Working Life Tables for South Africa, 1996-2001

Martin E. Palamuleni
Population Training and Research Unit, North West University
Mafikeng Campus, Private Bag X2046, Mmabatho 2735, South Africa
Email: palamulenim@uniwest.ac.za

Abstract

This paper presents the results of the construction of a working life tables for males and females in South Africa using the 1996 and 2001 population censuses. The main objective of the paper is to illustrate the use of life table analysis in the examination of the labour force using South African data. The study indicates that based on the 1996 census a South African male who survives to age 15 is expected to live 40.9 years, out of which 35.3 years are expected to be spent in active status and the remaining 5.3 years in inactive years. Similar values for South African females are 49.9 years, 37.9 years and 12 years, respectively. Using 2001 census the study indicates that a South African male who survives to age 15 was expected to live 43.9 years of which 36 years will be in active and 8 years will be inactive whereas a South African female was expected to live 50 years of which 34 years will be active and 16 years will be inactive. It was estimated that out of the total number of males who left the working population in 1996, 50 percent left because of death and another 50 percent left for other reasons other than death. The corresponding figures for females are 28 percent and 62 percent respectively. In 2001, 64 percent of the males left the labour force due to deaths whereas 36 percent left due to other causes. Similar figures for females are 45 percent and 55 percent respectively. These figures suggest an increased proportion of men and women are leaving the labour force due to deaths. This means that mortality takes a heavy toll of the seemingly short economically active life. Probably, this is a reflection of the devastating impact of HIV/AIDS on the working population.

Key words: labour force, unemployment, life tables, working life tables, South Africa

Introduction

The life table is one of the most powerful tools in demography (Burch, 2003; Shyrock and Siegel, 1973). Although life tables are traditionally designed to measure mortality experience of a population, various scientists employ them in a variety of ways. For instance, life tables are used by health workers, demographers, actuaries, and many others in studies of longevity, fertility, migration, and population growth, as well as in making projections of population size and characteristics and in studies of widowhood, orphan hood, length of married life, length of working life, and length of disability free life. In its simplest form, the entire life table is generated from age-specific mortality rates. In recent times, there has been an interest in applying the life table approach to study various aspects of the demography of South Africa. Mba (2003) has used life tables to analyse the impact of external causes of death on expectation of life at birth, whereas Bah (2005) has employed it to study the multiple causes of deaths in the country. In this paper we use the life table concept in the study of the labour force dynamics in South Africa. In particular, the main objective of this paper is to calculate working life tables for males and females in South Africa in 1996 and 2001[1].

Among other functions, working life tables can be used to study labour force attrition and replacement (United Nations, 1971). These tables can help make assessment of future trends of labour force more accurately; as such they are useful in making assumptions for the economically active population especially in the extreme age groups which are the most unstable. Therefore, the information from working life tables is very useful for manpower planners and policy makers in planning for labour force replacement and designing appropriate policies for retirement age respectively.

Employment situation in South Africa

Unemployment in South Africa is surprisingly high and rising. Unemployment rate has increased from 31% in 1993 to 38% in 1998

[1] Working life tables are also known as "tables of working life". In this study the two terms are used interchangeably.

and to 42% in 2002 on the broad definition[2]. Similar rates for the narrow definition are 13%, 26% and 31% respectively (Kingdon and Knight, 2002). Estimates based on 1996 and 2001 population censuses also show a similar trend. Other studies favour the use of the broad definition because it is conclusive (Kingdon and Knight, 2002). Consequently, this study uses the broad definition of unemployment. Applying the broad definition, unemployment rate has increased from 34% in 1996 to 49% in 2001.

Several factors have been suggested as influencing high and rising unemployment in South Africa (Kingdon and Knight, 2002). These include the aftermath of the discriminatory policies of the apartheid regime to the negative consequences of globalization (Department of Social Development, 2001). However, one thing that comes out clearly is that to understand the nature and patterns of unemployment in South Africa one has to appreciate the social and economic history of the country.

The high unemployment in South Africa could be understood from a historical perspective. For instance, as a result of the 1913 and 1936 Land Acts, African ownership was restricted to only 13% of South Africa's land area, thus considerably limiting the opportunities for African farming and creating the migrant labour system. Shortly after taking power in 1948, the National Party government passed the Group Areas Act, enforcing separate residential areas, and the Population Registration Act. In 1953 came the Bantu Education Act, providing "separate education, with a built-in inequality". This was followed by the 1956 Industrial Conciliation Act, which "included the principle of job reservation, that is special jobs reserved for whites."

As Davies *et al*. (1984:31) have written, 47% of Africans lived in Bantustans in 1970 and the majority of the latter, "were unemployed proletarians, forced by apartheid to live there, rather than peasants reproducing themselves in rural production." Furthermore, apartheid limited "the black petty bourgeoisie" and structural changes in the economy had resulted in more unemployment, so that in the early 1980s this number had risen to around three million because of mass

[2] The narrow definition counts as unemployed only those jobless persons who actively searched for work in the previous four weeks while the broad definition also includes those that say they want work, even if they did not actively search.

expulsions to the Bantustans and agricultural and industrial mechanisation (Davies *et al*.,1984:30). According to Brown (1987), the mechanisation of agriculture contributed to soaring unemployment, which in turn prompted the establishment of a national family planning programme in 1974. Unemployment remains a matter of serious concern in South Africa - for its effects on economic welfare, production, erosion of human capital, social exclusion, crime, and social instability.

Data Sources and Methods

The data for this analysis have been taken from the results of the 1996 and 2001 census data. Two sets of data have been exploited in this paper, namely mortality and economic activity data. First, for mortality data, we have relied on the 1996 and 2001 life tables South African life tables. The 1996 life tables were published by Statistics South Africa (2000) whereas the 2001 were supplied by Sulaiman Bah[3]. In general terms, the life tables utilised in this study are based on the responses to the question "deaths in the household in the last 12 months". The following is how the question was phrased in the 2001 census:

- (H-31) Has any member of this household died in the past 12 months, i.e. between 10 October 2000 and 10 October 2001? If YES, how many?
- If YES to H-30 What was the first name of the deceased?
- What was the month and year of death?
- What is the sex of the deceased?
- What was the age in years at death?

Studies reveal that these data are distorted in many ways that they cannot be relied at face value (Statistics South Africa, 2000; Dorrington, Moultrie and Timaeus, 2004). Some of the problems encountered include wrongful wording, underreporting of deaths, age

[3] Dr Sulaiman Bah is a Statistician/Demographer currently working with MEDUSA. He was previously working for Statistics South Africa in the Vital Statistics Section. He has written extensively on mortality issues including life tables in South Africa.

misstatements, (Dorrington, Moultrie and Timaeus, 2004) As such the final life tables calculated are based on appropriate adjustments[4].

Second, in both the 1996 and 2001 South African population censuses collected some information on economic activity for a person aged 15 years and over. The concepts and definitions employed in collecting such data on the economically active population were based on recommendations of the United Nations secretariat, with some modifications to suit local conditions. From the point of view of this study, the population aged 15 years and over was divided into two broad categories as follows: those who were economically active and those who were economically inactive.

According to the 1996 census, the economically active population is generally understood to comprise all those persons who contribute to the supply of labour for the production of economic goods and services including not only those employed at the time of the census or survey, but also those unemployed but available for work. In South Africa, economically active person was defined as a person aged 15 years or more who is either employed or unemployed but who is looking for work. On the one hand, an employed person refers to "a person who works for pay, profit or family gain"; on the other hand, employment means working for *pay, profit or family gain*. The term covers *formal work* for a salary or wage in a business, or a business establishment which has a value added tax (VAT) number, as well as *informal work* such as making things for sale or selling things or rendering a service in an establishment which has no VAT number. The term (employment) also covers work on a farm or the land, whether for a wage or as part of the household's farming activities. In so far as working life tables are concerned the economically active population defined above is taken as equivalent to the working population.

Construction of the working life tables

The data summarized in the preceding section were used to estimate working life tables for South Africa under certain conditions. The procedure followed in this paper is based on the classical method

[4] Those interested in these errors and how adjustments was done should refer to relevant reports, Statistics South Africa (2002) and Dorrington, Moultrie and Timaeus (2004).

of calculating ordinary working life tables and involves the following three steps. First, life tables were obtained. Second, labour force participation rates (also known as Age specific activity rates) were calculated. These are denoted as ${}_nn_x$. This step involves the calculation of the proportion of the working population to the total population in various age groups from age 15 years onwards. Third, appropriate functions of the estimated life tables were combined with the labour force participation rates to derive working life tables.

The approach described above suggests that the construction of the working life table is essentially based on the working population and labour force participation rates. These rates are obtained by dividing the working population by the total population in each age group. Table 1 below illustrates the calculation of labour force participation rates using data obtained from 2001 census.

Unfortunately, not all entrants to the labour force enter at the same age. If the working population at each age group is based on the actual proportion working at that group, the man-years of work per generation may be rightly calculated, and for some purposes such as international comparative studies this may be enough. However, for purposes of estimating the expected years of working life and retirement at each age group this actual proportion cannot be used. The reason for this is that at age below that at which the last entrants enter, the total working life of the generation includes work of those yet to enter. This problem may be overcome by employing at the age groups when all entrants have not yet entered, not the actual proportion working, but the maximum value of this proportion attained in the other age groups. This hypothetical proportion may be interpreted as the proportion who have entered or are training for employment. These are denoted ${}_nW^1_x$ as in Table 1 below.

The hypothetical proportions relate to the number of working person who have reached their xth birthday but have not yet reached their x+5th birthday. For the purpose of computing the working life table, it is essential to obtain proportions which can be related to the xth birth day. These proportions are calculated using the following relationship:

$${}_nW_x = ½ ({}_nW^1_x + {}_nW^1_{x-n})$$

Table 1 Actual and hypothetical percentage of the working population for South Africa, 2001

Male					
Age, x	Population	Working	${}_nn_x$	${}_nW^1_x$	${}_nW_x$
(1)	(2)	(3)	(4) =(3)/(2)*100	(5)	(6)
15-19	2453065	338653	13.8	86.2	86.2
20-24	2099286	1238629	59.0	86.2	86.2
25-29	1899117	1558537	82.1	86.2	86.2
30-34	1594489	1370459	85.9	86.2	86.2
35-39	1441526	1242485	86.2	86.2	86.2
40-44	1233642	1045915	84.8	84.8	85.5
45-49	967605	793817	82.0	82.0	83.4
50-54	769485	575620	74.8	74.8	78.4
55-59	552319	345728	62.6	62.6	68.7
60-64	444526	179681	40.4	40.4	51.5
65+	74817	16926	22.6	22.6	31.5
Female					
Age, x	Population	Working	${}_nn_x$	${}_nW^1_x$	${}_nW_x$
(1)	(2)	(3)	(4) =(3)/(2)*100	(5)	(6)
15-19	2528648	356336	14.1	70.7	70.7
20-24	2195235	1173591	53.5	70.7	70.7
25-29	2035819	1423065	69.9	70.7	70.7
30-34	1746409	1234636	70.7	70.7	70.7
35-39	1630255	1130728	69.4	86.2	70.2
40-44	1385825	923766	66.7	66.7	68.0
45-49	1119779	686981	61.3	61.3	64.0
50-54	868534	436605	50.3	50.3	55.8
55-59	652941	241802	37.0	37.0	43.7
60-64	620775	86306	13.9	13.9	25.5
65+	113034	7559	6.7	6.7	10.3

The ${}_nW_x$ values, together with the l_x, ${}_nL_x$ and e_x values of the ordinary life tables, form the basis of computing the various functions of a working life table. The calculated working life tables for South Africa by sex for 1996 and 2001 are given in Tables 2, 3, 4 and 5 below.

The derivation and meaning of the functions of the various columns of a working life table are described in Appendix A.

The procedure described above has been found appropriate for the construction of ordinary working life tables and a number of researchers have employed this approach (Kpedepo, 1969a, 1969b; Iro, 1976; Krishnan, 1977; Misiku, 1993). Other researchers have subsequently expanded the approach and come up with methodologies to generate generalised multiple-decrement tables (Schoen and Woodrow, 1988; Schoen, 1988). Unfortunately multiple-decrement tables require data that are not readily available especially in developing countries. As such only the basic work life table for South Africa has been calculated in this study.

The working life tables constructed using the approach described in the preceding paragraphs are based on the following assumptions:

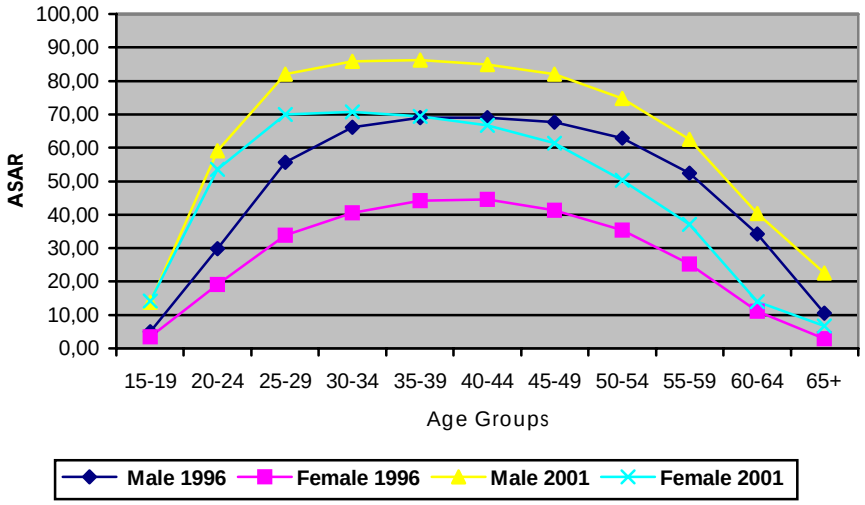
1. a uni-modal curve of labour-force participation rates
2. no withdrawals from the labour force before the age of maximum participation (except for deaths)
3. no new entrants to the Labour force after that maximum age.
4. the age at which people retire are independent of the ages at which they enter the labour force.
5. the mortality rate for the economically active population is the same as that of the inactive population. In other words, there is no differential in mortality due to labour force participation status.
6. the observed mortality and age-sex activity rates for both sexes will remain constant in the near future.

Results

According to the 2001 census there were 8706447 male and 7701378 female workers in South Africa. The crude activity rates (CAR) for males and females are computed as 64 and 52 percent, respectively. The results highlight that CAR of male is 12 percent point higher than CAR for female. Similar rates for 1996 were 53 for male and 54 for female.

Since crude activity rates are not meaningful, age specific activity rates were calculated and these are presented in Table 1 and Figure 1 below. The age pattern of both male and female activity rates is uni-modal. The age specific activity rates for males start from a low value in age group 15-19, then increase with rising age groups up to 35-39 declines gradually reaching a low value in age group 60-64. For females the age specific activity rates follow more or less the same pattern but reach a maximum in 30-34 age group. For all age groups, age specific activity rates for females are lower than those of males.

Figure 1 Age Specific Activity for South Africa, 1996 and 2001



The age pattern of activity rates described in the preceding paragraph contrast with studies in developed countries especially the United States of America which indicates a bi-modal pattern for females (Schoen and Woodrow, 1980). Furthermore, Shyrock and Siegel (1976:268) noted that "the construction of working life tables presents some special problems because of the more irregular age pattern of economic activity of women". These observations appear to have influenced researchers either to calculate working life tables for the male population only (Schoen and Woodrow, 1980;) or to publish the working life tables for each sex separately (Kpedepo, 1969a, 1969b)

The estimated working life tables for South Africa for 1996 and 2001 are presented in Tables 2 to 5 below. Table 2 shows the length of working life for males in South Africa in 1996. It is observed from the

table that the expectation of economically active life at age 15 for males was 35.3 years and it gradually decreased to 3.8 years in the last age group. Similarly, the expectation of economically active life at age 15 for females was 37.9 years and it gradually decreased to 3.7 years in the last age group (see Table 3). It is also clear from Table 2 that a South African male who survives to age 15 is expected to live 40.7 years, out of which 35.3 years are expected to be spent in active status and the remaining 5.3 years considered as inactive years. Similar values for females are 49.9, 37.9 and 12 years respectively.

Table 4 shows the length of working life for males in South Africa in 2001. It is observed from the table that the expectation of economically active life at age 15 for males was 34.5 years and it gradually decreased to 3.9 years in the last age group. It is also clear from the table that a South African male who survives to age 15 is expected to live 43.9 years, out of which 34.5 years are expected to be spent in active status and the remaining 9.4 years considered as inactive years.

In case of females, the expectation of economically active life at age 15 was 32.6 years and it gradually decreased to 3.6 years in the last age group (see Table 5). A South African female who survives to age 15 is expected to live 49.7 years, out of which 32.6 years are expected to be spent in active status and the remaining 17.1 years considered as inactive years. It can also be noted that the length of working life is higher in all age groups for males than females. This is because generally males have higher labour force participation rates than females and that is why they have longer length of working life.

Table 2 Abridged Working Life Table, South Africa, Males, 1996

Age	l_x	e_x	w_x	l^w_x	${}_nL^w_x$	T^w_x	e^w_x	e^{in}_x	${}_nS^w_x$	${}_nE_x$	${}_nd^w_x$	${}_nR^w_x$	${}_nr^w_x$
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
15-19	93160	40.7	69.1	64355	319230.8	2272231.8	35.3	5.3	1017	3.2	1017	0	
20-24	91688	36.3	69.1	63338	310981.0	1953001.0	30.8	5.4	2283	7.3	2283	0	
25-29	88383	32.5	69.1	61055	297529.4	1642020.0	26.9	5.6	3098	10.4	3098	0	
30-34	83899	29.1	69.1	57957	280611.8	1344490.6	23.2	5.9	3670	13.1	3670	0	
35-39	78587	25.9	69.1	54288	262241.8	1063878.7	19.6	6.3	3678	14.0	3678	0	
40-44	73262	22.6	69.1	50609	239556.5	801636.9	15.8	6.8	5396	22.5	4325	1071	4.5
45-49	66934	19.5	67.5	45213	206545.2	562080.5	12.4	7.1	7809	37.8	4942	2867	13.9
50-54	59379	16.7	63.0	37405	162490.5	355535.2	9.5	7.2	9813	60.4	5053	4760	29.3
55-59	50813	14.1	54.3	27592	110008.1	193044.8	7.0	7.1	11180	101.6	4712	6468	58.8
60-64	40983	11.9	40.0	16412	57639.7	83036.6	5.1	6.8	9768	169.5	2982	6786	117.7
65+	31597	9.7	21.0	6644	25396.9	25396.9	3.8	5.8	6644	261.6	1755	4889	192.5

Table 3 Abridged Working Life Table, South Africa, Females, 1996

Age	l_x	e_x	w_x	l^w_x	$_nL^w_x$	T^w_x	e^w_x	e^{in}_x	$_nS^w_x$	$_nE_x$	$_nd^w_x$	$_nR^w_x$	$_nr^w_x$
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
15-19	93999	49.9	44.5	41816	208159.7	1586605.3	37.9	12.0	368	1.8	368	0	
20-24	93171	45.4	44.5	41448	205358.2	1378445.6	33.3	12.1	752	3.7	752	0	
25-29	91480	41.2	44.5	40696	200800.7	1173087.3	28.8	12.3	1071	5.3	1071	0	
30-34	89073	37.2	44.5	39625	195069.8	972286.7	24.5	12.7	1222	6.3	1222	0	
35-39	86327	33.3	44.5	38403	188675.0	777216.9	20.2	13.1	1336	7.1	1336	0	
40-44	83323	29.4	44.5	37067	176852.3	588541.9	15.9	13.5	3393	19.2	1533	1860	10.5
45-49	79789	25.6	42.2	33674	153070.4	411689.6	12.2	13.4	6120	40.0	1739	4381	28.6
50-54	75382	22.0	36.6	27554	118203.7	258619.3	9.4	12.6	7827	66.2	1761	6066	51.3
55-59	69969	18.5	28.2	19727	78393.5	140415.6	7.1	11.3	8097	103.3	1759	6339	80.9
60-64	62538	15.4	18.6	11630	42309.3	62022.1	5.3	10.0	6336	149.8	1200	5136	121.4
65+	54256	12.3	9.8	5294	19712.7	19712.7	3.7	8.6	5294	268.5	806	4488	227.7

Table 4 Abridged Working Life Table, South Africa, Males, 2001

Age	l_x	e_x	w_x	l^w_x	${}_nL^w_x$	T^w_x	e^w_x	e^{in}_x	${}_nS^w_x$	${}_nE_x$	${}_nd^w_x$	${}_nR^w_x$	${}_nr^w_x$
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
15-19	89963	43.9	86.0	77368	384140.4	2782936.3	36.0	7.9	1079	2.8	1079	0	
20-24	88707	39.5	86.0	76288	375329.1	2398795.8	31.4	8.0	2445	6.5	2445	0	
25-29	85864	35.7	86.0	73843	358900.8	2023466.7	27.4	8.3	4126	11.5	4126	0	
30-34	81066	32.6	86.0	69717	335731.2	1664566.0	23.9	8.8	5142	15.3	5142	0	
35-39	75088	30.0	86.0	64575	309156.6	1328834.8	20.6	9.5	5488	17.8	5050	438	
40-44	69196	27.4	85.4	59087	280632.3	1019678.1	17.3	10.1	5922	21.1	4607	1314	4.7
45-49	63739	24.5	83.4	53166	246757.3	739045.8	13.9	10.6	7628	30.9	4597	3031	12.3
50-54	58066	21.7	78.4	45537	203386.5	492288.5	10.8	10.9	9720	47.8	4379	5341	26.3
55-59	52135	18.9	68.7	35817	148733.9	288902.0	8.1	10.8	12141	81.6	3741	8400	56.5
60-64	45966	16.1	51.5	23676	89912.7	140168.1	5.9	10.1	11387	126.6	2955	8432	93.8
65+	38985	13.5	31.5	12289	50255.4	50255.4	4.1	9.4	12289	244.5	2146	10143	201.8

Table 5 Abridged Working Life Table, South Africa, Females, 2001

Age	l_x	e_x	w_x	l^w_x	${}_nL^w_x$	T^w_x	e^w_x	e^{in}_x	${}_nS^w_x$	${}_nE_x$	${}_nd^w_x$	${}_nR^w_x$	${}_nr^w_x$
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
15-19	91168	49.7	71.0	64730	321547.1	2223456.9	34.3	15.3	840	2.6	840	0	
20-24	89985	45.3	71.0	63889	313433.2	1901909.8	29.8	15.5	2405	7.7	2405	0	
25-29	86597	42.0	71.0	61484	298271.5	1588476.6	25.8	16.1	3659	12.3	3659	0	0.0
30-34	81443	39.5	71.0	57825	278329.1	1290205.1	22.3	17.2	4318	15.5	3671	646	2.3
35-39	76243	37.0	70.2	53507	255797.1	1011875.9	18.9	18.1	4695	18.4	3090	1605	6.3
40-44	71773	34.1	68.0	48812	230748.8	756078.8	15.5	18.7	5324	23.1	2529	2796	12.1
45-49	67945	30.9	64.0	43488	198341.2	525330.0	12.1	18.8	7639	38.5	2227	5411	27.3
50-54	64234	27.6	55.8	35849	155639.5	326988.8	9.1	18.4	9442	60.7	1866	7576	48.7
55-59	60496	24.1	43.7	26407	102101.5	171349.3	6.5	17.6	11973	117.3	1332	10641	104.2
60-64	56674	20.6	25.5	14434	49399.8	69247.7	4.8	15.8	9107	184.4	900	8207	166.1
65+	51736	17.3	10.3	5326	19848.0	19848.0	3.7	13.6	5326	268.4	453	4874	245.6

One practical use of the working life table is the estimation of the annual losses from the actual working population based on the assumptions that the population is subjected to the age specific death rates and the age-specific activity rates used to construct the working life tables. For a country like South Africa where mortality is increasing as a result of HIV/AIDS, one would expect work life being cut short by the force of mortality. In order to estimate the loss due to mortality, we have calculated the gross years (ie mortality free) of active life.

The multiplication of the rates of ${}_nm^s_x$ and ${}_nm^w_x$ in the various age groups by the actual number of men in the working population in the corresponding age groups will give the total losses, the losses due to death and the losses due to other causes other than death. Computations based on the actual working population enumerated in 1996 and 2001 population censuses have been made and these are presented in tables 6 and 7 below respectively.

Table 6 Working Population and its estimated losses by age group, South Africa, 1996

Age Group	Working Popula-tion	Total Losses	Losses due to death	Losses due to other cause	Working Popula-tion	Total Losses	Losses due to death	Losses due to other cause
15-19	100059	319	319	0	71443	126	126	0
20-24	570350	4187	4187	0	396276	1452	1452	0
25-29	924310	9623	9623	0	606032	3232	3232	0
30-34	967614	12653	12653	0	653184	4090	4090	0
35-39	887672	12451	12451	0	604169	4279	4279	0
40-44	711930	16035	12854	3181	492917	9456	4272	5184
45-49	550295	20805	13166	7639	356014	14234	4044	10190
50-54	378051	22831	11755	11076	236343	15649	3521	12128
55-59	253038	25716	10839	14877	147425	15228	3307	11921
60-64	120784	20468	6248	14220	59521	8914	1688	7226
65-69	32222	8430	2227	6202	12863	3454	526	2929
	5496324	153518	96322	57196	3636187	80115	30537	49577

Table 6 indicates that the total number of males estimated to have left the working population in 1966 was 153518 of which 96322 (or 63%) left on the account of death and 57196 (37%) left due to other causes. Similar figures for the female population indicate that 80115 females left the working population of which 30537 (38%) left on the account of death and 49577 (62%) left due to other causes.

Table 7 Working Population and its estimated losses by age group, South Africa, 2001

Age Group	Working Popula-tion	Total Losses	Losses due to death	Losses due to other cause	Working Popula-tion	Total Losses	Losses due to death	Losses due to other cause
15-19	338653	952	952	0	356336	931	931	0
20-24	1238629	8069	8069	0	1173591	9007	9007	0
25-29	1558537	17918	17918	0	1423065	17459	17459	0
30-34	1370459	20988	20988	0	1234636	19153	16286	2867
35-39	1242485	22057	20295	0	1130728	20754	13659	7096
40-44	1045915	22069	17172	4897	923766	21315	10123	11191
45-49	793817	24541	14788	9752	686981	26458	7715	18743
50-54	575620	27509	12392	15117	436605	26487	5235	21252
55-59	345728	28222	8697	19525	241802	28356	3155	25201
60-64	179681	22756	5906	16850	86306	15911	1573	14339
65-69	16926	4139	723	3416	7559	2028	172	1856
	8706450	199220	127900	69558	7701375	187858	85314	102545

The total number of males estimated to have left the working population in 2001 was 199220 of which 127900 (64%) left on the account of death and 69558 (36%) left due to other causes. Similar figures for the female population indicate that 187858 females left the working population of which 85314 (45%) left on the account of death and 102545 (55%) left due to other causes.

Furthermore, Table 8 indicates that mortality is the major factor affecting the exit from the Labour force for males for both 1996 and 2001 census. In 1996 63 percent of the males left the labour force due to deaths. A similar percentage was 64 percent in 2001 suggesting

that relatively more males are now leaving the labour force as a result of deaths than was the case before.

On the other hand, females leave the labour-force due to other causes. The results indicate that 62 percent of the females who left the labour-force in 1996 were due to other causes. The percentage of the women leaving the labour force due to other causes has declined to 55% in 2001. Probably this is a reflection of increasing importance of deaths as a factor affecting exit from the working population.

Table 8 Comparison of estimated losses from male and female working population in South Africa, 1996 and 2001

					Male		Female	
Labour force	5496324		3636187		8,706,450		7,701,375	
Total Loss	153518	100.0	80115	100.0	199,220	100.0	187,858	100.0
Loss due to deaths	96322	62.7	30537	38.1	127,900	64.2	85,314	45.4
Loss due to other causes	57196	37.3	49577	61.9	69,558	34.9	102,545	54.6

Length of Working Life by Sex and Population Group

There are significant differentials in the length of working life by population group. Table 9 presents length of working life by sex and population group for South Africa[5]. The length of working life is highest among the white population followed by the Asian population then the coloured population and lowest among the African population. The same pattern is also observed in the length of inactive years. Overall, for all population groups with the exception of the African population, the length of working life for males is higher than that of females. The African population indicate that the length of working life for females is slightly higher than that of males. The

[5] Working Life Tables for each sex and population group are available from the author on request.

Asian population reveal the largest difference between the length of working life for males and females.

Table 9 Estimates of Length of Working Life by Sex and Population Group, South Africa, 2001

	Male			Female		
	e_x	e^w_x	e^{in}_x	e_x	e^w_x	e^{in}_x
National	42.9	36.1	6.8	50.8	36.0	14.8
African	40.9	35.0	6.0	49.0	35.4	13.6
Coloured	45.0	36.8	8.1	52.7	35.2	17.5
Asian	49.7	40.0	9.8	58.8	33.9	24.9
White	52.9	41.7	11.2	60.4	39.2	21.2

Comparisons with other countries

A comparative picture of the situation in South Africa with those in some countries would help us know the relative standing of the economic powerhouse on the continent. The data on work life expectancy for selected countries are shown in Table 10. However, it should be noted that data was collected in different years using not only different definitions of economically active population but also reference periods. As such caution must be taken when dealing with such information.

Notwithstanding the aforementioned challenges, comparison of the working life expectancy for South Africa and selected African countries is still enlightening. First, most of the estimates presented in Table 10 are for earlier periods. Second, as expected, given higher labour force participation rates, the length of working life for males is higher than that of female. The largest differences are observed in countries with a large proportion of Muslims (Sudan and Somalia). Third, comparing estimates for Malawi 1998, Zimbabwe 1996 and South Africa 1996, which more or less refer to the same time period, one notices that working life expectancy at age 15 for male is highest in Zimbabwe, then Malawi and lowest in South Africa. Female working life expectancy follows the same pattern expect that the value for Malawi is more or less the same as that of South Africa. The high e^w_x for Malawi and Zimbabwe could be a consequence of high labour force participation rates probably arising from high number of people involved in agricultural activities. Life expectancy for the inactive

years is highest in South Africa and Zimbabwe and lowest in Malawi and overall e^{in}_x for females are higher than that of males.

Table 10 Expectation of working life for selected countries by sex

		Male			Female		
Country	Year	e_{15}	e^{w}_{15}	e^{in}_{15}	E_{15}	e^{w}_{15}	e^{in}_{15}
Malawi	1987	46.4	34.6	11.8	49.0	33.1	15.9
	1998	38.9	37.4	1.5	41.4	37.8	3.6
Liberia	1984	46.4	34.0	12.4	49.0	23.8	25.3
Ghana	1984	47.5	38.6	8.9	50.2	37.5	12.7
Sudan	1983	49.2	44.3	4.9	52.0	16.6	35.4
Zimbabwe	1982	49.5	44.1	5.4	51.4	46.4	5.0
	1997	45.3	39.6	5.7	49.5	43.3	6.2
Botswana	1981	50.4	47.3	3.1	53.2	38.3	14.9
Tanzania	1978	44.6	43.7	0.9	47.3	44.2	3.1
Somalia	1975	45.7	32.6	13.1	48.4	16.1	32.3
South Africa	1996	40.7	35.3	5.4	49.9	37.9	12.0
	2001	43.9	36.0	7.9	49.7	34.3	15.4

Conclusion

The study has calculated working life tables for South Africa using 1996 and 2001 census data. The study indicate that based on the 1996 census a South African male who survives to age 15 was expected to live 40.9 years, out of which 35.3 years are expected to be spent in active status and the remaining 5.3 years considered as inactive years. Similar values for South African females are 49.9 years, 37.9 years and 12 years, respectively. Furthermore, using 2001 census the study indicates that a South African male who survives to age 15 was expected to live 43.9 years of which 36 years will be in active and 8 years will be inactive whereas a South African female was expected to live 50 years of which 34 years will be active and 16 years will be inactive.

Furthermore, the study has shown that most men who leave the labour force do so as a result of mortality whereas most women leave the labour force as a result of other factors rather than mortality. For both male and females there is an increase in the proportion

leaving the labour force attributable to deaths. This is probably an indication of the impact of HIV/AIDS.

Future research can replicate this work using data from demographic surveys especially the labour force surveys whose information of employment can be deemed more reliable than the ones collected in population censuses. In this regard it is also expected that data collected in the labour force surveys may allow the calculation of multiple-decrement which in certain quarters are deemed more accurate than the simple working life tables presented in this study.

Lastly, an additional issue that can be considered is the analysis of the policy implications of the findings. The observation that an increasing proportion are leaving the labour force due to death, probably arising from HIV/AIDS, re-enforces the need for work-based HIV/AIDS programmes and activities. In this regard, organisations that have not yet conducted needs assessment and drafted HIV/AIDS strategic framework for their organisations will be encouraged to do so now. The finding that most females leave the labour force as a result of factors other than mortality should stimulate interest to identify these factors. If it is established that females leave the labour force because of marriage, childbearing and child rearing, then efforts should be made to make the working environment conducive to women who want to further their careers at the same time maintain their traditional roles as wives and mothers. One means of achieving this is to ensure that crèche facilitates are available in all institutions.

Reference

Appold, S.J. (2004) "How much longer would men work if there were no employment dislocation? Estimates from cause-elimination work life tables" ***Social Science Research,*** 33(4):660-680.

Bah, S. (2005) "Assessing the triple burden of HIV, TB and pneumonia in South Africa using multiple-cause life table analysis, 1997-2001" Paper to be presented at the International Population Conference to be held in Paris, France, 18-23 July 2005

Brown, B. (1987) "Facing the 'black peril'" ***Journal of Southern Africa Studies***, 13-256-73.

Burch, T.K. (2003) "Demography in a new key A theory of population theory" ***Demographic Research,*** 9(11)

Buwembo, P. (2004) "Why is unemployment so high in Census 2001" ***Labour Market Review 2004***, Department of Labour, Pretoria, pp. 37-40.

Davies et al. (1984) ***The Struggle for South Africa***, Zed books, London.

Department of Social Development (2001) ***The State of South Africa's Population Report 2000: Population, Poverty and Vulnerability***, National Population Unit, Pretoria.

Dorrington, R., Moultrie, T.A. and Timaeus, I.M. (2004) "Evaluation of mortality using the South African Census 2001 data" ***Center for Acturial Research (CARe) Monography No 11***, University of Cape Town.

Kingdon, G. and J. Knight (2002) "The measurement of unemployment when unemployment is high"

Kpedepo, G.M.K. (1969a) "On Working Life Tables in Ghana with Particular reference to the Female Working Population" ***Journal of the Royal Statistical Society,*** 132(3):431-441.

Kpedepo, G.M.K. (1969b) "Working Life Tables for Males in Ghana" ***American Statistical Association Journal,*** March 1969, pp.108-110.

Krishnan, P. (1977) "The Length of Working Life: India 1971" ***Journal of the Royal Statistical Society,*** 140(3):359-365.

Lestrade-Jefferis, J. (2000) "The Labour market" ***Statistics South Africa (2000) The People of South Africa Population Census 1996 Summary Report.*** Report number 03-01-12(1996), Pretoria.

Iro I.M. (1976) "The main features of a working Life Table of the Female Labour Force in Nigeria, 1965" ***Journal of the Royal Statistical Society*** 143(2):258-264.

Mba, C.J. (2003) "The impact of external causes on South Africa's expectation of life" paper presented at the fourth African Population Conference held in Tunis, Tunisia, 8-12 December 2003.

Misiku, J.A.T.M. (1993) Population Growth and Labour Force Participation in Malawi, MA Thesis, University of Ghana.

Schoen R. (1988) "Practical Uses of Multistate Population Models" ***Annual Review of Sociology*** 14():341-361.

Schoen R. and Woodrow, K., (1980) Labour force status life tables for the United States, 1972. ***Demography*** **17**(): 297–322.

Schoen R. (1975) "Constructing Increment-Decrement Life Tables" ***Demography*** **12**(2):313-324.

Shyrock, H.S. and Siegel, J.S. (1976) ***The Methods and Materials of Demography***, Academic Press, New York.

Statistics South Africa (2000) ***South African Life Tables***, Pretoria.

Willekens, F.J., Shah, I. and Ramachandran, P. (1982) "Multi-state Analysis of Marital Status Life Tables: Theory and Application" ***Population Studies*** 36(1):129-144.

Appendix 1: Derivation and meaning of the functions of the various columns of a working life table.

Column (1): This shows the conventional five-year age groups from 10 to 60 years and over.

Column (2), l_x: This refers to the number of survivors to age x out of the original birth cohort.

Column (3), e_x: This refers to the average number of years individuals aged x are expected to live if they experience the given age specific death rates upon which the life table is based.

Column (4), ${}_nW_x$: Age specific activity rates at the beginning of the age interval.

Column (5), l^w_x: Survivors at exact age x out of 100000 born alive and active and was obtained as a product of columns (2) and (4) divided by 100. In other words, the figures are obtained by multiplying W_x by corresponding l_x. Thus $l^w_x = {}_nW_x\, l_x$

Column (6), ${}_nL^w_x$: This is the stationary economically active population in the age interval. On assumption that the withdrawal from the working population is uniformly distributed, ${}_nL^w_x = 0.5(l^w_x + l^w_{x+5})$

Column (7), T^w_x: This represents the economically active person years that would be lived after age x by members of a hypothetical cohort. It was obtained by cumulating column (6) from the bottom.

Column (8), e^w_x : It refers to the average number of economically active years expected to be lived per person in the hypothetical cohort at birth and among survivors at each age. It was computed by dividing column (7) by column (5). Thus $e^w_x = T^w_x / l^w_x$

Column (9), e^{in}_x: This column refers to the average number of economically inactive years expected to be lived per person by a hypothetical cohort at birth among survivors at each age x and is computed by simply subtracting column (8) from column (3). $e^{in}_x = e_x - e^w_x$

Column (10), ${}_nS^w_x$: This refers to the net change of those entering or leaving the labour force and is obtained by utilising column (5) using the following relationship $l^w_x - l^w_{x+5}$. For the extreme age groups "15-19" and "65+", survivors in age group "15-19" and those in last age group were taken as S(xw) values, respectively.

Column (11), ${}_nE_x$: This refers to the rate of entry or exit from the labourforce and is obtained by dividing column (10) by column (6) and multiplying the results by 1000. That is, ${}_nE_x = {}_nS^w_x / {}_nL^w_x$.

Column (12), ${}_nd^w_x$: This indicates the number of people dying in the age interval x to x+n. This is based on assumption that the death rate in the working population is the same as in the total population. The death rate in the later population is equal to ${}_nd_x/{}_nL_x$ and this is multiplied by the working population, ${}_nL^w_x$. Thus ${}_nd^w_x = {}_nd_x/{}_nL_x \, {}_nL^w_x$

Column (13), ${}_nR^w_x$: This indicates the number of people leaving the labourforce in the age interval x to x+n. This is calculated as column (10) minus column (12). That is, ${}_nS^w_x - {}_nd^w_x$.

Column (14), ${}_nr^w_x$: It is the age-specific rate of retirement per 1000 active individuals and is computed by I(x) = column (14) divided by column (7) multiplied by 1000.