Additional Evidence regarding Fertility and Mortality Trends in South Africa and Implications for Population Projections

Eric O. Udjo
Directorate of Analysis
Statistics SA
Pretoria

Summary

Errata

Introduction

The size of a country's population at a given point in time can be estimated on the basis of information about the initial base population, and the components of population growth (fertility, mortality and migration). Information about fertility and mortality in South Africa is fragmentary, and this has resulted in diverse estimates of the country's population size at different time periods.

The levels and trends of fertility and mortality in South Africa using information from the 1995 October household survey (OHS95) were first estimated by Udjo in 1997. A number of assumptions were made due to lack of data, or deficiencies in the data, or both - especially with regard to mortality.

Fertility and mortality questions were included in the first democratic census conducted in South Africa in October 1996 (Census 96). Analysis of the responses to the appropriate questions could provide corroborative evidence (or otherwise) for the results derived from the OHS95. It is against this background that this study has been undertaken.

Objectives

The objectives of this study are:

- To provide additional evidence regarding fertility and mortality trends in South Africa using Census 96 with a view to corroborating (or otherwise) the estimates derived from OHS95.
- To review the earlier population projections by Udjo (1997) in light of the additional evidence on fertility and mortality trends in South Africa that is now available from Census 96.

Methods

The estimations of fertility and mortality were based on methods developed by Brass that were designed to detect and adjust for reporting errors typically observed in demographic data from less developed countries. Using the fertility and mortality estimates, three sets of population projections were made based on the cohort-component method. The projections did not take account of net migration due to lack of reliable data in the form required by the method.

Results

- The evidence from Census 96 indicates that the total fertility rate (TFR) in 1996 is 3,3. The results based on the OHS95 fertility report (Udjo, 1997) indicated that the TFR had declined from 4,2 in 1980 to 3,2 in 1995.

- Mortality rates based on Census 96 indicate an overestimate in the previous study, especially for the periods 1970-1985. On the basis of the new evidence, female life expectancy at birth rose from 57,6 years in 1970 to 64,5 years in 1996.
- By comparison, in the earlier study based on OHS95, female life expectancy at birth was estimated to have increased from 51,3 years in 1970 to 64,9 years in 1995.
- As in the earlier study, plausible estimates of adult male mortality could not be made from Census 96 data.
- Excluding the effects of net migration, additional evidence from Census 96 suggests that the population of South Africa in October 1996 was between 38,3 million and 39,9 million. The earlier study based on OHS95, estimated the population of South Africa at between 37,5 million and 39,2 million for the same period.

Conclusion

The results from the present analysis corroborate those obtained in the earlier study by Udjo - that the size of South Africa's population is smaller than hitherto estimated – however, additional studies are needed to confirm this.

Additional Evidence regarding Fertility and Mortality Trends in South Africa and Implications for Population Projections

Contents

	List of Figures and Tables
	List of figures

Additional Evidence regarding Fertility and Mortality Trends in South Africa and Implications for Population Projections

Introduction BACK TO TOP

The levels and trends of fertility and mortality in South Africa using information from the 1995 October household survey (OHS95) were estimated by Udjo (1997). The results indicated that fertility had declined from 4,2 in 1980 through 3,5 in 1985 and 3,3 in 1990, to 3,2 in 1995. Female life expectancy at birth was estimated to have increased from 51,3 years in 1970 to 55,5 years in 1975, 59,4 years in 1980, 62,9 years in 1985 and 64,9 years in 1995. On the basis of these estimates, the population of South Africa was projected from 1970 to 1996, using the 1970 census as a base. Due to lack of the appropriate, data, migration was not taken into account. According to the projections, the population of South Africa was between 37,5 million and 39,2 million in 1996 excluding the effects of migration.

A number of assumptions were made in the study due to lack of data, or deficiencies in the data, or both - especially with regard to mortality. The following assumptions are particularly noteworthy:

1. The assumption that on the basis of OHS95 data, the level of female childhood mortality indicated by the adjusted total mortality in the first five years of life was plausible. This assumption was necessary because plausible time period estimates of childhood mortality could not be obtained from the proportions dead of children ever born due to large-scale underreporting of dead children by women during the OHS95. As a result, childhood mortality was estimated from the reported distribution of deaths in the households during OHS95.

2. The assumption that the trend in childhood mortality is similar to the observed trend in maternal orphanhood reports in the OHS95. This was necessary, because of the improbable trends in childhood and male adult mortality due to deficiencies in the birth histories and paternal orhphanhood reports during the OHS95.

Fertility and mortality questions were included in the first democratic census conducted in South Africa in October 1996 (Census 96). Analysis of the responses to the appropriate questions could provide corroborative evidence (or otherwise) for the results derived from the OHS95. It is against this background that this study has been undertaken.

Objectives

The objectives of this study are:

1. To provide additional evidence regarding fertility and mortality trends in South Africa using Census 96 with a view to corroborating (or otherwise) the estimates derived from OHS95.

2. Review the population projections by Udjo (1997) in light of the additional evidence on fertility and mortality trends in South Africa that is now available from Census 96.

Data

The analysis presented in this study is based on the 1996 South African population census.

Methods

Fertility

Although analyses of fertility are usually confined to women of reproductive age (i.e. aged 15-49 years) this author has noted the fieldwork advantage of extending the age limit for the fertility (and childhood mortality) questions beyond the conventional reproductive age by setting a lower and an upper limit as was the case during Census 96. Women aged twelve years or older at the time of the census, were asked how many live births they had ever had (i. e children ever born). In addition, women who were fifty years old or between the ages of 12 and 14 years at the time of the census were asked how many children they had given birth to during the last twelve months (i.e. current births). Although this study uses the conventional reproductive age group, given the age limits set in the census, any tendencies by interviewers to exclude women close to the upper and lower limits of the reproductive age-group in order to reduce the work-load (see Udjo, 1985) would have been reduced.

Tabulation of the number of current births showed that some women reported having had up to nine births within the last 12 months before the census. It is not biologically possible for women to have nine single births within one year (see Bongaarts, 1978). Other than multiple births, one should not expect women to have more than two live births within 12 months. Because birth histories are not collected in censuses, it is not possible to identify multiple births among those reported as current births in Census 96, the reported maximum number of live births within the last 12 months used in this analysis is six. This was regarded as sufficiently flexible to allow for multiple births, taking into consideration international practice. For example, the upper limit set by the Demographic and Health Surveys (DHS) in the input/output database in the following countries were as follows. For births within the 12 months, it was four in Botswana and Ghana, and for births within the last five years, it was six in Botswana, Ghana, Zambia, and Zimbabwe. (See the ISSA data dictionaries).

As a starting point, it is now common practice in demography to use Brass (1968) P/F ratio method (or its variants) to analyse the number of children ever born (CEB) and births within the last 12 months (current births) reported by women of reproductive age during a survey or census. The method assumes that fertility has been constant in recent years, and errors in the data on current births are not correlated with the age of the mother. In the application of the method, mean parity equivalents, F_is are estimated and compared with reported mean parities P_is. The ratios of P/Fs by age serve as indicators of the consistency and accuracy of the two sets of data. If fertility in a population has not been constant in recent years, it would not be appropriate to estimate the level using the P/F ratio method since the assumption of constant fertility would be violated. However, one could still use the method to analyse the trend in fertility. Although Arriaga (1983) has shown how the P/F ratio method can be used to estimate fertility when fertility has been changing in a population, initial examination of CEB and current births reported during Census 96 was based on Brass method.

The estimation of fertility was based on the Relational Gompertz model. The equation for fitting the model to current fertility is:

$$z(x)-e(x) = a + 0.48(b-1)^2 + g(x)$$

where z(x) is $-\log[-\log F_x/F_{(x+5)}]$, where F_x is cumulated age specific fertility rates (ASFR) up to age x, e(x) and g(x) are tabulated standard values (see Booth, 1979); 0.48 is a constant. From average number of CEB (mean parities), z(i) is $-\log[-\log P_i/P_{(i+1)}]$, where P_i is the mean parity in the age group i. (See Zaba, 1981, and Brass 1974, 1996 for details). The application of the method to cross sectional fertility data is explained among others, by Brass (1981), Zaba (1981) and Udjo (1991,1995,1996, and forthcoming, 1998).

Arriaga's method was applied to CEB and current births reported during Census 96 and compared with the estimate obtained from the Relational Gompertz model. Arriaga's method does not require an assumption of constant fertility. The method can be applied when data on children ever born and the age pattern of fertility are available for two or more enumerations. But when the data are available for only one date, it assumes that fertility was constant during the past as in the case of the Brass method.

The estimated total fertility rate (TFR) from Census 96 was compared with the reported age distributions during the census, using Rele's method. The method estimates TFR for one or two 5-year periods prior to the enumeration, using information on the age distribution of women and children, and life expectancy at birth. The rationale for the method is the observed relationship between the ratio of children to women and fertility in a population taking into consideration mortality. See Arriaga (1994) for details.

Mortality

Childhood mortality

In addition to CEB, women aged twelve years and above were asked how many of their children were still alive at the time of the census. These two sets of information were tabulated by 5-year age group for women in the reproductive age to derive proportions dead of children ever born by age of women. Life table survival probabilities among children at different ages were estimated from this information using Brass (1971) technique and refinements by Fernandez (1985, 1989). The method converts proportions dead of children ever born by age of mothers, to probabilities of dying between birth and certain exact ages using the following equation:

$q_x = D_i K_i$,
where q_x is the probability of dying between birth and exact age x,
D_i is the proportion dead of children ever born to women in age group i, and K_i is a multiplier that adjusts for non-mortality factors determining the value of D_i.

The appropriate set of multipliers for a particular population are determined by the mean age of the fertility schedule, m, and the ratio of mean parity of women aged 15-19 years to that of women aged 20-24 years, p_1/p_2, or the ratio of mean parity of women aged 20-24 to that of women aged 25-29, p_2/p_3. In this study, m and p_2/p_3 were used for selecting the multipliers. Coale and Demeny (See Brass, 1971) have shown that p_2/p_3 is more satisfactory for estimating q_2, q_3 and q_5. Using several data sets from the World Fertility Surveys (WFS), Fernandez (1985) showed that the proportions dead of children everborn from women aged15-19 and to some extent, from women age 20-34, give childhood mortality estimates that are higher than the average for the population. The q_x values derived from the Brass method were therefore adjusted using Fernandez coefficients.

The adjusted q_x were converted into a values (level of childhood mortality) in Brass logit system (1971). The time locations of the a values were estimated using Brass (1985) method.

Adult mortality BACK TO TOP

Brass (1971) developed a method (the orphanhood method) for translating the proportions of persons with a surviving parent into probabilities of survival. The relevant question was asked in Census 96 - Is the (person's) own mother/father still alive? To calculate probabilities of survival from a base age B, to age B+N the following equation is used:

$$l_{B+N}/l_B = W_N({}_5P_{N-5}) + {}_5P_N\,(1-W_N)$$

where l_{B+N}/l_B is the probability of surviving from a base age B, to B+N,
and the term $W_N({}_5P_{N-5}) + {}_5P_N\,(1-W_N)$ on the right side of the equation, is explained as follows:

N is the central age between two adjacent five-year age groups;
${}_5P_{N-5}$ is the proportion in the age group N-5 to N having a surviving parent;
${}_5P_N$ is the proportion in the age group N to N+5 having a surviving parent; and
W_N is a weighting factor which depends on N and the location of child bearing, represented by the mean age of childbearing, M.

The l_{B+N}/l_B values were translated into levels of adult mortality, a in Brass logit system. The time location of the a values was estimated using Bamgboye (1982), and Brass and Bamgboye (1982) method. The applications of the methods to orphanhood data are described among others, by Udjo (1987, 1991, 1995).

Life Tables BACK TO TOP

The construction of life tables from the childhood and orphanhood estimates were based on Brass two-parameter logit system using the African standard life table. The procedures involved are described by Udjo (1991). The two parameters in Brass logit system are a and b . The former defines the level while the latter defines the relationship of childhood and adult mortality in a population. The two parameters of the logit system correspond to the two factors which Ledermamn and Breas (1959) found to be the most important in explaining variation in the mortality schedule among populations.

Projections

In outlining some general principles in population estimates, Shryock, Siegal and Associates (1976) have noted the following:

"more accurate estimates can generally be made for an entire country than for geographic subdivisions of the country. The national population is much more likely to be closed than is that of a subdivision of a country. ------ *In general, more direct data, data of better quality and more information on how to adjust these data for deficiencies, are available for the larger areas, particularly for entire countries, than for smaller areas, the size of small populations may fluctuate widely, with the result that accurate estimation is extremely difficult*

or impossible. ----- It is usually advisable, therefore, to adjust estimates of geographic subareas to agree with an independently estimated area total; eg. Estimates for provinces should be adjusted to the national total".

"More accurate estimates can generally be made for the total population of an area than for the demographic characteristics of the population of the area. Fewer data and data of poorer quality are usually available for making estimates of the population of a given area classified by age, color, sex and other characteristics than of the total population of the area. It is usually advisable, therefore, to adjust estimates of such classes to the area total for the characteristics".

On the basis of the above principles, estimates of the national population usually precede estimates of its subgeographical and demographic characteristics. Accordingly, the U.S Bureau of Census in its projection of population of states, adjusted the final results of the states projections by race etc to be consistent with the national projections by age sex, and race. (See U.S. Bureau of Census in, U.N., 1993).

The general principles outlined above have been adopted in this study. Only the national population estimates have been attempted at this stage. The second stage of this study would be to estimate the demographic parameters of the South African population by province and population group and their implications for population projections. The subnational estimates that would be carried out would be adjusted to the national estimates presented in this study.

The base population of the projections

The base period of the projections of the national population in this study is 1970. Three base population figures by age and sex were used in the projections:

1. The base population of the unadjusted 1970 census population by age and sex is 21,8 million;
2. The base population of the adjusted 1970 census population by age and sex is 22,1 million (Sadie, 1988); and
3. The base population of the adjusted 1970 census population is 22,8 million (CSS).

Age and sex distributions of the CSS adjusted figure were obtained by applying the overall sex ratio and proportionate age-sex distributions of the unadjusted 1970 census count to the CSS adjusted census population for 1970. The distributions of the base population figure by age and sex are shown in appendix 1.

Fertility and mortality

The estimates of fertility from the previous study and the fertility estimate obtained from the 1996 census were used as inputs in the projections. It was assumed that the level of fertility indicated in 1996 was the same as in 1995. The mortality inputs were obtained from the 1996 census. An improbably high level of male adult mortality was indicated in the 1996 census, as was also the case in OHS95 (Udjo, 1997). Life expectancy at birth was assumed to be six years higher among males compared to females in the population, for each of the projection periods in this study (five years in the previous study). The justification for choosing a six-year difference in male-female life expectancy at birth was based on the following observations.

Recent data from the Population Reference Bureau (see Population Reference Bureau: World 1995 World Population Data Sheet) suggest that in 1995 male-female life expectancies at birth were:

- 3 years in less developed countries (including China)
- 3 years in sub-Saharan Africa
- 5 years in Southern Africa
- 1 year in South Central Asia, and

- 9 years in Europe.

In addition, regression analysis undertaken by the United Nations (1982) on male-female differences in life expectancies at birth and at age 10 for countries in sub-Saharan Africa, Latin America and Far East Asia suggest a difference of 4,7 years for a life expectancy at birth of 60 years.

The above observations are also consistent with estimates of male-female differences in mortality provided by Blacker, Hill and Timaeus (1985) for some African countries. In their study, the a and b parameters of the logit system for several African populations in the 1970s – 1980s were estimated. Using these parameter estimates, this author constructed life tables for three countries using Brass African Standard. The male-female differences in life expectancy at birth derived from their parameter estimates were as follows: Malawi (2,1 years), Lesotho (3,9 years); Botswana (5,6 years); Swaziland (8,2 years). With the exception of Botswana, in the other three countries, male-female expectations of life at birth were below 50 years.

Within the South African context, it has been suggested that the difference in male-female life expectancy at birth is seven years or more. However, Bradshaw, Dorrington and Sitas (1992) using published life tables and recorded deaths, observed that in 1995 life expectancy at birth in South Africa was about six years higher for females than for males.

It is against this background that the male-female difference in expectation of life at birth of six years was assumed in this study.

Sex ratio at birth

Reliable vital registration systems provide the strongest basis for firmly establishing sex ratios at birth in human populations. In common with most African countries, vital registration statistics are incomplete at the national level in South Africa. Blacker in a study (see UNECA, 1968) made the following observations: "*There is a great shortage of reliable data on the sex ratio at birth in Africa, but there is reason to suppose that it may be somewhat lower than in most European, Asian and Latin American countries. In the absence of any trustworthy indications to the contrary, it is suggested that for countries south of the Sahara .... sex ratio at birth of 103 should be adopted, while for North African countries 105 or 106 may be more appropriate* . In another study, Udjo (1994) suggested that the sex ratio at birth in Botswana is perhaps close to 102. There are certain features of Botswana's demographic characteristics that are similar to South Africa's, the sex ratio at birth in Botswana may not be very different from at least, the major population group in South Africa. In view of the above, and given that about 24% of South Africa's population is non-black, a sex ratio at birth of 103 was assumed in the projections.

Net migration

Due to lack of appropriate data, net migration was not taken into account in the projections.

Projection variants

Three sets of projections were made which, for convenience are referred to as the low, medium and high variants. The low variant is based on the unadjusted 1970 census population; the medium variant is based on the adjusted 1970 census population (Sadie, 1998) while the high variant is based on CSS adjusted 1970 census population. The fertility and mortality inputs in the projections are the same in the three variants.

The projections were based on the cohort-component method (see Shryock, Siegal and Associates, 1976) using the computer software, DemProj prepared by the Futures Group (1976).

Results

Fertility BACK TO TOP

Table 1: Brass P/F ratios based on Census 1996 using Hamad's multipliers

Age group	ASFR	Multipliers	Average parity		
	f	k	implied	reported	P/F
			F	P	
15 – 19	0,047	2,561	0,121	0,210	1,732
20 – 24	0,100	3,043	0,541	0,836	1,547
25 – 29	0,116	3,077	1,093	1,631	1,492
30 – 34	0,115	3,159	1,679	2,510	1,495
35 – 39	0,095	3,313	2,204	3,178	1,442
40 – 44	0,072	3,431	2,611	3,719	1,425
45 – 49	0,057	4,225	2,963	4,058	1,370

f_1/f_2 = 0,474
m = 28,3

Table 1 shows the application of the P/F ratio method using a refined model by Hamad (1982). The observed mean age of the fertility schedule (31,6), was out of range of the tabulated values for selecting the multipliers. It was therefore necessary to estimate "m" indirectly from Brass' (1985) table on time location of childhood mortality using the observed ratio of the mean parity of women aged 20-24 years to that of women aged 25-29 years, p_2/p_3. As can be seen in Table 1, the P/F ratios are greater than 1 and decline as the age of mothers increases. Declining P/F ratios usually indicate underreporting of current births. The reported TFR of 3,0 appears implausibly low.

While at face value the declining series of P/F ratios could mean that fertility is currently rising it could also mean any combination, or all the following:

- the current fertility pattern is distorted by reporting errors;
- current births have been under-reported by women in the younger age groups; or
- older women have over-reported the number of children ever born.

Insight into the nature of the error was sought by fitting the Relational Gompertz model. The results are shown in Tables 2 and 3 and illustrated in Figure 1. While both the F and P points curve downward at the older ages, the curve is less pronounced for the P points (Figure 1). This pattern is suggestive of age exaggeration. Since the curving downward is more pronounced for the F points, a straight line was fitted to the P points by the group average method ignoring the last point, since it was an outlier.

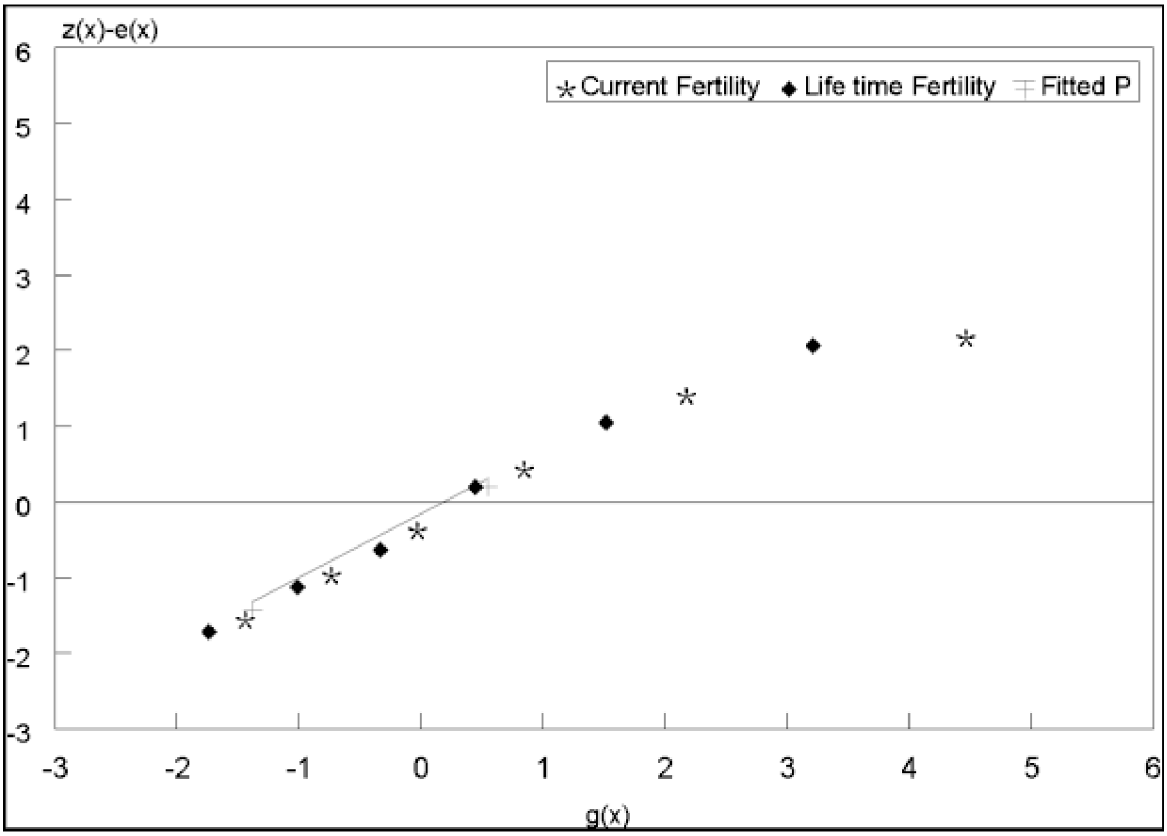
Table 2: Fitting the relational Gompertz model to age specific fertility rates from Census 1996

Age group x	Cumulated ASFR	z (x)	e (x)	z(x)-e(x)	g (x)
15 – 19	0,235				
20 – 24	0,735	- 0,131	1,336	- 1,468	- 1,450
25 – 29	1,315	0,542	1,418	- 0,877	- 0,743

30 – 34	1,890	1,014	1,298	- 0,284	- 0,038
35 – 39	2,365	1,495	0,967	0,528	0,836
40 – 44	2,725	1,954	0,451	1,503	2,165
45 – 49	3,010	2,308	0,046	2,262	4,456

BACK TO TOP

Figure 1: Fitting the relational Gompertz model
to current births (F) and children ever born (P), from Census 1996



BACK TO TOP

Table 3: Fitting the relational Gompertz model to mean parities from Census 1996

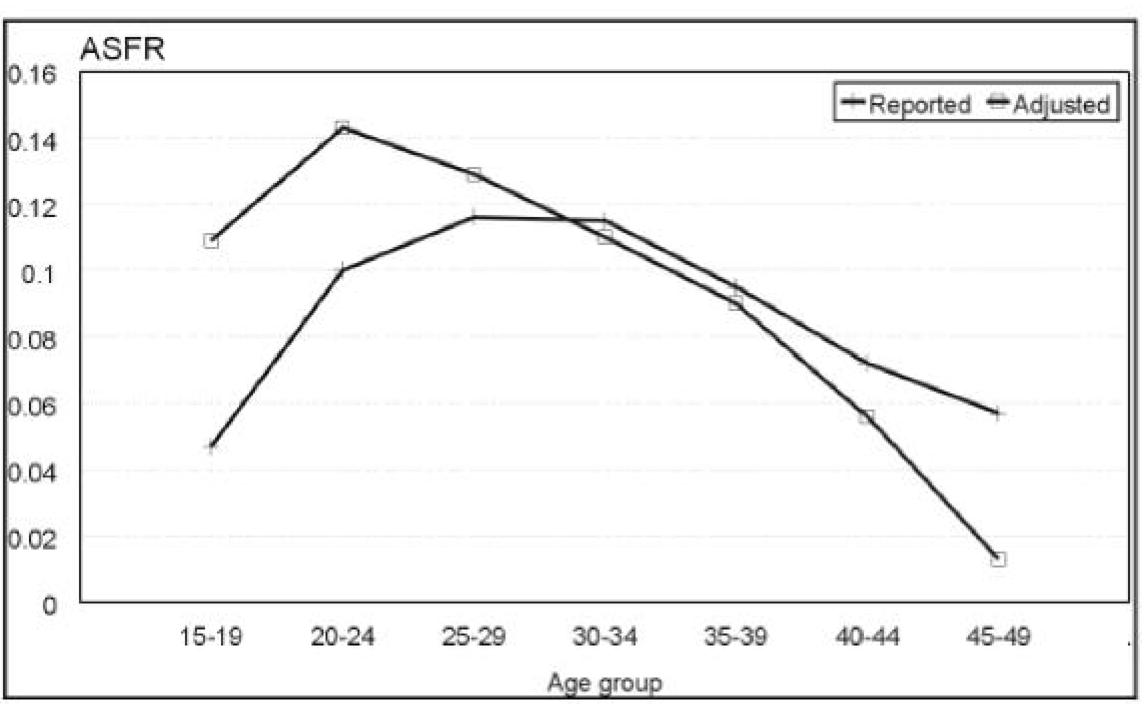
Age group **i**	**Mean parities**	**z (I)**	**e (i)**	**Z(i)-e(i)**	**g (i)**
15 – 19	0,210				
20 - 24	0,836	- 0,323	1,290	- 1,613	- 1,744

25 - 29	1,631	0,403	1,425	- 1,022	- 1,016
30 - 34	2,510	0,841	1,373	- 0,531	- 0,335
35 - 39	3,178	1,444	1,142	0,302	0,439
40 - 44	3,719	1,850	0,706	1,144	1,512
45 - 49	4,058	2,439	0,276	2,163	3,211

ß = 0,846
a = 0,111
TFR = 3,3

The Gompertz parameters were estimated from the fitted line and then applied to the standard values to obtain the TFR for 1996. The average of the TFRs derived from all the age groups, yielded a TFR of 3,3. The estimated Gompertz parameters and TFR are shown underneath Table 3. Adjusted age specific fertility rates (ASFRs) were obtained by applying the parameters to the standard values of cumulated fertility rates. The results were then applied to the estimated TFR to obtain adjusted ASFRs.

Figure 2: Reported and adjusted age specific fertility rates from Census 1996



BACK TO TOP

Figure 2 shows the reported and adjusted ASFRs. The pattern is atypical of what is known about the age pattern of fertility for human populations. The adjusted ASFRs is closer to the pattern published for Southern Africa by the United Nations (1997).

Childhood mortality

The selection of the appropriate multipliers for converting the reported proportions dead of children ever born were based on the reported p_2/p_3, and an indirectly estimated "m" as explained above.

The parameters for selecting the appropriate adjustment factors of q_x values in Fernandez (1985) were:

- female singulate mean age at marriage 28,7 years (estimated from Census 1996);
- TFR of 3,3
- pace of fertility (slow).

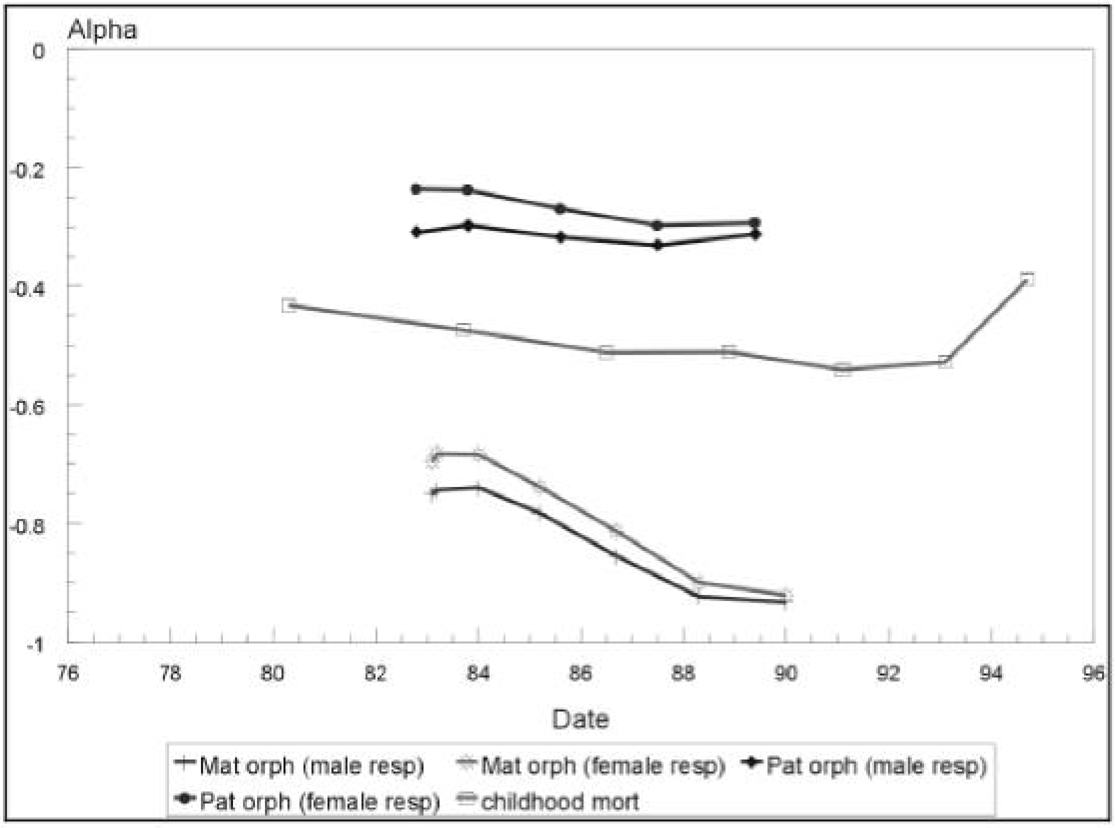
Table 4: Reported life table probability of dying from birth to exact age x (q_x) from proportions dead of children ever born (D_i) from Census 1996

Age of mothers	**D_1**	**Age x**	**q_x**	**a**	**Date**
15 - 19	0,086	1	0,059	-0,389	94,7
20 - 24	0,073	2	0,065	-0,528	93,1
25 - 29	0,075	3	0,074	-0,541	91,1
30 - 34	0,086	5	0,089	-0,511	88,9
35 - 39	0,101	10	0,107	-0,512	86,5
40 - 44	0,123	15	0,122	-0,474	85,7
45 - 49	0,146	20	0,145	-0,432	80,3

p_2/p_3 = 0,513 m = 28,3

BACK TO TOP

Figure 3 : Trend in mortality from Census 1996



The results are shown in Table 4 and illustrated in Figure 3. There is no obvious indication of underreporting of children dead from the adjusted q_x pattern (Table 3). The a values suggest a moderate level of childhood mortality. The time trend in a (Figure 3) suggests a modest decline in childhood mortality between 1980 and 1994 and an increase in recent years. The question which arises, is whether or not the upward trend in recent years is a true reflection of child mortality, or is merely an artefact of the data. Note that usually, the qx values for younger women (on which the a values are based) have been adjusted, yet the trend in childhood mortality in recent years indicates a worsening situation. Further research on the trend in childhood mortality in recent years is needed.

Maternal orphanhood

The observed female mean age of child bearing "M" of 30,7 years, was out of range of Brass tabulated values. The indirectly estimated "m" (as explained above) was therefore used as an estimate of M in selecting the appropriate multipliers for converting the proportions of persons with a surviving mother into probabilities of survival. The analysis was done by sex because male and female responses to the census question regarding surviving parents were different.

Table 5a: Adult female mortality from reports of mothers alive from Census 1996 (male respondents)

Age of respondents	Proportion with mother alive	Age 25+N	l_{25+N}/l_{25}	a	T	Date
10-14	0,971	35	0,977	- 0,934		1990,0

					6,0	
15-19	0,954	40	0,968	- 0,924	7,7	1988,3
20-24	0,922	45	0,952	- 0,856	9,3	1986,7
25-29	0,872	50	0,924	- 0,783	10,7	1985,3
30-34	0,808	55	0,880	- 0,740	11,9	1984,1
35-39	0,732	60	0,821	- 0,745	12,6	1983,3
40-44	0,631	65	0,748	- 0,751	12,6	1983,3

M = 28,3

The results of maternal orphanhood are shown in Tables 5a and 5b and illustrated in Figure 3. Tables 5a and 5b show that, the proportions of male respondents reporting mother alive is higher than the corresponding proportion of female respondents. This pattern has been observed in the data of other African countries. Blacker (1977) attributes this to differential age misreporting. Accordingly, males have a tendency to exaggerate their ages, and since the proportions with mother alive falls rapidly with increasing age of respondents, any exaggeration of reported ages mean that the proportions with living mothers would be biased upward.

BACK TO TOP

Table 5b: Adult female mortality from reports of mothers alive
from Census 1996 (female respondents)

Age of respondents	**Proportion with mother alive**	**Age 25+N**	l_{35+N}/l_{35}	**a**	**T**	**Date**
10-14	0,970	35	0,977	- 0,922	6,0	1990,0
15-19	0,952	40	0,967	- 0,900	7,7	1988,3
20-24	0,916	45	0,950	- 0,814	9,3	1986,7
25-29	0,863	50	0,918	-0,739	10,8	1985,3
30-34	0,792	55	0,871	- 0,684	12,0	1984,1
35-39	0,710	60	0,806	- 0,683	12,8	1983,3
40-44	0,609	65	0,727	- 0,697	12,9	1983,3

M = 28,3

The level of female adult mortality as indicated by the a in Tables 5a and 5b is low in comparison with childhood mortality (Table 4). The levels indicated by male respondents are slightly lower than the corresponding levels from female respondents. In view of the explanation given above by Blacker for this pattern, additional estimates requiring female adult mortality were based on female adult mortality derived from female respondents. The trend in female adult mortality (Figure 3) indicates a sharp decline and is inconsistent with the trend in childhood mortality (and male adult mortality discussed below). It would appear that during Census 96, the biological mothers of younger people (those aged 10-19 years) were reported alive when in fact they were dead (i.e. underreporting of dead mothers by younger respondents). Thus, the level of mortality derived from the younger respondents is relatively low, resulting in an apparent sharp decline in female adult mortality. This pattern is often due to the "adoption effect"; this has long been recognised in African data as the following evidence (See Blacker, 1977, Hill and Trussell, 1977,Timaeus, 1991, Mandela, 1994) suggests. According to Timaues, "---*mortality estimates obtained from the reports of young respondents seem too low, exaggerating the apparent decline in the level of mortality" ---- Most orphaned children are reared by another adult and may not even know that this person is not their biological parent. ---- The problem is most severe for young children, whose "adopted" parent may answer the question on their behalf or be assumed by the interviewer to be the biological parent".*

On another note, Blacker (1977) observed that *"in Africa, the words 'father' and 'mother' are often used loosely to denote not only a person's biological parents, but also foster parents, or older relatives acting, perhaps temporarily, in loco parentis, or simply as terms of respect for members of an older generation. ---- The substitution of foster parents for true parents in the response might clearly lead to serious bias, since the process of adoption may take place because of the mortality one is trying to measure".*

Within the South African context, Mandela (1994) has noted that *"In African culture, ---- we do not make the same distinctions among relations practised by whites. We have no half-brothers or half-sisters. My mother's sister is my mother; my uncle's son is my brother;* ***my brother's child is my son, my daughter*** (emphasis mine)*".*

The trend in maternal orphanhood from Census 96 is inconsistent with that obtained from the OHS95 data. The estimates from the census show a steeper decline than those obtained from the OHS95 even though the time periods are somewhat similar.

In view of the above, the relationship between female adult mortality and childhood mortality was based on the childhood mortality estimates and the report of older women aged 30-49 years reporting mother alive. The level of female adult mortality in this age group is consistent with that obtained from the OHS95.

Paternal orphanhood BACK TO TOP

Usually, there are problems in estimating "M" for males in any population. (See Brass,1975). In accordance with Brass' proposal, M was estimated by adding a constant to the estimated female M. In the present study, this constant is 2,3 years - the difference between the estimated male and female SMAMs. On the basis of this, the appropriate multipliers were selected and used in converting the proportions of persons with a surviving father into probabilities of survival. The results are shown in Tables 6a and 6b.

Similar to maternal orphanhood, the proportions of male respondents reporting father alive is higher than the corresponding proportion of female respondents. Consequently, the level of male adult mortality implied by the proportions of female respondents reporting father alive is higher than the corresponding level implied by the proportion of male respondents.

Table 6a: Adult male mortality from reports of fathers alive from Census 1996 (male respondents)

Age of respondents	Proportion with father alive	Age 35+N	l_{35+N}/l_{35}	a	T	Date
10-14	0,881	45	0,899	- 0,312	6,6	1989,4
15-19	0,831	50	0,862	- 0,331	8,5	1987,5
20-24	0,756	55	0,804	- 0,317	10,3	1985,6
25-29	0,664	60	0,720	- 0,297	12,1	1983,8
30-34	0,554	65	0,606	-0,309	13,0	1982,8
35-39	0,452	70	0,479	-	-	-
40-44	0,339	75	0,335	-	-	-

M = 33,0

BACK TO TOP

Table 6b: Adult male mortality from reports of fathers alive from Census 1996 (female respondents)

Age of respondents	Proportion with father alive	Age 35+N	l_{35+N}/l_{35}	a	T	Date
10-14	0,880	45	0,897	- 0,293	6,6	1989,4
15-19	0,825	50	0,858	- 0,297	8,5	1987,5
20-24	0,743	55	0,795	- 0,269	10,4	1985,6
25-29	0,646	60	0,705	- 0,238	12,3	1983,8
30-34	0,529	65	0,585	-0,236	13,4	1982,8
35-39	0,424	70	0,452	-	-	-
40-44	0,315	75	0,312	-	-	-

M = 33,0

The a values indicate improbably high levels of male adult mortality. Similar levels were observed in OHS95 data. It would appear that for reasons not quite clear, mortality of fathers is overstated in South Africa. When the a values were combined with those from childhood mortality to define the relationship between childhood and male adult mortality, they implied b values that were improbably high and inconsistent with those obtained by combining the childhood and maternal orphanhood a values. The resulting b values from childhood mortality and male adult mortality were also inconsistent with those obtained from several other countries in sub-Saharan Africa. For example, Blacker, Hill and Timaeus (1985) found that, among the seventeen sub-Saharan African countries studied, male b values were greater than 1 in only three countries - Mali, Lesotho, and Ghana.

Although the trend in male adult mortality (Figure 3) is plausible, the levels appear too high and were therefore not used in further analysis.

Life tables BACK TO TOP

In view of the weaknesses of the mortality data outlined above, time period two-parameter logit life tables were constructed for quinquennial years from 1970-1990, and for 1996. The observed annual improvement in childhood mortality between 1980 and 1991 was approximately -0.010 in terms of a . Childhood mortality was linearly extrapolated backward to 1970 and forward to 1996 on the basis of this trend. The values derived from the older female respondents (aged 30-49 years) were averaged yielding a value of about –0.688. On the assumption that trend in female adult mortality is similar to the observed trend in childhood mortality, the trend in female adult mortality was extrapolated backward to 1970 and forward to 1996 based on the trend in childhood mortality between 1980 and 1991.

On the basis of the a values derived from these extrapolations (Table 7a), the relationship of childhood mortality and female adult mortality was defined by constructing hybrid life tables (using the Brass African Standard) for each of the time periods shown in Table 7a. The two parameters (a and b) of the logit life table were then estimated. The procedure is described by Udjo (1991)and the results are shown in Table 7b.

Table 7a: Time period female a values from Census 1996

Year	a Adulthood	a Childhood
1996	-0,815	-0,541
1990	-0,755	-0,531
1985	-0,704	-0,480
1980	-0,654	-0,430
1975	-0,603	-0,380
1970	-0,553	-0,329

BACK TO TOP

Table 7b: Estimated parameters of the female logit life table from Census 1996

Year	a	ß
1996	-0,677	0,792
1990	-0,643	0,828
1985	-0,591	0,830
1980	-0,540	0,832
1975	-0,488	0,834
1970	-0,436	0,835

Using the a and b estimates, two-parameter logit life tables using Brass African Standard were then constructed for the female population. A summary of the life tables are shown in Table 8. The results in Table 8 suggest that Udjo (1997) overestimated the mortality of the female population especially in the earlier periods due to the assumptions about childhood mortality derived from OHS95. For example, in the earlier study, the estimated infant mortality rates ($_1q_0$) in 1970 and 1975 were 108 and 87 per thousand respectively (Udjo, 1997). However, the new evidence from Census 96 suggests values of about 73 and 67 respectively. Correspondingly, the estimated life expectancies at birth (e_0) 1970 and 1975 based on the evidence from the census are 57,6 and 59,1 years respectively, instead of 51,3 and 55,5 years as estimated in the earlier study based on OHS 95 data.

BACK TO TOP

Table 8: Estimated time period indices of female mortality from Census 1996

Year	$_1q_0$	$_4q_1$	$_5q_0$	e_0
1996	0,051	0,037	0,084	64,5
1990	0,050	0,039	0,086	63,4
1985	0,055	0,043	0,094	62,0

1980	0,061	0,047	0,103	60,6
1975	0,067	0,052	0,113	59,1
1970	0,073	0,057	0,123	57,6

Evaluation of the fertility and mortality estimates

One needs to be cautious in comparing the fertility and mortality estimates obtained by Udjo (1997) and those presented here (by the same author) with other estimates for the following reasons:

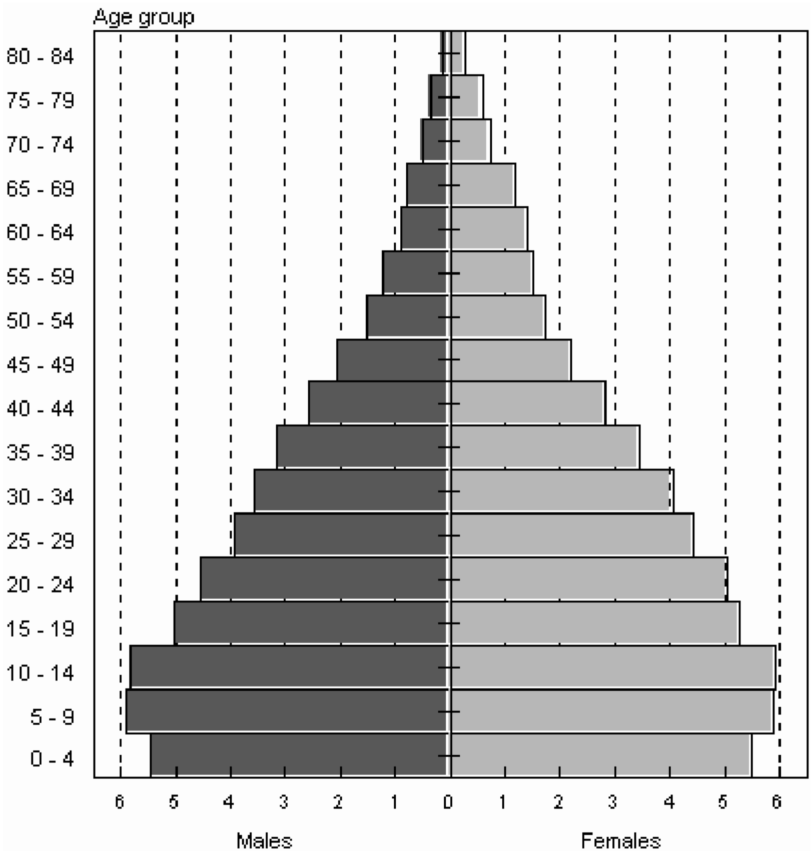
- The methods of estimation differ.
- Estimates of fertility and mortality levels for South Africa by other authors vary, and often by a large margin. As a consequence, among the available estimates, it is difficult to determine which provide the best comparison with those by Udjo.
- The reference periods for the fertility and mortality estimates differ from those used by other authors. In many cases, the estimates relate to a five-year period while those used by this author relate to single-year period estimates.

In light of the above, the comparisons in the section which follows should therefore be interpreted with caution.

As noted above, Arriaga (1983) has shown how the P/F ratio method can be used to estimate fertility when fertility has been changing in a population. The use of this model on the basis of Census 96 data alone was inappropriate because, in common with the Brass method, it assumes fertility has been constant during the past, when information on CEB and pattern of fertility are available for only one date. To address this limitation, the model was applied using reported CEB and ASFRs from both OHS95 and Census 96 so that two data points were used. Despite this modification, the results were largely meaningless.

BACK TO TOP

Figure 4: Unadjusted age-sex distribution from Census 1996
(males or females in each age group as % of total population)



Rele's technique was used to estimate TFR from the age distribution in Census 96. The TFR was then compared with the estimates derived from the Relational Gompertz model. Note that Rele's technique is a form of reverse-survival method. As noted by the United Nations (1983), reverse survival techniques*"are all heavily dependent upon the accuracy of the reported age distribution of the population being studied. Errors in age-reporting or differential completeness of enumeration affecting certain age groups, especially the younger ones, are certain to bias the estimates obtained. Because these types of deficiencies are all too frequently characteristic of the data sets available, reverse-survival methods are often ineffective in producing reliable fertility estimates"*.

The implied level of TFR using Rele's technique based on the reported ratio of children aged 0-4 years to women aged 15-49 years during Census 96 is 2,92 which corresponds to a time period 1994. This implied level of fertility appears too low and suggests under reporting of persons aged 0-4 years during the census. On the other hand, the implied TFR from the ratio of children aged 5-9 years to women aged 20-49 years is 3,66 which corresponds to the period 1989. This appears to be an overestimate for the period due to age shifting of some children aged 0-4 years into the 5-9 year age group (See Figure 4). An average of the estimates derived from these two age groups however implies a TFR of 3,3 for the period 1989-1994. This is consistent with the estimate of 3,2 derived from the OHS95 in the previous study (Udjo, 1997).

The estimated TFR of 3,3 for 1996 based on Census 96 (derived from the Relational Gompertz Model) is marginally higher than that for 1995 (3,2) based on OHS95. However, TFRs can change from one year to another due to changes in the tempo of fertility. (See Bongaarts and Feeney, 1998). The TFR for 1996 is also consistent with the estimate reported by Sidiropulous et al (1997) who reported a TFR of 3,3 as the current level of fertility in South Africa.

It has been suggested that the estimated TFRs by this author for the 1970s are too low compared to those in other studies. See Chimere-Dan (1993) for a review of time period estimates of TFRs in South Africa.

Against this background, this author has used the age distributions of the 1970 census as indicative insight of fertility during the period. Using Rele's technique the reported number of children aged 0-4 years in the 1970 census implies a TFR of 4,85. In addition, the corresponding value based on the adjusted 0-4 age group (Sadie, 1988) was 5,16. Both estimates relate to 1967 and both are consistent with the fertility rate of 4,9 estimated for the year 1970 by this author.

With regard to mortality, Sidiropoulous et al (1997) reported a female life expectancy at birth of 68 years in South Africa for the period 1991-96, and infant mortality rate (both sexes) of 56,1 per thousand. While the former is higher than that estimated for 1996 in this study, the latter is consistent with the estimated female life expectancy at birth for 1996 in this study (with the assumption of a 10-point difference in male-female infant mortality rate).

Implications of the Results for Population Projections BACK TO TOP

Between 1970 and 1990 the TFRs used in the current projections are similar to those obtained previously (Udjo, 1997). These were combined with the TFR derived from census 96. It was assumed that the level of fertility in 1996 (derived from the 1996 census) was the same as that in 1995. Thus the TFRs were 4,9 in 1970, 4,2 in 1985, in 1990 3,5 and 3,3 in 1995 and 1996.

The estimated female life expectancies shown in Table 8 and a difference of six years between female and male life expectancy at birth were used as the mortality inputs. The assumptions about sex ratio at birth and net migration were as explained in the beginning of this paper.

On the basis of the above, the population of South Africa was projected from 1970 to 1996 using the cohort component method. The results are shown in Table 9. The estimated population of South Africa in October 1996 on the basis of the projections ranges between 38,3 million in the low variant, and 39,9 million in the high variant (excluding the effects of migration).

It has been suggested that a sex ratio at birth of 102 and a seven year difference between male and female life expectancy at birth are more appropriate for projecting the population of South Africa. However, when these are used for the medium variant projections, a population size of 38,6 million in October 1996 is obtained. On the other hand a 5-year difference between male and female life expectancy at birth and a sex ratio at birth of 102 produced a population size of 38,9 million.

BACK TO TOP

Table 9: Estimated population of South Africa

Year		**Population (thousands)**			**Implied rate of**
		Low variant	**Medium variant**	**High variant**	**natural increase of medium estimate**
1996	**October**	38 257	38 763	39 895	-
	Mid-year	38 004	38 505	39 631	2,0
1995	**Mid-year**	37 263	37 751	38 861	2,0
1990	**Mid-year**	33 768	34 184	35 221	2,0
1985	**Mid-year**	30 657	31 008	31 975	2,1
1980	**Mid-year**	27 575	27 902	28 759	2,3
1975	**Mid-year**	24 541	24 868	25 601	2,3

1970		21 794	22 105	22 783	-

Discussion

The above estimates are higher than those in the earlier study by Udjo (1997). The higher estimates in the present study are due to:

- a marginally higher level of fertility indicated from Census 96 (3,3) than that of 3,2 assumed in the previous study;
- an overestimate of mortality in the previous study especially for the periods 1970-1985.

The present study however, has some weaknesses. As in the previous study, it does not take account of net migration due to lack of the appropriate data. Among other things, the structure of the population may have changed since 1970 due to net migration. Hence the sex ratios implied in the projections may not be an accurate reflection of the South African population today. The sex ratio at birth was held constant throughout the projection period. Although sex ratio at birth does not change dramatically in a population, there is evidence that it is not constant either in a population. For instance, Lassus (1995) has shown how the sex ratio at birth has varied between 1620 and 1799 in Quebec. Lastly, male adult mortality could not be reliably estimated as was the case in the previous study. Some of these weaknesses could be overcome as more reliable data become available. Despite these weaknesses, the results of this study still lead to the same conclusion as that in the previous that the size of South Africa’s population is smaller than hitherto estimated. However, more corroborative studies are needed to confirm this.

Acknowledgements

The author wishes to thank senior management of Stats SA for the encouragement and provision of the infrastructure that made this project possible. In addition, the assistance of the following need special acknowledgement: Jean-Marie Hakizimana who extracted the demographic variables from the census database; Samuel Chaba, Andre Delport, Cornelius Mothoa, Judy van der Linde and especially Celna Human and Johan Spies - all from the Information Technology section - for providing excellent support services; Joyce Lestrade-Jefferis for editing and making this paper more intelligible.

Sincere thanks are also due to my family - Eugenia, Oke and Ogaga - who bore the brunt of the many long hours I was at work during the course of this study.

References

Arriaga E. E. (1994). Population analysis with microcomputers. Bureau of the Census, USAID and UNFPA, pp 204-205.

Arriaga E. E. (1983). Estimating fertility from data on children ever born by age of mother. International Research Document, no. 11. U. S. Bureau of the Census, Washington D. C.

Blacker J. G. C., Hill A. G., and Timaeus I. (1985). Age patterns of mortality in Africa: an examination of recent evidence. Paper presented at the International Union for the Scientific Study of Population Conference, Florence.

Bongaarts J. (1978). A framework for analyzing the proximate determinants of fertility. Population and Development Review, vol. 4, no. 1, pp.105-132.

Bongarts J., and Feeney G. (1998). On the quantum and tempo of fertility. Population and Development Review, vol. 24, no. 22, pp271-291.

Booth H. (1979). The estimation of fertility from incomplete cohort data by means of the transformed Gompertz model. Ph.D. Thesis, Faculty of Medicine, University of London (London School of Hygiene and Tropical Medicine)

Bradshaw D., Dorringtion R. E., and Sitas F. (1992). The level of mortality in South Africa in 1985 - what does it tell us about health? South African Medical Journal, vol. 82, pp. 237-240.

Central Statistical Service (1977). Census'96: Preliminary estimates of the size of the population of South Africa. CSS, pp. 17-25.

Brass W. (1968). Methods of analysis and estimation. In, Brass, et al, The Demography of Tropical Africa. Princeton University Press, Princeton.

Brass W. (1971). Mortality estimates from children ever born and children surviving. In, Methods for estimating fertility and mortality from limited and defective data. The University of North Carolina at Chapel Hill, pp. 50-59.

Brass W. (1974). Perspectives in population prediction: illustrated by statistics of England and Wales. Journal of the Royal Statistical Society, series A 137, part 4, pp. 532-583.

Brass W. (1981). The use of the relational Gompertz model to estimate fertility. Proceedings of the International Union for the Scientific Study of Population Conference, Manilla, Liege.

Brass W. (1985). A simple approximation for the time location of estimates of child mortality from proportions dead by age of mother. In, Advances in methods for estimating fertility and mortality from limited and defective data. Centre for Population Studies, London School of Hygiene and Tropical Medicine, pp. 1-16.

Brass W. (1996). Demographic data analysis in less developed countries: 1946-1996. Population Studies, vol 50, no. 3, pp 451-467.

Chimere-Dan O. (1993). Racial patterns of fertility decline in South Africa. In, International Population Conference, Montreal. International union for the Scientific Study of Population, Liege, pp. 43-51.

Fernandez C. R. E. (1985). The influence of differentials in child mortality by age of mother, birth order and birth spacing on indirect estimation methods. Ph.D thesis, Faculty of Medicine, University of London (London School of Hygiene and Tropical Medicine).

Lederman and Breas. (1959) Les dimensions de la mortalite. Population, no. 4.

Fernandez C. R. E. (1989). The effects of maternal age, birth order and birth spacing on indirect estimation of child mortality. Proceedings of the International Union for the Scientific Study of Population Conference, New Delhi.

Shryock H. S., Siegal J. S. and Associates (1976). The methods and materials of demography. Academic Press, New York, pp. 409-410.

Sidiropoulos E., et al. (1997). South Africa Survey 1996/97. South African Institute of Race Relations, Johannesburg, pp. 10-13.

Udjo E. O. (1985). Levels and differentials in fertility and mortality among some Kanuri of north-east Nigeria. Ph.D Thesis, Faculty of Medicine, University of London (London School of Hygiene and Tropical Medicine), p. 35.

Udjo E. O. (1987). Levels and trends in infant and child mortality among some Kanuri of N. E. Nigeria. Journal of Tropical Paediatrics, vol 33/1, pp. 43-47.

Udjo E. O. (1991). Fertility levels among Nigeria's Kanuri. GENUS, vol, XLVII no.1-2, pp. 163-176.

Udjo E. O. (1991). Adult mortality from information on orphanhood and widowhood among Nigeria's Kanuri. Journal of Biosocial Science, vol. 23, no. 2, pp. 155-165.

Udjo E. O. (1995). Fertility and mortality trends and implications for social demands in Botswana. Southern Africa Journal of Demography, vol. 5, no. 1, pp. 1-10.

Udjo E. O. (1995). Childhood and adult mortality patterns in Botswana. In, Central Statistical Office: 1991 Population Census Dissemination Seminar, Government Printers, Gaborone, pp. 131-143.

Udjo E. O. (1997). Fertility and mortality trends in South Africa: the evidence from the 1995 October household survey, and implications on population projections. Central Statistical Service, Pretoria.

Udjo E. O. (forthcoming). Trends in level and tempo of fertility in Botswana.

United Nations (1992). Model life tables for developing countries. U.N., New York, p. 30.

United Nations (1993). Readings in population research methodology: population models, projections and estimates. United Nations Population Fund, section 17-58 – 17-65.

United Nations Economic Commission for Africa. (1968). The report of the seminar on the organisation and conduct of censuses of population and housing, vol. II, part II, Addis Ababa.

Zaba B. (1981). Use of the Relational Gompertz model in analysing fertility data collected in retrospective surveys. Centre for Population Studies Working paper 8 1-2, London School of Hygiene and Tropical Medicine.

BACK TO TOP

APPENDIX 1: 1970 Population age-sex distributions

Age group	**Unadjusted 1970 Census Population***		**Adjusted 1970 Census population (Sadie)****		**Adjusted 1970 Census population (CSS)*****	
	Males	**Females**	**Males**	**Females**	**Males (Thousands)**	**Females (Thousands)**
0-4	1 622 117	1 632 327	1 739 500	1 726 310	1 698	1 703
5-9	1 527 967	1 524 461	1 544 030	1 530 030	1 600	1 592
10-14	1 369 129	1 371 047	1 369 820	1 361 000	1 433	1 431
15-19	1 080 641	1 128 503	1 137 660	1 131 850	1 131	1 178
20-24	909 435	943 477	939 500	942 170	953	985
25-29	776 950	796 408	796 680	800 540	813	832
30-34	666 137	693 332	698 130	704 470	698	724
35-39	591 778	600 033	594 980	597 990	620	626
40-44	514 944	518 718	510 970	514 010	539	542
45-49	444 640	426 235	421 790	430 600	466	445
50-54	365 961	373 290	342 070	360 410	384	390
55-59	278 181	277 584	273 380	297 140	291	289

60-64	222 248	262 456	221 480	251 380	232	274
65-69	160 528	188 201	167 750	189 140	167	196
70-74	99 229	134 332	98 690	132 180	103	141
75-79	53 430	75 242	55 760	81 260	56	78
80+	62 774	102 439	47 290	95 400	66	107
Total	**10 746 089**	**11 048 085**	**10 959 480**	**11 145 880**	**11 250**	**11 533**

* Source: Republic of South Africa, Department of South Africa (1976). Single ages: 1941-1970. Report No. 02-05- 05, The Government printer, Pretoria.

** Source: Sadie J. L. (1988). A reconstruction and projection of demographic movement in South Africa.

*** Source: Central Statistical Service (1996). Statistics in Brief. CSS, Pretoria.

BACK TO TOP

APPENDIX 2a: Implied age distributions from the population projections medium variant mid-year estimates

Age group	1970	1975	1980	1985	1990	1995	1996
0 - 4	15,68	15,52	14,94	13,76	12,83	12,85	12,86
5 - 9	13,90	13,62	13,54	13,19	12,28	11,45	11,47
10 - 14	12,35	12,27	12,04	12,10	11,89	11,06	10,90
15 - 19	10,28	10,89	10,82	10,74	10,89	10,69	10,53
20 - 24	8,52	8,99	9,55	9,61	9,62	9,75	9,71
25 - 29	7,23	7,41	7,85	8,44	8,57	8,59	8,61
30 - 34	6,35	6,26	6,44	6,91	7,51	7,62	7,63
35 - 39	5,40	5,46	5,41	5,64	6,11	6,65	6,66
40 - 44	4,64	4,60	4,68	4,69	4,95	5,37	5,46
45 - 49	3,85	3,89	3,88	4,00	4,06	4,29	4,37
50 - 54	3,18	3,15	3,20	3,24	3,39	3,45	3,49
55 - 59	2,58	2,51	2,51	2,59	2,66	2,79	2,80
60 - 64	2,14	1,93	1,90	1,94	2,03	2,10	2,12
65 - 69	1,61	1,48	1,36	1,36	1,42	1,50	1,51
70 - 74	1,04	1,01	0,94	0,89	0,91	0,95	0,97
75 - 79	0,62	0,57	0,56	0,54	0,52	0,54	0,55
80 +	0,64	0,44	0,37	0,36	0,35	0,35	0,35
Total	**100,00**	**100,00**	**100,00**	**100,00**	**100,00**	**100,00**	**100,00**

BACK TO TOP

APPENDIX 2b: Implied age distributions from the population projections high variant mid-year estimates

Age group	1970	1975	1980	1985	1990	1995	1996
0 - 4	14,93	15,69	15,11	13,86	12,81	12,80	12,82
5 - 9	14,01	12,97	13,67	13,34	12,38	11,44	11,44
10 - 14	12,57	12,35	11,45	12,20	12,03	11,15	10,98
15 - 19	10,13	11,06	10,89	10,21	10,99	10,83	10,66
20 - 24	8,51	8,86	9,69	9,65	9,15	9,85	9,82
25 - 29	7,22	7,40	7,72	8,56	8,62	8,17	8,29
30 - 34	6,24	6,25	6,42	6,80	7,62	7,68	7,60
35 - 39	5,47	5,37	5,40	5,62	6,02	6,75	6,76
40 - 44	4,74	4,66	4,59	4,68	4,94	5,29	5,42
45 - 49	4,00	3,98	3,92	3,92	4,05	4,28	4,35
50 - 54	3,40	3,27	3,27	3,28	3,33	3,45	3,49
55 - 59	2,55	2,68	2,59	2,64	2,69	2,75	2,77
60 - 64	2,22	1,90	2,03	2,00	2,07	2,12	2,13
65 - 69	1,59	1,54	1,33	1,45	1,46	1,53	1,54
70 - 74	1,07	1,00	0,98	0,87	0,97	0,98	0,99
75 - 79	0,59	0,59	0,56	0,57	0,51	0,58	0,58
80 +	0,76	0,45	0,38	0,36	0,37	0,35	0,35
Total	**100,00**	**100,00**	**100,00**	**100,00**	**100,00**	**100,00**	**100,00**

BACK TO TOP

Back to Methodology Reports index