential size of the future labour force and hence a rough indication of the future number of additional jobs that need to be created given the current stock of jobs. A better indication can be obtained by projecting the labour force if other information such as labour force participation rates is available. The size of the working age population in Uganda is projected to increase steadily in absolute terms from about 14 million in 2007 to about 21 million in 2017 (Figure 8).

**Figure 8: Annual projected Working –age Population (14-64 years), 2003-17**



Although the absolute size of the working age population is projected to continue to increase, with slightly declining fertility the number of persons entering the working age population would decline and hence a subsequent decrease in the annual growth rates of the size of the working age population. It is projected that given the HIV/AIDS epidemic with the introduction of ARVs there would be a reduction in the number of AIDS-related deaths among persons in the working age group and therefore an increase in the working age population. Otherwise it would reduce as observed in the period before the introduction of ARVs i.e before 2006. (Figure 9).

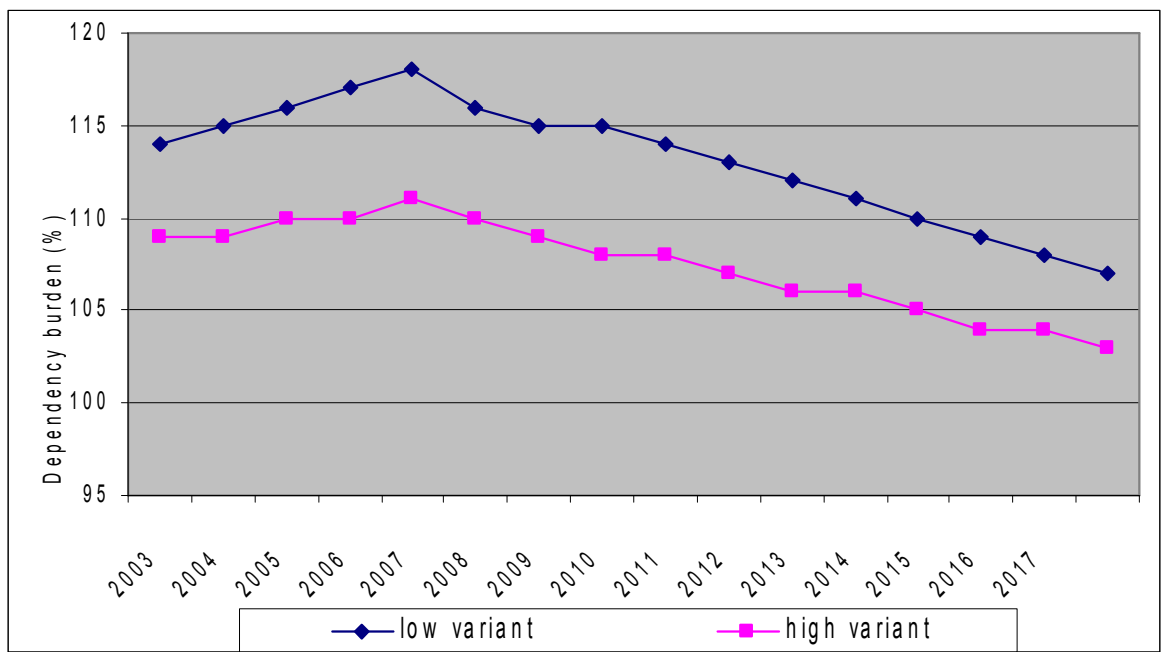
**Figure 9: Projected Proportion of the Population that is of Working Age (14-64 years)**



#### 4.5 Dependency burden

The age dependency burden is a proxy measure for economic dependence. It is defined as the ratio of persons less than 15 years old plus persons 65 years and older to the number of persons in the working age group [15-64 years]. As seen in figure 10, if the past trends in fertility and mortality continued, it is projected that the number of dependants would decrease from 116 for every 100 working persons in 2007 to 107 dependants for every 100 persons of working age in 2017 without AIDS. However in an HIV/AIDS free environment the dependency burden is generally lower (Figure 10).

**Figure 10: Projected Dependency burden**





## CHAPTER 5: IMPACT OF HIV EPIDEMIC ON THE POPULATION

The fertility, mortality and migration assumptions are similar for both low and high variants. Thus, the difference in the two scenarios is due to a difference in HIV/AIDS assumptions. Therefore, the High variant projection does not explicitly take into account HIV/AIDS in the assumptions while the low variant projections do. Therefore, the low variant scenario is considered the more probable of the two variant projections. However, by comparing the results of the low variant projections with those of the High variants, one is able to examine the impact of HIV/AIDS on the future population size and structure.

### 5.1 Impact of HIV/AIDS

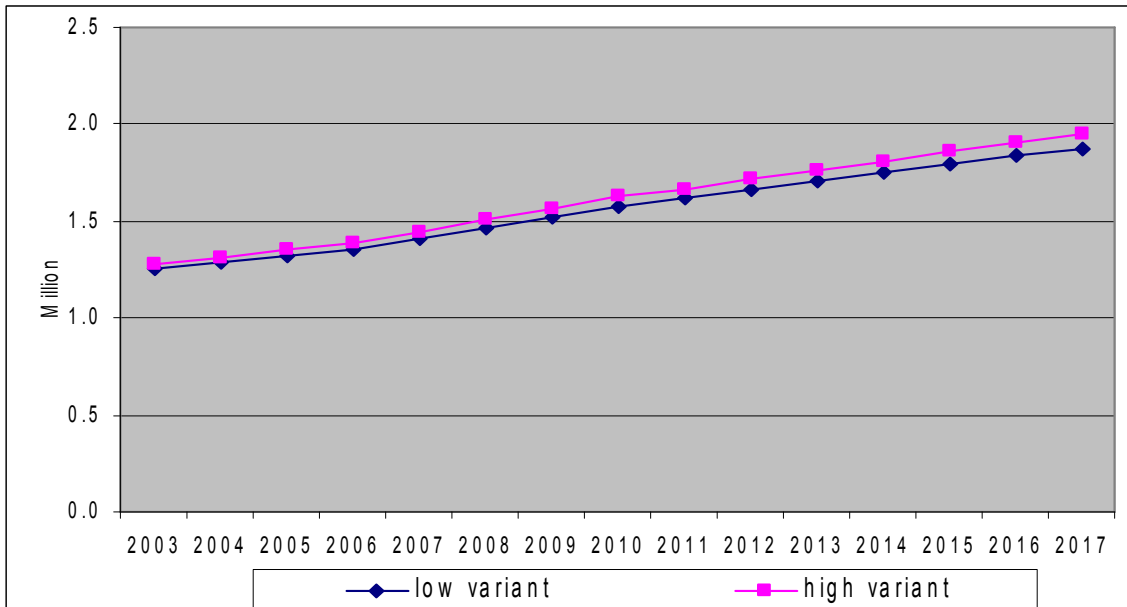
The impact of AIDS on the projected size of the population may be examined by comparing the high and the Low Variant projections. On this basis, AIDS is projected to reduce the size of the population of Uganda's population by about 7percent by 2017. Within the different selected age groups, its observed that HIV/AIDS will lead to a 7 percent reduction as shown in table 4 below. The reduction is however small in the births. HIV/AIDS is projected to increase the number of annual deaths by 13 percent in 2017.

**Table 4: Illustration of the impact of HIV/AIDS on different age groups**

	2017 Population		
	Low variant	High variant	percent difference
Total Population	40,578,748	43,380,306	6.5
Births	1,877,257	1,953,012	3.9
Deaths	530,962	468,691	-13.3
Children aged 5 years	1,411,978	1,509,461	6.5
Primary School going (6-12 years)	8,886,746	9,500,287	6.5
Teenagers (13-19 years)	6,614,336	7,070,990	6.5
Children (<18 years)	22,764,700	24,336,352	6.5
Adults (18+ years)	17,814,100	19,043,954	6.5
Youth (18-30 years)	9,089,600	9,717,189	6.5
Working age (14-64 years)	24,550,143	26,245,085	6.5
Older persons (60+ years)	1,826,044	1,952,114	6.5

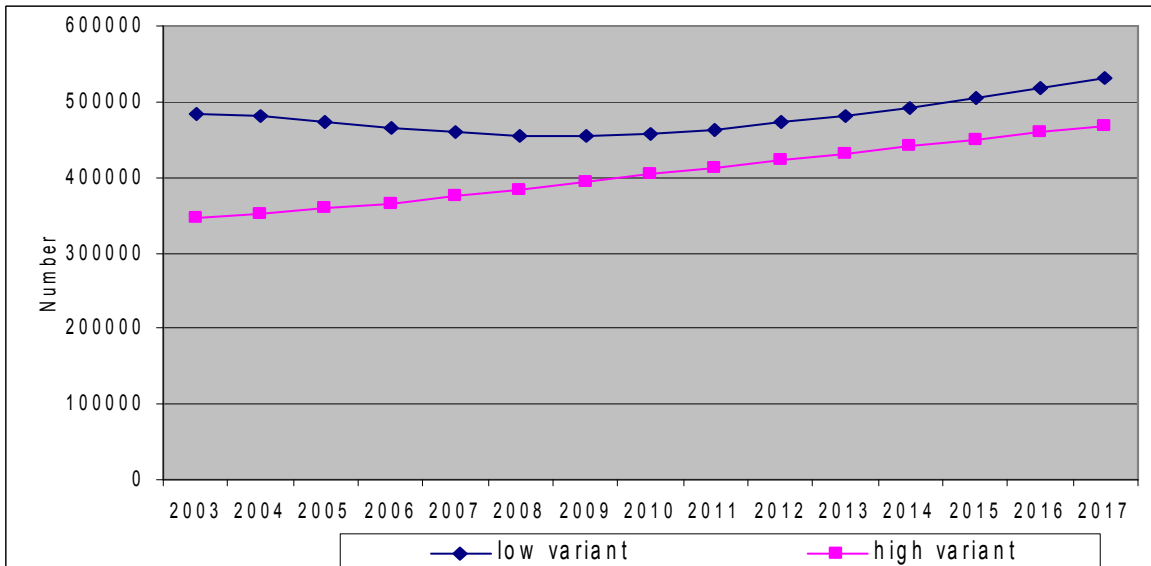
Figure 11 shows that the projected annual births are increasing over the projection period and the gap between the high and low variant is very small. This therefore indicates that HIV seems not to have a significant impact on the births.

**Figure 11: Projected Annual Births**



More deaths are recorded in the low variant than in the high variant due to HIV/AIDS, it is also observed that the gap between the low and high variant is narrowing as seen in figure 12 probably due to the introduction of ARVs.

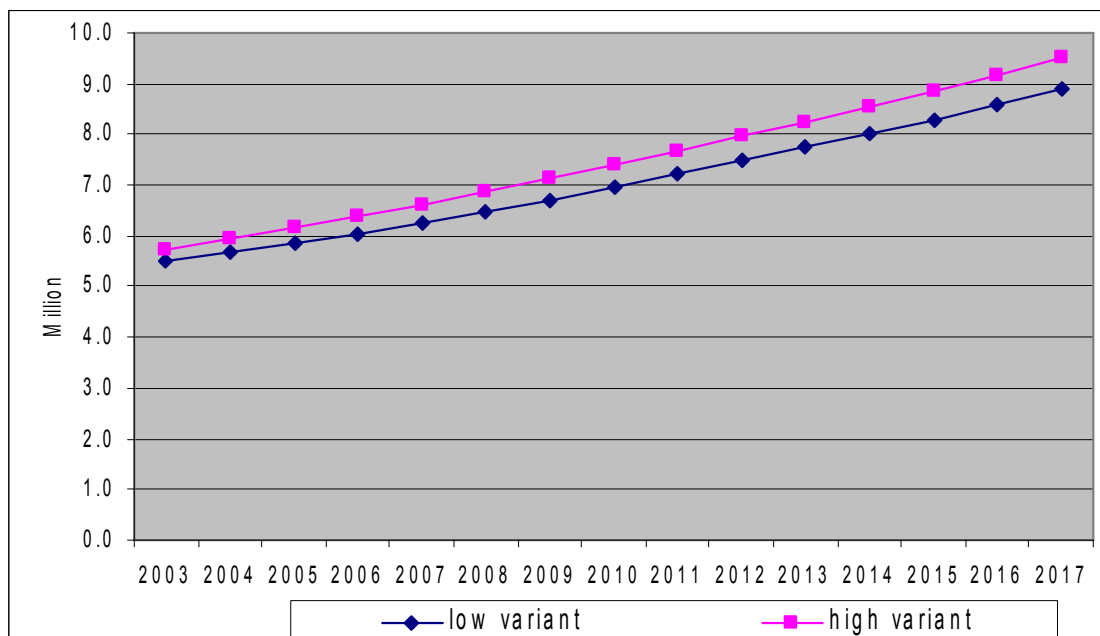
**Figure 12: Projected Annual Deaths**



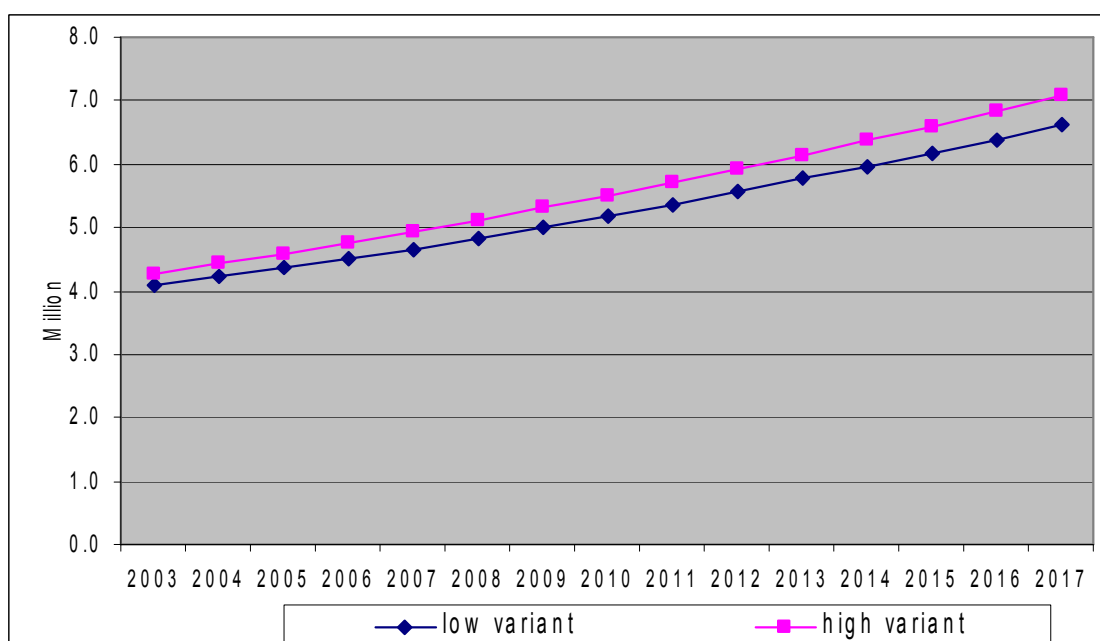
The pattern for projected figures of school age going population is the same (i.e increasing ) over the projection period irrespective of the existence of HIV/AIDS. Although the actual numbers are

higher in the case where there is no HIV/AIDS and vice versa implying that HIV/AIDS actually has an impact on the number of school going children. Figure 13 shows the trend for primary school age going and figure 14 shows that for the secondary school age going.

**Figure 13: Trend of Projected Primary school going population**



**Figure 14: Trend of Projected secondary school going population**



The impact of the HIV epidemic on the older person's population was also examined. In terms of proportions, it is projected that without HIV the proportional change from 2007 to 2017 is 0.2% while if there is HIV the change is 0.3. This therefore implies that although, declining fertility is mainly responsible for the increase in population ageing in absolute and proportionate terms, the impact of HIV/AIDS epidemic is projected to accelerate the ageing process.

## **5.2 CONCLUSION**

Population estimates are essential because they are used as denominators in most of the indicators in monitoring progress in the PEAP, Millennium Development Goals etc. The results from the projections given in this study especially those from the Low variant projections relating to overall population size can be used as denominators for computing various kinds of indicators as they require up to date population figures. The projections also provide projected infant mortality rates on the basis of certain mortality assumptions.

The projections show: a steady increase in population despite the HIV epidemic, the population growth rate is high but decreasing slowly (approximately 24 million in mid 2002 to about 41 million in 2017), increasing size of the school going population, the working age population as well as the population of the elderly taking into account AIDS.

In making comparisons between the two scenarios (with HIV and without HIV), it is observed that the HIV epidemic has an effect on the size of the different population groups. However this effect is not very big.

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## APPENDICES