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AN ANALYSIS OF AGE-SEX DATA OF ETHIOPIA IN THE PRE-1984 PERIOD

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ABSTRACT. The main trust of this study was the application of internal consistency checks to various sets of Ethiopian (rural) age data collected prior to 1984 to assess their reliability and accuracy, and to check improvement in the quality of age-sex statistics over the period 1967-1981. Analysis of the age and sex ratios of the 1967, 1970 and 1981 survey data revealed marked irregularities (more marked among females than for males) suggesting, among other things, the incidence of age preference (heaping) and age mis-reporting. Model stable population techniques were also used to examine the pattern and extent of errors in the reported age-sex data from these various surveys. Attendant errors are similar to those in other African countries and are consistent over the years except the 1981 age distribution which is unique after age 25. The findings of this study also indicate that the quality of age reporting has improved over the years (1967-1981).

1. INTRODUCTION

With very few exceptions, the accuracy of age-sex data is doubtful in all Third World countries. Probably, however, no age-sex statistics ever collected, even in highly developed countries, is completely accurate.

The collection of accurate age data from surveys involves a number of definitional, sampling, and operational problems. The argument is not that these problems are necessarily limited to the less developed countries for they are encountered in similar surveys in the developed nations. The main point is that these problems are most marked in the less developed nations where most of the people are illiterate, not traditionally age-conscious; suspicious of age data reporting, and are not issued with birth certificates because they seldom need it. In an extensive study of the age data from less developed countries, Coale and Demeny [10, p.15] have described the more common experience: "In many of the less developed countries

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the age distribution reported in surveys and censuses is affected by gross misreporting of age .... Indeed, it appears likely that often many more ages are misreported than given correctly".

The most common type of errors revealed in age data reported in the less developed surveys are, omissions at the time of enumeration, digit and age preferences and ignorance of exact age. It has been observed that in Indonesia, India and some other countries in Asia and the Far East Region these kinds of errors are so large that even after grouping into five or ten year intervals, these errors continue to persist [1, p.287].

Ethiopia is no exception to this. Ethiopia is one of the many countries of the Third World where reliable demographic data are almost completely lacking. In Ethiopia this lack of data is mainly caused by the absence of effective vital registration systems and population census until 1984. (The first national census was carried out in 1984). With the failure to obtain data from either vital registrations or censuses, a series of surveys (none of which had a complete national coverage) has been conducted to fill the gaps. The first real and scientific national sample survey was carried out during 1964-67 by the Central Statistical Office, CSO (now CSA). The second national sample survey was conducted during 1968-71 and the most recent rural demographic survey in 1980-81 by the same office.

Despite the fact that these surveys have been instrumental in collecting, among other things, information on certain basic demographic data (i.e. size of the population, its age and sex distribution, fertility and mortality data, etc.), no systematic and comprehensive evaluation and analysis (other than the CSO's official publications and few other studies) of the data collected by these surveys exist to our knowledge. An attempt is made in this study to assess the quality of the existing age-sex data collected prior to 1984.

Only such evaluation and analysis can ensure that any future survey and/or census will be an improvement on these surveys. This data assessment will, it is hoped, alert users of the risks and limitations of the data available and the extent and nature of errors involved when using and interpreting such information.

2. OBJECTIVES OF THE STUDY

Knowledge of population characteristics is central to the planning process. We need not only the size of a population or its rate of growth but also its age-sex structure, because when errors in the age reporting are substantial, conclusions drawn from such statistics are likely to be inaccurate. Only with proper knowledge of the change in population structure and its composition by age and sex can the necessary estimates be made for planning socio-economic development. For example, the health services required are very different for a young and for an old population. In estimating the needs of a population in regard to education, health, labour force, housing and food, the planner and the policy-maker will have to depend on pertinent population statistics classified by age and sex. From a purely demographic point of view, age data are vital for reliable estimation of the basic components of population growth and for making acceptable population projections.

If these needs are to be adequately met, a critical appraisal of the quality of age and sex distribution of a population is very vital. The purpose of this paper, therefore, is to provide some evidence on the accuracy and reliability of the age-sex statistics of rural Ethiopia collected prior to 1984.

The main objectives of the study may be specified as follows:

1. to identify the patterns and types of age-reporting errors and their probable causes;

2. to determine the level of accuracy of the age-sex statistics;

3. to check improvements in quality of the survey age data over the period between 1967 and 1981.

3. THE DATA

The major data sources are the published results of the 1967[2], 1970[3] and 1981[4] surveys conducted by the CSO (The input data used in the present analysis are provided in Table 1).

In rural Ethiopia, where most people are not aware of their exact age, there is a good chance that errors in the reporting of age will occur. Further, age in some cases may not be known at all, and the interviewer may have to estimate it by reference to historical events or guess it by using physical and demographic characteristics (e.g. attainment of menarche, puberty, menopause, marital status and number of children) of the respondents. In such circumstances, it is very likely that different types of errors, such as heaping at certain ages, a systematic tendency of age mis-statement, actual omissions of certain age segment, etc., will distort the age-sex data of the surveys. In recognition of these problems, attempts are made here to investigate the extent to which these types of errors are prevalent in Ethiopian survey data collected in 1967, 1970 and 1981 surveys.

4. METHODOLOGY USED

There are usually two main approaches to evaluate age-sex data: firstly checking against external data sources and secondly, checking for internal consistency. The latter approach has been used in this study. In order to achieve our goal of the assessment of the quality of the age data, a variety of the internal consistency checks have been utilized. These include, the age and sex ratios, the UN Age-Sex Accuracy index, the Myers' index, the Carrier's index and the Stable Population technique. Each one of these methods including their assumptions and functions are discussed in subsequent sections.

Table 1

Reported age Sex Distribution of Rural Ethiopia, 1967, 1970, and 1981

	1967[a]		1970[b]		1981[c]	
Age Group	Male	Female	Male	Female	Male	Female
0 - 4	1,014,940	984,130	1,666,400	1,646,300	2,324,402	2,278,400
5 - 9	1,007,715	918,380	1,671,400	1,534,800	2,323,379	2,253,148
10 - 14	596,620	452,390	989,200	760,900	1,646,664	1,388,047
15 - 19	463,830	387,205	746,000	640,200	1,185,902	944,250
20 - 24	318,525	453,015	522,900	674,900	783,433	838,648
25 - 29	400,090	543,710	646,600	836,800	743,164	920,571
30 - 34	385,855	459,140	605,200	696,600	652,118	853,376
35 - 39	363,010	325,425	561,900	525,400	655,606	699,661
40 - 44	278,080	304,215	449,100	448,000	595,029	637,196
45 - 49	189,520	149,775	306,100	254,200	463,751	409,160
50 - 54	201,565	186,380	293,200	272,800	429,859	427,173
55 - 59	137,625	65,400	177,600	104,800	309,768	207,679
60 - 64	121,745	100,510	195,700	156,900	344,040	308,605
65 - 69	65,585	32,465	102,900	55,800	201,391	126,467
70 - 74	54,440	35,600	77,700	56,000	189,125	147,363

Source: a - CSO,[1971]: *The Population of Ethiopia*, Addis Ababa.
b - __, [1974]: *The Demography of Ethiopia*, Addis Ababa.
c - __, [1985]: *Report on the Results of the 1981 Demographic Survey*, Addis Ababa.

5. EVALUATION OF AGE-SEX DATA OF ETHIOPIA (RURAL) COLLECTED PRIOR TO 1984

The study of age distribution begins with the plotting of population in single year of age or broader age groups against ages. In the absence of genuine fluctuations and age reporting errors one would expect a decreasing trend in the age distribution as age advances in a regular fashion along a smooth curve by virtue of mortality. In practice however, age curves are seldom smooth due to sharp fluctuations in birth, migrations and abnormal situations like wars and due to age misstatement errors.

The age pattern observed for rural Ethiopia is quite distinct from the normal expectation. The peaks and troughs corresponding respectively to the preferred and avoided terminal digits of the single year of age data of 1981 presented in Figure 1 are manifestly evident. Graphical methods are useful in locating errors in age distribution. But they fail to give a measure of the degree of accuracy in the entire age structure. Thus in order to get a fairly good idea of the overall accuracy in age returns several indices have been computed in this analysis.

5.1 Quality of Age-Sex Data: Accuracy Test

The method of assessing the quality of age data involves computing age ratios* for five-year age-groups and observing how far these deviate from 100. In distortion-free age distributions these ratios should be quite close to 100. The underlying assumption of this fact is that, in normal conditions, any age group is equal to or slightly larger than the arithmetic mean of the two adjacent age groups and itself since mortality increases with age and thus age ratios are approximately 100.

*Age ratio is here defined as 100 times the ratio of the popualtion in a given age-group to the arithmetic mean of the popualtions in the age-group itself and the two adjacent age-groups.

The age ratios for males and females of various surveys are shown in Table 2. Figures 2 and 3 show graphically the age ratios for males and females respectively. It is evident from Table 2 and these Figures that the age distribution for each sex contains heavy distortions. Also the magnitude of the deviation from 100 in each sex rises with age.

However, the pattern is quite regular for ages above 40 inclusive. For these ages, the ratios are well below 100 for each quinary age group ending with digit 5 while they are much above 100 for the age groups ending with 0. These are simply the effects of the differential digital preference between digit 0 and digit 5. Because of the greater preference for digit 0 than for digit 5, more clustering is observed at age groups ending with 0 than the neighbouring ones ending with 5.

For ages below 40 the differential preference between 0 and 5 is still highlighted but in the reverse order. The age ratios for age groups ending with digit 5 are now above 100 or clearly greater than those for age groups ending with digit 0. This reversal which is common in age data of many inquiries of Francophone African countries has also been noted by Van de Walle [14, pp. 12-87]. It is most probably due to the practice whereby in these inquiries interviewers during their training have been specifically cautioned against figures ending in 0. The same reason was also to be expected in the Ethiopian surveys.

Inspection of the age ratios in Table 2 also reveals that the effect of age heaping is more marked for females than for males and for older than for younger ages. Differences in literacy status may be cited as one of the factors behind the sex differential with regard to the accuracy of age reporting. In this instance, nearly 8.9 and 63.4 percents in 1970 and 1981 respectively of the rural Ethiopian males age 10 and over were recorded as literate as compared to only 0.4 and 39.1 percents for females at the same ages [3, p.18, 4,p. 183]. Another possible explanation for this difference could be due to the fact that the respondents were the heads of the household who are usually males. These heads of

households are likely to know their exact ages and those of their offsprings better than those of their spouses and hence divergence in the accuracy of age reporting.

It is encouraging to note that the amount of bias in the age data is not as pronounced as it was in the previous survey of 1967. Once again, part of the improvement in age statistics between 1967 and 1981 may be explained in terms of the overall increase in the level of literacy of the population. In 1967, 4.1 percent of the population (both sexes) age 10 and over was recorded as literate but by 1981 this figure had risen to 58.0 percent [3, p.18, 4. p. 183].

Another method of testing the accuracy of age data is to compute the sex-ratios (number of males per 100 females) for successive five-year age groups. Normally, sex ratios should be close to 100, since the excess of males at birth is compensated for, in subsequent years, by the higher death rates of the males. Therefore, any considerable variations of sex ratios from 100 that cannot be explained by abnormal mortality conditions (e.g. high maternal mortality) or by a pattern of heavy migrations, suggest reporting errors in age and sex data [7, pp. 86-89]. Such sex ratios are computed from the 1967, 1970 and 1981 Ethiopian survey data. They are shown here in Table 2 and Figure 4.

Broadly, the sex ratio pattern indicates an excess of males over females at age 0-19, a predominance of females over males at age 20-34 while above age 44 the males outnumber females. This unusual pattern (except when compared with other African data) might have been created by various circumstances.

Fig. 1

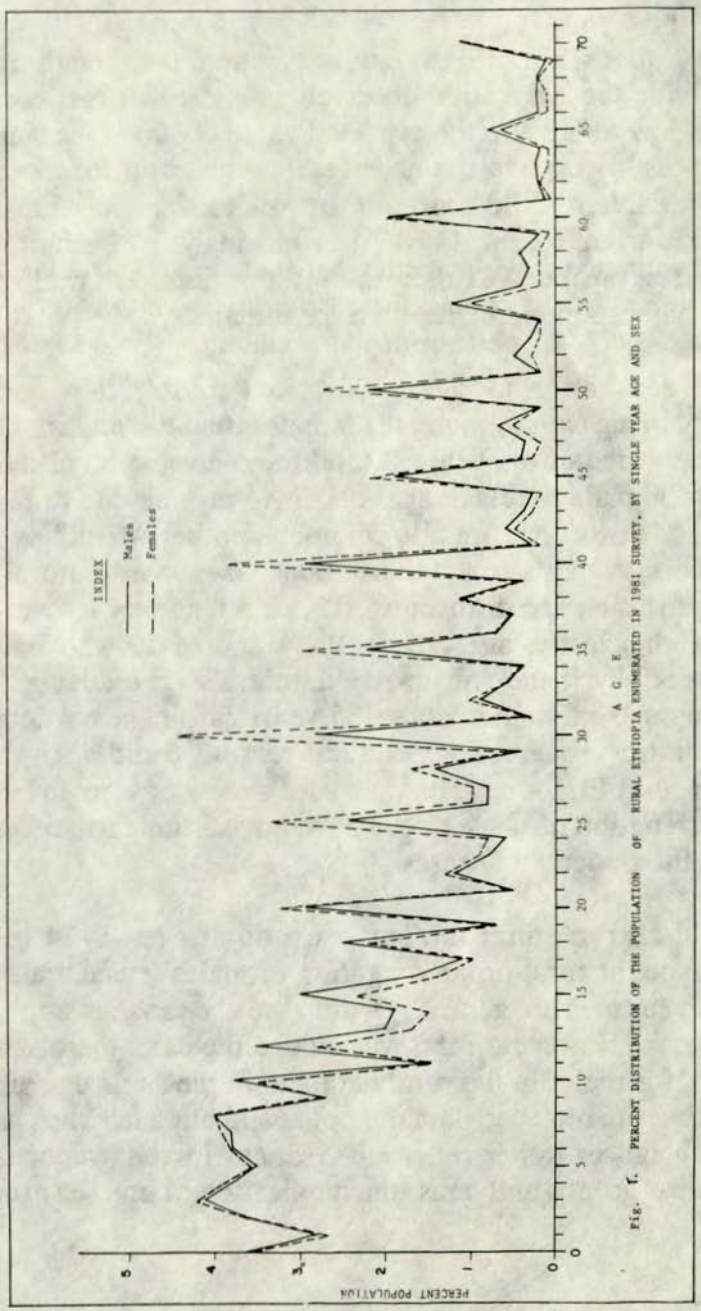

Fig. 1. PERCENT DISTRIBUTION OF THE POPULATION OF RURAL ETHIOPIA ENUMERATED IN 1981 SURVEY, BY SINGLE YEAR AGE AND SEX

Regarding the sex ratio of the age group 0-4,though it is high compared with the sex ratios observed in most African countries, it appears still low relative to the expected value of 100. One single factor that could possibly explain the observed low sex-ratio for age 0-4 is the known higher infant/child mortality for males than for females. For example,. G.Mariam [6, pp. 149-165] in his analysis of infant and child mortality based on the 1981 data showed that infant mortality is about 20 percent higher among males than for females.

The low sex ratios at ages 20-34 are most likely due to age misreporting being worse among the females than the males: the upward ageing of the women from below 20 and the rejuvenation of those above 35. Part of the male excess at ages above 44 may be due to this reason. These kinds of distortions are also common in other African data [13, pp. 58-62]. This suggests that there may be some cultural reasons responsible for such age distortions. This is a tendency to over-estimate the ages of girls in the age groups 10-14 and 15-19 who have passed puberty, especially if they are married, and also a tendency to under-estimate the ages of women above 35 years causing a net forward and backward shifting errors. Such cultural reasons could also possibly be reflected in rural Ethiopia. These upward ageing of women from below 20 and rejuvenation of those above 35 years call for further research to investigate the underlying causes.

We would also interpret the low sex ratio at ages 20-34 in terms of possible impact of rural-urban migration of males (since male migrants in Ethiopian cultures are generally within the age range of approximately 20 to 40 years). However, if this was indeed the case, there should have been a "dip" for males in the rural data and in the same age groups. To the extent that the reported data did not reveal any such 'dip', we suggest that the imbalances rather reflect the extent of wrong reporting of age for specific sex groups and omission/duplication of one sex group or the other.

Table 2

Age Ratios and Sex Ratios by Quinary Age Groups for Ethiopia, 1967, 1970 and 1981.

Age Group	Age Ratios						Sex Ratios		
	1967		1970		1981		1967	1970	1981
	Male	Female	Male	Female	Male	Female			
0-4	-	-	-	-	-	-	103.13	101.22	102.02
5-9	115.42	117.00	115.88	116.80	110.73	114.19	109.73	108.90	103.12
10-14	86.54	77.20	87.11	77.75	95.81	90.81	131.88	130.00	118.63
15-19	100.91	89.87	99.11	92.51	98.39	89.33	119.79	116.53	125.59
20-24	80.81	98.20	81.90	94.09	86.65	93.06	70.31	77.48	93.42
25-29	108.67	120.04	109.30	113.68	102.33	106.44	73.59	77.27	80.73
30-34	100.75	103.70	100.10	101.51	95.39	102.06	84.04	86.88	78.06
35-39	106.05	89.67	104.30	94.38	103.37	96.62	111.55	106.95	93.70
40-44	100.44	117.09	102.30	109.48	104.12	109.48	91.41	100.25	93.38
45-49	84.90	70.17	87.59	78.22	93.46	83.30	126.54	120.42	113.64
50-54	114.40	139.24	113.20	129.50	107.16	122.75	108.15	107.48	100.63
55-59	89.57	55.69	79.94	58.82	85.76	66.04	210.44	169.47	149.16
60-64	112.40	152.00	123.29	148.30	120.69	144.00	121.13	124.73	111.48
65-69	81.38	57.78	82.03	62.30	82.25	65.14	202.02	184.41	159.24
70-74	-	-	-	-	-	-	-	-	-

Source: The Same as Table 1.

Fig. 2

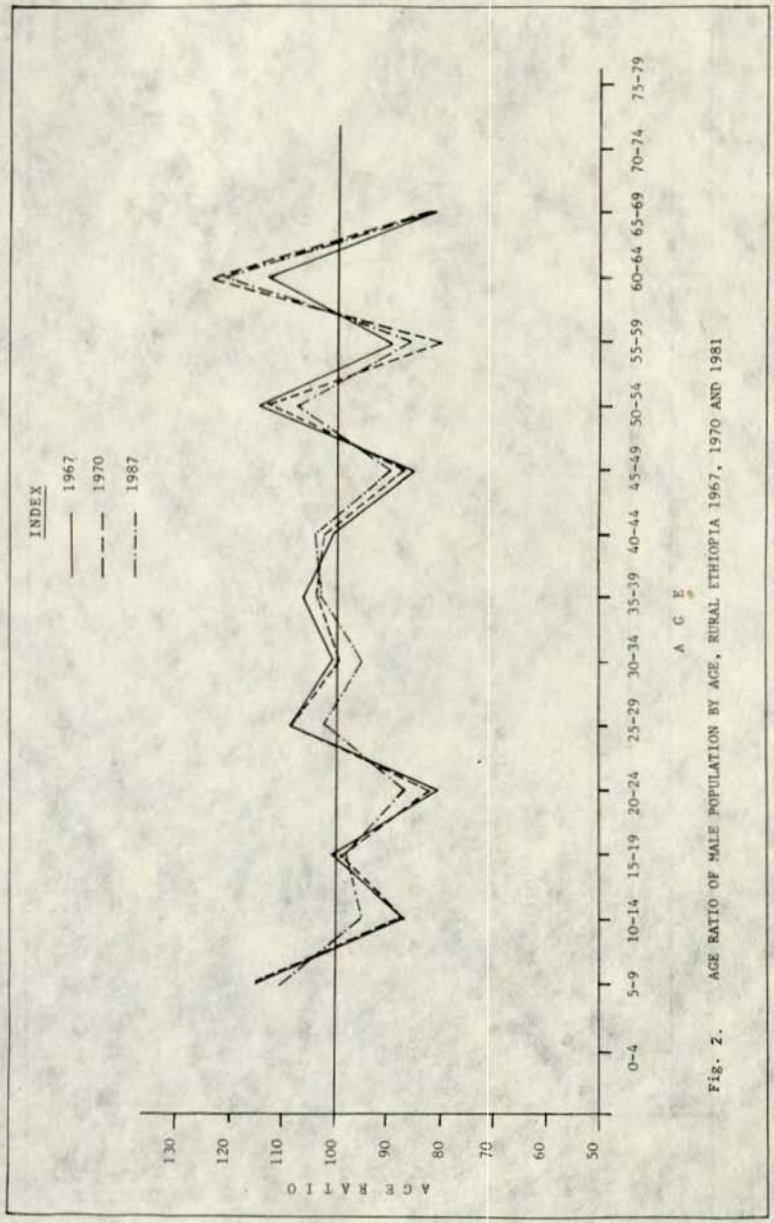

Fig. 2. AGE RATIO OF MALE POPULATION BY AGE, RURAL ETHIOPIA 1967, 1970 AND 1981

Fig. 3

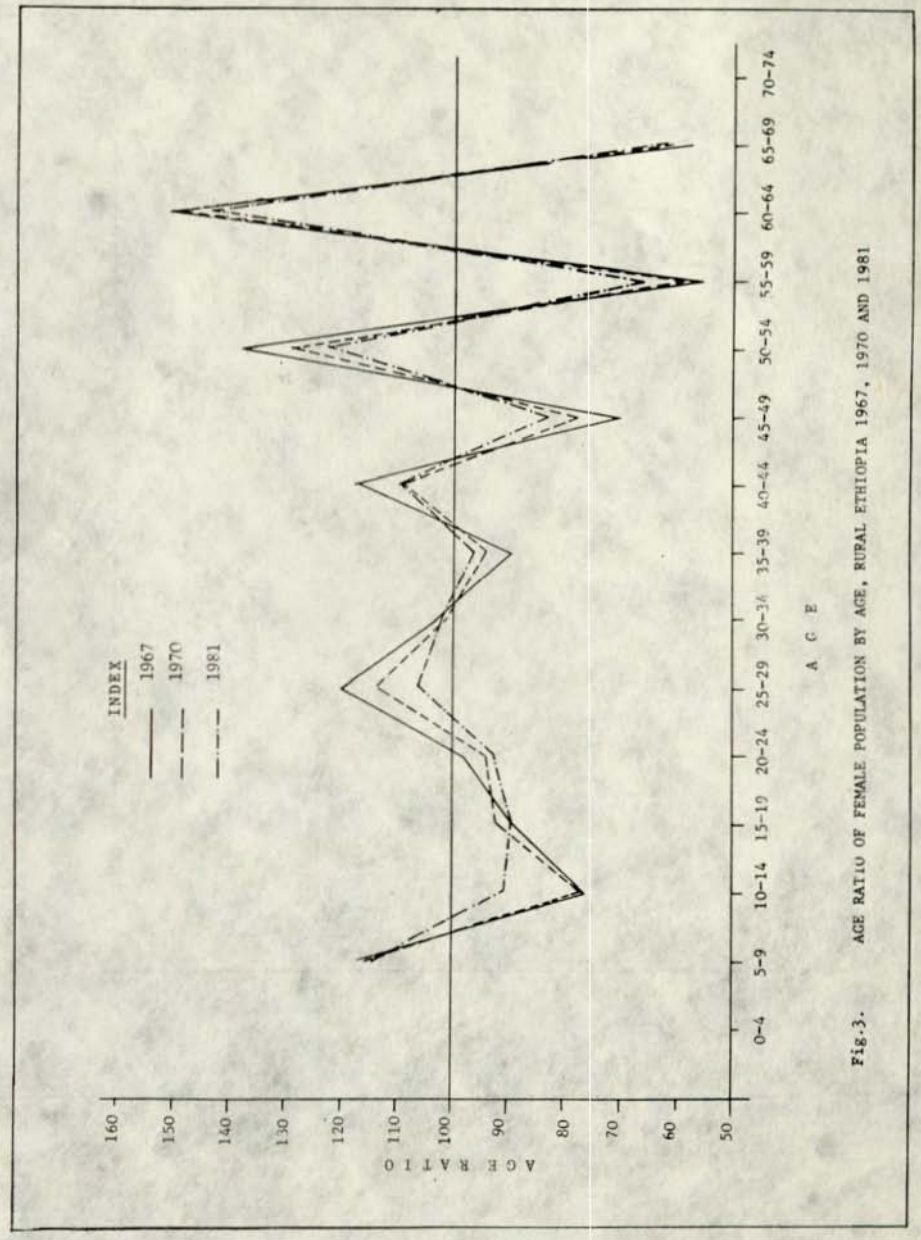

Fig.3. AGE RATIO OF FEMALE POPULATION BY AGE, RURAL ETHIOPIA 1967, 1970 AND 1981

Fig. 4

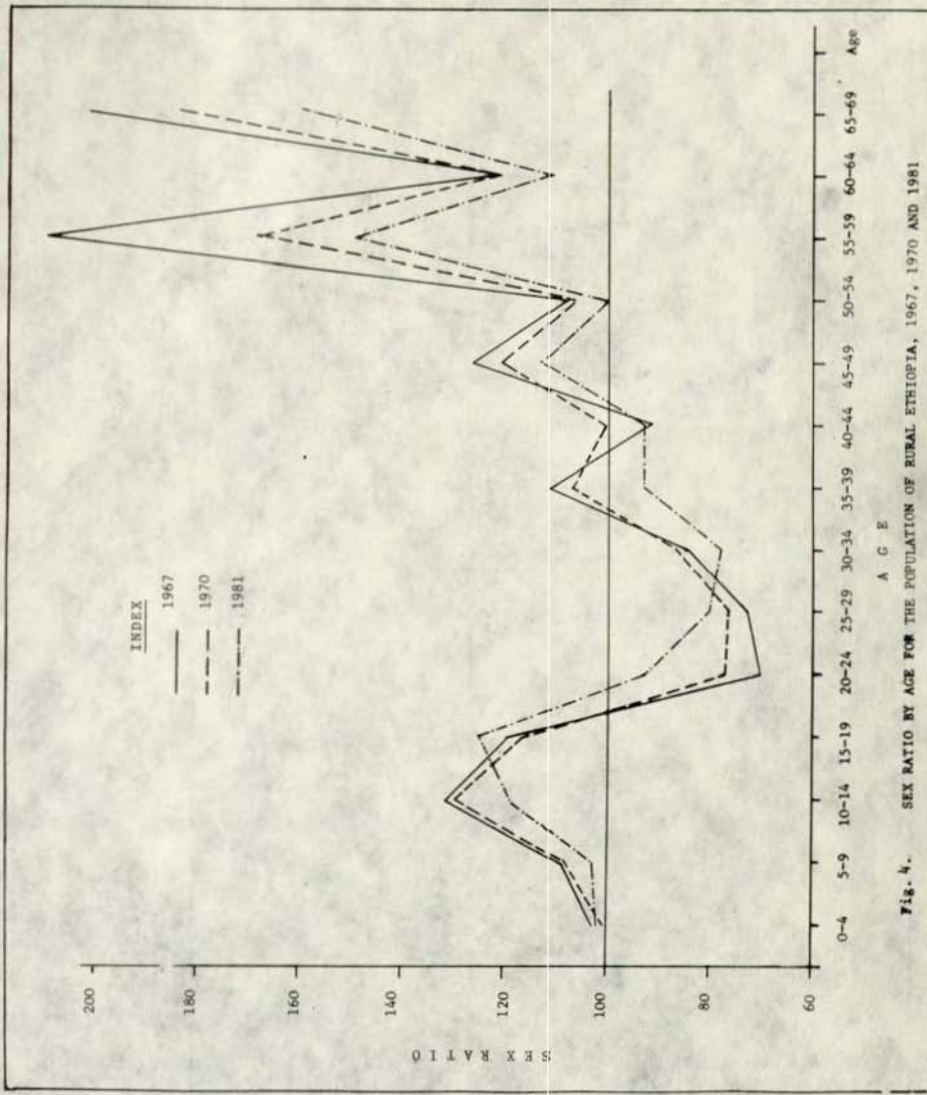

Fig. 4. SEX RATIO BY AGE FOR THE POPULATION OF RURAL ETHIOPIA, 1967, 1970 AND 1981

In order to take account of variations of both the sex-ratios and age-ratios the UN Age-Sex Accuracy index (UN Joint Score) has been computed for each survey data. This index is a measure of overall age reporting accuracy and is defined as the sum of the mean deviations of age ratios from 100 for males and females (i.e age ratio scores) and three times the mean of age-to-age differences in sex ratios. Since sex ratios are more severely affected by irregular population trends more weight is given to sex-ratio score in the UN index. Experience indicates that data quality is described as "accurate", inaccurate" or "highly inaccurate" depending upon whether the UN index is less than 20, 20-40 or greater than 40 respectively.

However, the major problem with the UN index is that true fluctuations in the age distribution will inflate its values, which will anyway be greater than zero even for a perfectly recorded stable population because sex ratios do change gradually with age and on average, any age group is larger than the arithmetic mean of both its neighbours and itself, since mortality increases with age. In addition, this index does not measure net under-enumeration by age [9, pp. 113-123].

Based on the age and sex ratio analysis, the overall Age-Sex Accuracy indices come out as 143.9, 104.9 and 83.6 for the 1967, 1970 and 1981 surveys respectively indicating that the data are extremely unreliable and of unacceptable quality. But part of the problem may be the fact of fluctuating fertility and mortality conditions which the method is unable to take care of. To sum up, the age and sex ratios as well as the UN index support the conclusion that although the quality of age data in rural Ethiopia is still unsatisfactory, it has nevertheless improved during the 1967-1981 period.

In order to determine the extent of preference (heaping) at specific ages the Myers'and the Carrier's indices have been computed for single year of age data of the 1981 survey. Unfortunately, single year of age

data for the 1967 and 1970 were not available to the author and thus these indices were calculated only for the 1981 data.

The Myers' summary index of preference for all terminal digits is derived as one-half the sum of the deviations from 10 percent, each taken without regard to sign. On the assumption of all else being equal, Myers' index should be approximately equal to 0 for no heaping, and 90 if all ages were reported at a single digit. The problem, however, is that all else is not equal in practical terms. Because of the effect of such factors as the sample size of the population, migration as well as the varying incidence of digit preference over the age range, the Myers' index will be greater than 0 even when age-heaping is non-existent. These problems are to a certain extent taken care by the Carrier method (Table 3).

Table 3 presents the deviations from 10 percent of preference for terminal digits for both males and females separately. According to these indices (Myers' and Carrier), a positive deviation for any digit indicates over selection of ages ending in that digit (digit preference), conversely, a negative deviation indicates underselection of ages in that digit (digit avoidance).

A closer examination of Table 3 reveals that the greatest amount of digit preference occurred at ages ending in 0, followed by ages ending in digit 5. There was also a slight degree of overstatement for ages ending in 8. Ages ending in any of the remaining seven terminal digits, however, tended to be understated, with the extent of understatement (or avoidance) being least for ages ending in digit 2 and greatest for ages ending in digits 9 and especially 1. Digits 3,4 and 7 were also understated although certainly not pronounced as digits 1 and 9. Similar preference for digits 0 and 5 and avoidance for digits 1, 3, 7 and 9 have been observed for some of the African countries like, Ghana (1978), Kenya (1969), Nigeria (1969) and Tanzania (1967) [11, pp. 223-224].

Table 3
Deviation of Digit Preference from 10 Percent
At Each Digit and Myers' and Carrier's Indices (1981)

	Deviations from 10 Percent			
	Myers		Carrier	
Terminal Digit	Male	Female	Male	Female
0	15.96	21.56	10.47	16.56
1	-6.75	-6.95	-6.77	-6.64
2	-1.08	-2.09	-1.43	-1.88
3	-3.71	-4.71	-3.97	-4.58
4	-4.55	-5.31	-4.53	-4.98
5	10.67	11.85	10.15	12.40
6	-2.69	-3.97	-2.41	-3.58
7	-3.86	-4.78	-3.11	-4.09
8	2.13	1.06	3.23	2.74
9	-6.12	-6.66	-1.62	-5.96
Index of Preference	28.76	34.47	23.85	31.71

Source: Based on unpublished data obtained from CSO.

The application of the Myers' method to the single year of age data of 1981 yielded indices of preference of 28.76 and 34.47 for males and females respectively. These are very large indices, and indicate a substantial amount of digit preference/avoidance in that survey. Incidently, it is observed that male age reporting is better than the female. It may be that respondents were mostly males and therefore reported their ages better than those of the females whose ages would have been mostly recorded by estimation with the help of the interviewers or possibly the head of the household.

As in the Myers' technique, in the Carrier's technique all digits (i.e 0,1,2, ..., 9) get all possible positions in the arrangement, and hence do not have undue relative advantage/disadvantage. The overall Carrier's index is obtained as one-half the sum of the deviations from 10 percent each taken irrespective of sign. The smaller this index (i.e. the nearer it is to zero), the more accurate the age statistics can be considered in terms of digit preference. As can be surmised from Table 3 the digit 0 according to Carrier's method is the most preferred of all. The only other digit generally preferred is 5. In general, the conclusions drawn on the basis of the Myers' index are confirmed by the Carrier index. But the incidence of age heaping is less pronounced for each sex in the latter index. One possible reason for observed differences is the effect of other factors like the age structure of the population or the varying incidence of digit preference over the age range which the Myers' technique is unable to take care of.

5.2 Quality of Age Data: Comparison With Model Age Distribution

Apart from computing indices of accuracies in age data, comparison of reported age-sex distribution with an expected age distribution of population models can be used to throw more light on the quality of the Ethiopian age data collected prior to 1984. Calculation of indices based on the age-sex data of the surveys has already been accomplished.

Further attempts will be made to investigate the pattern of age reporting errors by comparing the reported age distributions with selected stable population models.

One of the problems with this approach is the suitability of the stability assumption vis-a-vis the population in question. In the case of Ethiopia we shall assume tentatively that the actual age distributions of the rural populations of the country were largely determined by previous trends of fertility and mortality. This assumption is subject to serious reservations. There is reason to believe that mortality has not been constant in rural areas of Ethiopia during the last several decades. Few studies conducted in Ethiopia also indicate that fertility has slightly increased. Migration (rural to urban), especially those in the labour force may be of a very significant volume (for which we have no evidence) to have adverse effect on the assumption of stability of the populations. Published information on rural-urban migration in Ethiopia is too fragmentary to be of any use for adjusting the age distributions. Nevertheless, it is convenient to compare reported age distributions to hypothetical ones based on stable population assumption.

This approach has been applied to age data from many other African countries whose fertility and mortality have not been constant, and a pattern of error has been discerned [10, p. 15-22]. The pattern discerned is that for the generality of African countries, the reported age-sex of female proportion in five year intervals exhibits the following characteristics relative to the stable: (1) the proportion 5-9 is above the stable, (2) the proportions 10-14 and 15-19 are below the stable, and (3) the proportions 25-29 and 30-34 are above the stable. In other words, the female age distributions in these other African countries have surplus at 5-9 and a deficit in the adolescent age intervals (10-14 and 15-19 years) followed by a surplus in the central ages of childbearing (25-34 years). It is, therefore, useful to ascertain if the error pattern from rural Ethiopia conforms to the general pattern.

Table 4

Cumulated Proportion under Age x, C(x) for Males and Females and Corresponding Fitted Stable Birth Rate*, b(x) Ethiopia (Rural), 1967, 1970 and 1981

Age	1967				1970				1981			
	Proportion under age x		Estimated birth rate		Proportion under age x		Estimated birth rate		Proportion under age x		Estimated birth rate	
x	C(x)		b(x)		C(x)		b(x)		C(x)		b(x)	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
5	17.95	18.10	49.13	48.14	18.33	18.88	50.31	50.44	17.73	18.09	47.37	47.17
10	35.78	34.99	55.87	52.69	36.71	36.48	57.78	55.62	35.45	35.48	53.80	53.40
15	46.33	43.31	51.63	45.57	47.59	45.21	53.73	48.51	48.01	47.00	53.06	50.33
20	54.54	50.43	47.77	41.11	55.79	52.55	49.64	57.06	54.50	50.33	45.60	45.60
25	60.17	58.76	42.95	40.48	61.54	60.29	44.86	42.47	63.04	61.16	45.87	42.70
30	67.25	68.76	41.94	43.63	68.65	69.89	43.88	45.22	68.71	68.47	43.03	42.35
35	74.08	77.21	41.99	46.72	75.31	77.88	43.83	47.90	73.68	75.10	40.53	42.58
40	80.50	83.20	42.44	48.23	81.49	83.90	44.77	49.65	78.66	80.66	39.24	42.73
45	85.42	88.80	43.05	51.58	86.43	89.04	45.31	52.28	83.22	85.72	38.24	43.59
50	88.77	91.56	41.44	50.31	89.80	91.95	44.01	51.51	86.76	88.97	36.26	42.43
55	92.34	94.99	41.93	54.06	93.02	95.08	44.13	54.52	90.04	92.36	34.93	43.00
60	94.77	96.19	40.80	50.15	94.97	96.28	41.67	50.66	92.40	94.01	31.99	39.39
65	96.92	98.04	41.11	53.34	97.12	98.08	42.45	53.80	95.02	96.46	31.03	40.63
70	98.08	98.64	37.82	48.00	98.25	98.72	39.65	49.21	96.56	97.46	27.22	35.90

* The stable birth rates are based on female mortality level 10 for 1967 and 1970 and level 11 for 1981 and are derived from the Regional Model Life Tables and Stable Populations, Princeton(1966).

Fig. 5

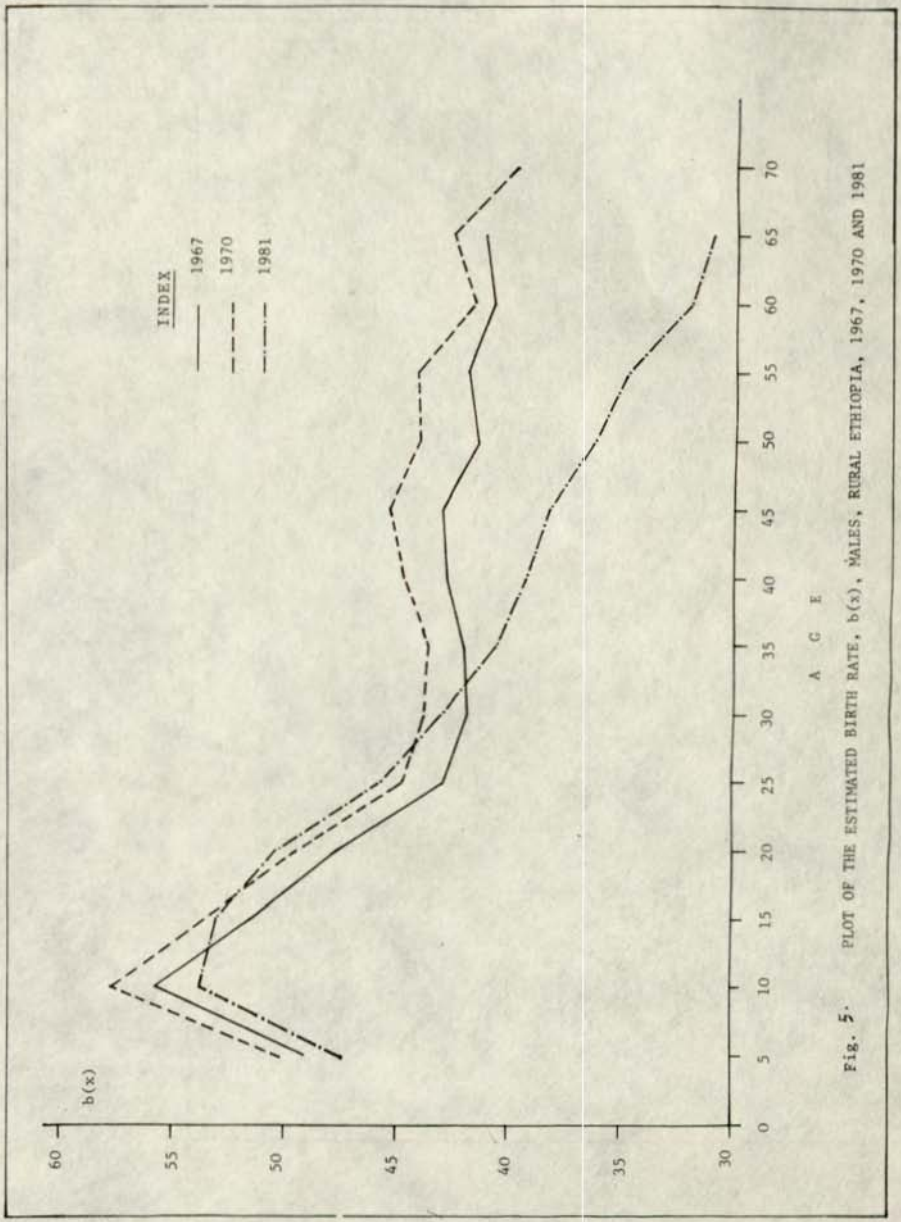

Fig. 5: PLOT OF THE ESTIMATED BIRTH RATE, b(x), MALES, RURAL ETHIOPIA, 1967, 1970 AND 1981

Fig. 6

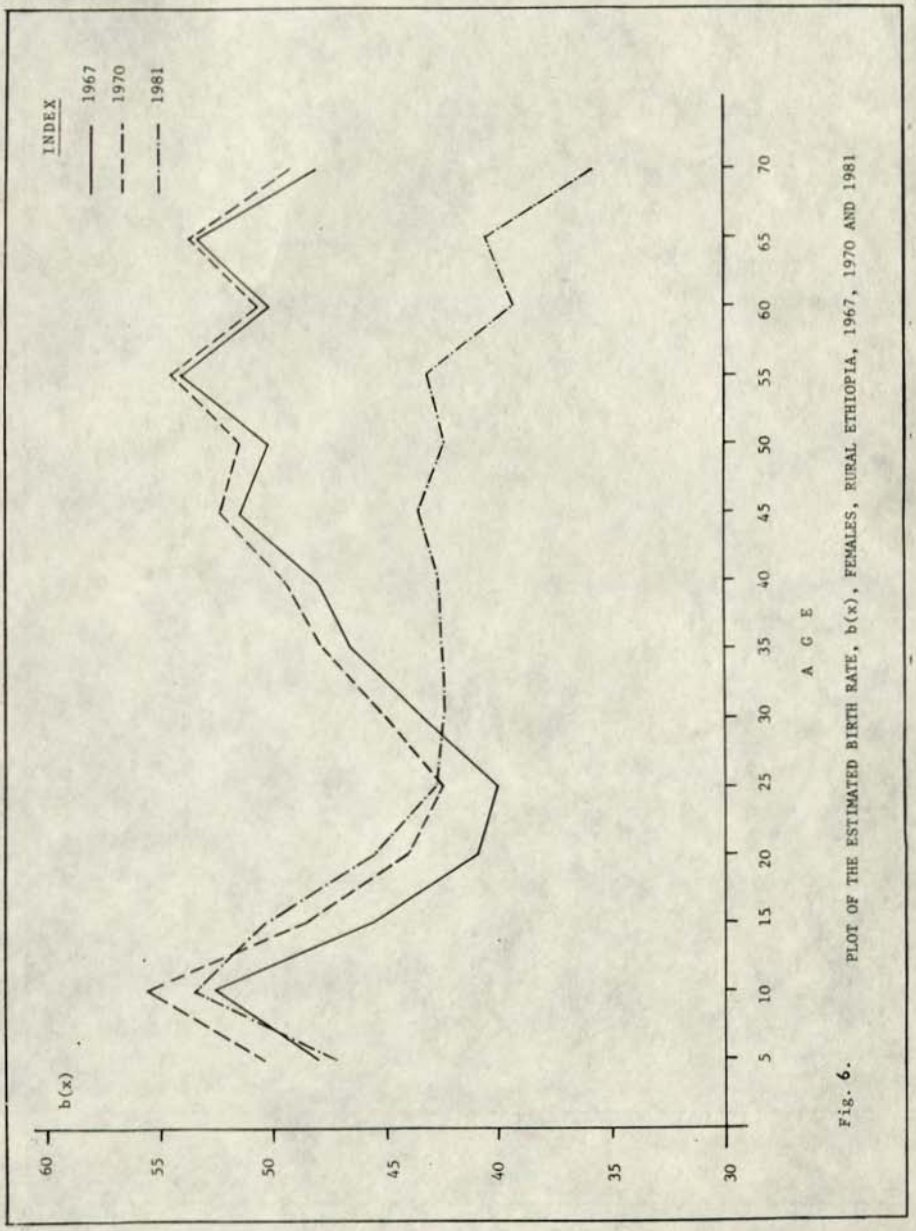

Fig. 6. PLOT OF THE ESTIMATED BIRTH RATE, b(x), FEMALES, RURAL ETHIOPIA, 1967, 1970 AND 1981

Specifically the method adopted here is the derivation of birth rates b(x), for each age x = 5, 10, 15, ..., 70 from the Coale Demeny Stable Population Tables [5]. For each cumulated age C(x), the corresponding stable is interpolated and the birth rate, b(x) identified. In theory, the values of b(x) derived from a truly stable population and error-free distribution is very nearly constant for different ages, x. When the age distribution in question is distorted by age-misreporting or age selective omission, b(x) values may be far from constant [12, p.160]. Thus the objective of this approach is not to make the reported age-sex data conform closely to the reference distribution (in this case, the stable population model) but to display the anomalies more clearly and aid in distinguishing between unique characteristics of the population and error in the data.

Figures 5 and 6 indicate that the reported age distribution of rural Ethiopia exhibits considerable distortions relative to the Stable. Normally, a descending segment of b(x) from age x to x + 5 implies that this age-group has a deficit (or lower proportion) as compared with the stable population, and a rising segment implies that this age-group comprises excess of the reported proportion relative to the stable one. Thus, the rise in b(x) from age 5 to 10 and age 25 to 45 (except for 1981) implies the reported proportion in the age groups 5-9 and 25-44 are higher than that of the stable populations while the decline from age 10 to 25 shows that these age-groups comprise a lower proportion of the reported than of the stable populations. These patterns show the conformity of the Ethiopian age data (except for ages above 25 of the 1981 data) with the general pattern of age distributions of the other African countries.

As a whole, Table 4 and Figures 5 and 6 reveal the following features in the age-sex distributions of the Ethiopian population:

1. The reported population are understated between ages 0-4, 10-14 and 15-19 but overstated at ages 5-9 and 25-35;

2. The distortions in age-group 25-34 are much less marked for the males than for the females;

3. This pattern of errors (observed both for the 1967 and 1970 data),does not apply to the 1981 data after age 25 but the errors under ages 25 are indeed very similar in all surveys.

These patterns of error, as pointed out above, are consistent with those observed for some other African countries and are no doubt caused by the same reasons. The under-reporting of the group aged below 5 probably resulted from omissions of children, coupled with an upward transfer of persons below 5 years to higher age-groups. The latter form of age transfer would account partially for the inflation of the 5-9 group but a more important causative factor may be the rejuvenation of those age-groups 10-14 and 15-19 which in turn would deplete the numbers of the group aged 10 to 19. The excess in the group 25-35 is probably the result of the progressive ageing of women especially mothers in their late teens and early twenties, and also some rejuvenation of those above 35 years. This rejuvenation may have accounted for the loss in the age-groups above 45 years.

In general, there are two possible explanations for the observed distortions in the age distributions of the Ethiopian surveys. In the first place, there may have been significantly large errors originating from age-reporting or omission or multiple counting in the surveys. These types of errors are most likely to be expected because of the inability and/or unwillingness of the large illiterate populations to state their ages accurately. Instances of age heaping with distinct preferences for certain

digits, memory lapse, and the like, are fairly common among illiterate populations [8, pp. 9-18]. Error differentials by gender may also have contributed to the detected greater inaccuracy of reported ages for females than for males. In the second place, there may have been lack of stability (i.e. fluctuations of births and deaths) among the populations under considerations.

6. CONCLUSION

The findings of the analysis of the age-sex data of rural Ethiopia suggest that in general, the quality of age reporting was not very high during 1967, 1970 and 1981. However, one interesting fact inferred from all the techniques used is that age-sex data of the 1981 survey are remarkably better in quality than those of the earlier surveys considered. This indicates that there has been an overall improvement in the quality of age reporting during 1967-1981. This may be due to improvements in data collection procedures (i.e, better coverage, better methods of preparing survey questionnaires, better trained interviewers, etc.) and due to the increased level of literacy rate over the period.

The sex ratio pattern of the age distributions, broadly the same among all the surveys, conforms (except for the age-group 0-4) closely to those of many other African countries. The pattern is characterized by an excess of males under age 20, a predominance of females between 20 and 34 while above age 35 the outnumbering of females by males. Causes of such a pattern are thought to be mainly due to differential age mis-reporting between the sexes.

The assessment of the quality of the age data suggests errors of content and coverage as reflected by the UN Age-Sex Accuracy index. The Myers' and Carrier's indices also showed significant age heaping in digits 0 and 5 and avoidance in digits 1 and 9.

Stable Population technique has been used to examine the pattern of errors in the age distributions of the three surveys. Using this approach

we found that the pattern of age distortions in other African countries as established by the UN was replicated by the 1967, 1970 and 1981 Ethiopian data, namely: (1) the excess of the reported proportion 5-9 for females relative to the stable; (2) the deficit in reported proportions 10-14 and 15-19 for females relative to the stable; and (3) the excess of the reported proportions 25-29 and 30-34 for females relative to the stable. The only exception to the tendency is the 1981 data where the irregularities between ages 25 and 45 years are almost non-existent. In general,the observed error pattern is thought to have been caused by age misstatements. Of course this does not rule out the possible influence of non-stability of the populations.

The age data for males were also examined and the age errors were found to be remarkably similar in pattern to, and in magnitude less serious than, those of the females. This was expected in the light of the known higher level of illiteracy among females than males and therefore the greater dependence on enumerators' "guesses" for the reported ages.

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