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AN EVALUATION AND ANALYSIS OF THE 1970 POPULATION CENSUS RESULTS OF GHANA

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by

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I. Introduction

A modern census of population defined as, "the total process of collecting, compiling and publishing demographic, economic and social data pertaining, at a specified time or times, to all persons in a country or delimited territory" has the following essential features : (i) Government sponsorship (ii) defined territory (iii) universality (iv) simultaneity (v) individual units for enumeration and (vi) plans for compilation and publication.

Census taking is a massive operation involving various interrelated steps and stages like pre census planning in the office and in the field, estimating and procuring finance and personnel, planning and deciding the objectives and calendar of operations, organizing the office and field operations, preparing of questionnaires, tabulation programmes and enumeration plans, census publicity, training of enumerators, survey of enumeration areas by enumeration staff, the logistics connected with enumeration itself and then the collection of filled in forms and finally the processing, publication etc.

For the success of the enterprise, each and every step should be properly planned and adequately controlled. Any lacuna in any one of the many interrelated operations could spell disaster to the entire programme.

II. The Ghana 1970 census operations

The 1970 census enumeration and the 1971 Supplementary Enquiry were carried out by the Census Office within the Central Bureau of Statistics of Ghana under the Statistics Act of 1961. The whole country was divided into enumeration areas and all the people living in the country as on census night (March 1, 1970) were to be enumerated and the required information on every person was to be obtained from each individual, if possible. Two types of questionnaire forms were used - one for household enumeration and the other for group quarters or institutions including the floating population. Complete coverage of areas, houses, households and population was aimed at and every effort was made to help the

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+ The opinions expressed in this paper are only those of the authors in their individual capacities and does not in any way commit the organisations or institutions where they are employed.

enumerator to identify his area clearly. Census maps, houselisting etc. preceded the main census enumeration and omission or duplication of houses etc. were minimised by spot checking.

The census questionnaire which contained all the topics recommended by the United Nations either in the main census or in the supplementary enquiry included several other topics of national importance. Also some of the questions were modified, to suit local conditions and needs.

Elaborate instructions and training were given to the vast army of enumerators and supervisors to ensure the quality of the returns. Quality control procedures were utilised at all stages in the collection, compilation and processing of the data. It is worth mentioning here that whereas in the 1960 main census, a house questionnaire was used due to fear of conceptual difficulties in the operations, in the PES and later on in the 1970 census and supplementary enquiries, a household questionnaire was utilised.

III. Evaluation of census results

Census results which are the end products of massive field operations and office processing, could have various types of errors, biases and deficiencies. Errors could enter the data through any one of the various aspects by which they are obtained. The questionnaire, the interview, the interviewer, the field work, the respondent, the recording, the processing and printing are the various channels through which the data are collected and processed and unless all precautions are taken, the data produced may be so defective as to be of not much value. Even when the strictest controls and precautions are taken, some errors could still be found in the data and it is essential that they be detected and appropriate remedial measures taken so that either the errors are removed or reduced or at least their approximate magnitudes indicated, thus ensuring that the users would not be misled. Also, for future work of a similar nature these findings become guidelines so that one can be wary of the possible types of errors etc. and guard against their recurrence.

The census results can be evaluated both by the direct and indirect methods. The direct method includes the postenumeration surveys and sample checks whereas analytical methods, comparison of census results with data from other sources like registration, survey and administrative or other operations, use of models and analogies comprise the indirect methods.

Unfortunately, as mentioned earlier, there was no postenumeration survey to chck the content errors of the 1970 census of Ghana. One was planned, but later due to personnel problems, it was converted into a case study of Axim. There were also two experiments - one to compare the population aged under one year in the census with births registered between 1 March 1969 and 1 March 1970 at selected urban centres, e.g. Axim, Cape-Coast municipality, Sekondi-Takoradi, Winneba etc., by a matching process and a second one, a coverage error evaluation programme, conducted 3 weeks after the main census, which involved remuneration of a 5 percent stratified systematic sample of enumeration areas (EA's).

For the matching of child population in the census with registration statistics, the items used were sex and birth place and date of birth of child, name of mother and in some cases, age and occupation of parents, in addition to other identification items like serial number of house/households, residential address, etc.

The coverage error check aimed at investigating coverage of houses within selected EA's and people within these houses. Information on age, sex, occupation and identification items like serial number of house/compound was collected on respnndents enumerated during the coverage check and these particulars were matched with the census information. Then a sub-sample of these EA's was selected after stratifying the above selected EA's by magnitude of discrepancy of unmatched events in either the census or the coverage check. In selecting the sub-sample, larger representation was given to EA's with bigger discrepancies. Ratio method, Chandra Sekar-Deming formula etc. are to be utilised to adjust the enumerated population. It can be noted that the coverage check data could, to a certain extent, be utilised also to check content errors in regard to those items collected in both the enquiries.

In addition to the external consistency checks like the one on children aged under one year with registration statistics, which was to be done on a step by step basis starting with a few urban areas and then cover the nation, if the preliminary investigations at Axim, Cape Coast, Sekondi-Takoradi and Winneba proved successful, there were also other experiments planned for checking of educational data and employment data. For example, it was planned to compare the number of persons attending school now, as stated in the census questionnaire, with the records of the Ministry of Education. Again, on a small sample of persons aged 15 years and over who were stated to be employed during the census, it was planned to contact their establishment to check on the accuracy of the information given with respect to the economic characteristics e.g., occupation.

Some internal consistency checks also were to be made as part of the quality control programme and an indication of the number and types of inconsistencies found during any stage of the quality control programme were to be indicated in the General Report of the census as reflecting one dimension of the error of the final tables. For example, the consistency of age and occupation reporting; age and number of children ever born etc. are some of the items which could be checked.

External consistency checks could also be carried out by comparison of census data with data from other sources, with analogy or with models. The balancing equation is one such method. Unfortunately, the data from registration is so incomplete that we can not apply this method in this situation.

However, we can apply an indirect balancing equation method based on growth rate of the population. For example, the total population (including Ghanaians and non Ghanaians) grew at only 2.2% for males and 2.6% for females per annum – one of the lowest rates for developing countries with known drastic fall in mortality and very little decline in the high fertility. The difference between the male and female growth rates also is too large.

The Ghanaian population on the other hand, grew at 3.0% for males and 3.1% for females. Obviously, this is a high growth rate. At the same time, the Ghana born population grew at 2.7% for males and 2.8% for females.

Considering the above three sets of growth rates, we can tentatively conclude that (i) there was an outmigration of a substantial number of aliens during 1960–70 (ii) the Ghanaian population excluded a few persons who should have been included in 1960, and/or included some non Ghanaians in 1970 due to the fact that in 1960 the question on origin was restrictive and the 1970 question on nationality was not only permissive but was even difficult of verification and there was an obvious advantage in reporting Ghanaian nationality in the circumstances existing at that time.

The alien population declined from 12.3% of the total population in 1960 to only 6.6% in 1970 and the sex ratio declined from 147 in 1960 to 136 in 1970. The total population showed a decline in the sex ratio from 102.2 in 1960 to only 98.5 in 1970 and the Ghanaian population indicated only a marginal fall in sex ratio from 97.2 in 1960 to 96.3 in 1970 and the Ghana born population showed a decline in sex ratio from 97.8 in 1960 to 96.8 in 1970.

Even though the fall in sex ratio is milder among Ghanaian population than among Ghana born population, the growth rate of population is rather high among the former than the latter.

The survival ratio of the total population (Ghanaian and non Ghanaian) in 1960 to age 10 and above in 1970 indicates very high levels of mortality, unless we assume substantial outmigration during the decade, where as for the Ghanaian population these survival ratio indicate very low mortality levels, unless we presume that the data is defective as mentioned earlier.

Again the age structure of the Ghana born population showed more consistency than the total population or the non-Ghanaian population. Thus for all practical purposes it can be considered that the statistics on age and sex as obtained on the Ghana born population (constituting 96% of the population of the country in 1970) would depict the demographic profile for the country. We shall go into more details of the age sex structure of the Ghana born persons to derive vital measures etc. later on.

Having tentatively decided that the age sex structure of the Ghana born population in 1970 is consistent with that of 1960 when the several tests of consistency based on growth rate by sex, sex ratio of population, survival ratio of population and age sex composition change etc., we shall now consider how far the reporting of age and sex was acceptable in the country.

As the evaluation studies on the 1960 census revealed, and as observed in statistically underdeveloped countries in the world, age is the most unreliable basic data in enumeration. Even though efforts were made to obtain the age of tne population as accurately as possible, some of the methods used to improve the estimation of age themselves vitiated the results. For example, in 1960 and 1970 a list of historical events were provided to the enumerators by reference to which the age of the people was to be estimated. Since Ghana gained independence in 1957 and the death of Lt. General Kotoka and the introduction of new cedis and pesewas took place in 1967 there was a tendency to report the ages of children as 3 years in 1960 and 1970 so much so that age 3 had the largest number reported for borth sexes in both censuses.

As in the other developing countries, in Ghana also the tendency of the people to report their ages with end digits 0 or 5 has been noted. For example, in 1960, 34% of males and females each reported themselves in the country with ages ending in digit 0 or 5 in the age range 10-69 instead of the expected 20%. In 1970, this percentage reduced slightly to around 32-33% for each sex. In addition to prefering digits 0 and 5, there were preferences for even digits and repulsion of odd digits. In 1960 and 1970 only 27-28% of persons reported ages ending in digits 1, 3, 7 and 9 as against an expected 40%. Surprisingly enough, even though age 3 was the most reported age both in 1960 and 1970, digit 3 almost was the least preferred.

The over all index of digit preference, the Myers index indicated quite poor age reporting when we consider single years of age data. The Myers index values are :

	1960	1970
Male	29.6	26.8
Female	31.2	31.2

There also seems to have been only marginal improvement in the quality of single years of age statistics over time.

Even though the single years of age data is found to be poor, since for most practical purposes we use quinary age data, let us consider how the five year of age sex statistics have evolved in the decade 1960-70.

For this purpose we apply the United Nations Age ratio, Sex ratio and Joint score method :

The scores are :

	1960			1970	
	All nationals	Ghanaian	Ghana born	Ghanaian	Ghana born
Age ratio, male	15.0	9.6	7.8	10.2	6.1
Age ratio, female	20.0	15.8	12.4	14.0	9.7
Sex ratio	9.6	9.8	8.2	7.6	7.8
Joint score	63.8	54.8	44.8	47.0	39.2

From the above we see that there was a marginal increase in age ratio for Ghanaians between 1960 and 1970 but all the other scores declined so that the joint score declined from 55 to 47. The scores consistently declined for the Ghana born even though the joint scores is near 40 in 1970 which implies that the data is not of good quality.

The large value of the scores for total population is due to the effect of migration on age sex composition.

Even though there is an improvement in age sex reporting as evinced by the Myer's Index and UN score methods, still it looks as if the data in 1970 is not of acceptable quality in the age range 10-69.

At the young ages we have already indicated that there was a predominant preference for age 3 due to the reasons mentioned. There was a marked deficit at age 0 and 1. Also the sex ratio at these young ages were very low. Usually the sex ratio at ages 0-4 would be slightly higher than 100. In Ghana it is found that in 1960 and 1970 the sex ratio at ages 0 to 4 is 98 to 99. The possibilities are (1) sex ratio at birth is not very high and is only 102-103 (2) male infant and early childhood mortality is much higher than female mortality (3) enumeration errors.

It is claimed that Ghana and other African countries have a comparatively low sex ratio at birth. Whereas other parts of the world have a sex ratio of 104-108 male per 100 female births, in Africa it is stated that it is only 102-103. How far this is correct is not clear. Relevant statistics have not been readily available either to prove or disprove the claim. Registration statistics between 1962-67 in Ghana showed a sex ratio at birth of 98.5 in 1965 to 110.0 in 1964 with an average 105.3.

The 1971 supplementary enquiry on births during last 12 months however indicated a sex ratio at birth less than 100 in the two regions Greater Accra and Volta for which data have become available.

However, we note that the percentage of males and females aged 0-4 in 1960 and 1970 enumeration look acceptable when we keep the fertility, mortality conditions in the country in mind.

At the same time, the sex ratio in the age group 5-9 is 103 in 1960 and 101 in 1970. Such an increase in sex ratio from age 0-4 to age 5-9 looks suspecious. Also the percentage reported as aged 5-9 in 1960 and 1970 are too high. There seem to be a corresponding deficit at ages 10-29 for males and 10-19 for females. The age ratios confirm this. Thus it looks very possible that there is an excess at ages 5-9 and deficit in the next few age groups. Coale-Demeny observed similar pattern for tropical Africa, India, Indonesia, Morocco and Pakistan 1/.

At the older ages, i.e. at ages 70 and above there is a tendency for exaggeration of ages. For example, instead of 1 to 1.5% who are expected to be aged 70 and above in countries with similar fertility and mortality conditions, in Ghana the observed percentage is sometimes even more than double the expected. There is prestige in old age and estimation of age becomes difficult when a person is past 40 years in tropical climates with poor diet and environmental conditions.

That there is some over reporting of age by women in the reproductive ages can easily be noted from the findings in the 1960 census, registration statistics of 1962-67 and the 1970 census which show that the mean age of the fertility schedule $\bar{m}$ is more than 29 for Ghana. Now keeping in mind that marriage is universal and early, child bearing is more or less uncontrolled and large families are preferred, this high value of $\bar{m}$ is nothing but due to over-reporting of age of women in the reproductive ages. It has been noted that women are reported as older than what they actually are merely by basing the estimation on number of children ever born. It was noted in Nepal 2/ for example, that women who were married over-reported their ages by one or two years and those who had one child over-reported their ages by two or three years and so on. This not only vitiates age data, it also affects estimates of fertility.

Thus we see that the age sex statistics obtained from census enumerations in 1960 and 1970 are riddled with several types of errors and any use we make of them should be such that these lacunae and deficiencies are clearly kept in focus.

Even though the age sex evaluation so far carried out has indicated that there could have been some omission of infants and very young children, it is inconclusive in regard to enumeration at other ages, in so far as coverage and completeness is concerned.

1/ U.N. Methods of estimating basic demographic measures from incomplete data, Manual IV, ST/SOA/SER.A/42, New York, 1972.

2/ Ramachandran, K.V., An evaluation and adjustment of basic age-sex data for Nepal, unpublished report prepared at Demographic Training and Research Centre, Bombay, for the United Nations Population Division, 1970.

For example, the results from the coverage error evaluation programme could give us an idea of the completeness of enumeration of houses and people. From tables 1 and 2 we find that actually the coverage evaluation programme listed a smaller number of houses and persons in the sample enumeration areas as compared with the census results for the same enumeration areas.

Either this means that there was an over counting in the census or there was missing of persons and houses in the coverage check. In 1960 the discrepancies were larger.

Again the percentage of matched events was not large enough to give confidence in the results and from the preliminary analysis so far made it appear that the coverage check exercise in 1970 is leading to the same inconclusive results as the corresponding one in 1960.

It seems as if we have to re-examine the whole question of the methodology of the re-enumeration, checking and matching in the circumstances as existing in African countries.

Thus it looks as if indirect methods may be the only ones which may be feasible for the time being with the situation as existing in tropical Africa in order to evaluate basic demographic statistics and population counts.

IV. Data analysis and derivation of vital measures

Even though the evaluation of the data presented in the earlier section indicates that the age sex statistics as obtained in the 1970 census enumeration is defective and needs to be used with caution, it is to be clearly understood that the figures given for each sex age group are the reported ages of respondents whose notion of birth dates and exact ages is vague. However, modern demographic analysis and techniques are specially developed to deal with such data and, if properly carried out, could produce not only viable estimates of birth and death rates but also of migration and reasonable age sex distributions.

We shall try to utilise some of the known techniques to be available age sex data in the next few pages and arrive at a consistent and convergent set of vital parameters.

As mentioned earlier, since the statistics of Ghana born persons are intuitively expected to be more acceptable and have also been shown to be more or less so, we shall illustrate the application of the diverse methods only to these values. Similar methods were also applied to the total population (Ghanaian plus non-Ghanaian) and to the Ghanaian population but the results were contradictory and inconclusive. Also they were at variance with known demographic processes in the country in the past and hence are not presented.

However, since the more detailed data from the Census and Supplmentary Enquiry have not yet become available, it should be clearly understood that the estimates derived are tentative and may need to be revised.

Table 1

1970 Ghana Population Census
Coverage evaluation
Summary of preliminary (Office) matching
(Houses)

Region	Number of houses					
	Listed in census	Listed in coverage check	Matched from census list	Matched from coverage Check list	On census list only	On coverage check list only
All regions	42,414	42,213	32,288	32,254	10,163	10,223
Western	3,523	3,490	2,595	2,603	928	965
Central	4,780	4,793	3,848	3,866	891	927
Greater Accra	3,427	3,651	2,053	2,188	1,387	1,553
Eastern	7,525	7,421	5,313	5,175	2,296	2,235
Volta	5,783	5,639	4,613	4,580	1,170	1,093
Ashanti	6,200	6,328	4,477	4,487	1,759	1,934
Brong-Ahafo	3,137	2,903	2,492	2,443	635	449
Northern	3,693	3,657	3,199	3,203	495	445
Upper	4,301	4,331	3,698	3,709	602	622

Table 2

1970 Ghana population census
coverage evaluation
Summary of preliminary (office) matching
(Persons)

Region	Number of persons				
	Enumerated in census	Enumerated in coverage check	Matched	Enumerated in census only	Enumerated in coverage check only
All Regions	399,685	397,185	266,594	139,729	124,080
Western	33,615	39,903	21,294	12,321	12,065
Central	39,931	38,318	25,200	13,815	12,317
Greater Accra	38,440	35,613	15,738	22,231	19,632
Eastern	60,581	59,391	38,535	21,579	20,899
Volta	43,854	43,314	33,336	11,868	11,387
Ashanti	68,747	69,763	46,586	21,854	23,378
Brong-Ahafo	32,743	30,577	23,657	9,482	6,860
Northern	37,260	36,464	27,162	9,331	8,632
Upper	44,514	43,842	35,066	17,248	8,910

The merit of such analyses lie in the fact that from a mass of apparently defective, incomplete and deficient data we can derive demographic measures which form a consistent and convergent set.

The first method we use is Hardy's differencing method. This method developed in the early twentieth century for dealing with defective and incomplete data from the Indian censuses is very simple to apply. We first calculate the deaths which occured to persons already enumerated in an earlier census by differencing persons aged k years and above in the later census from all those enumerated in the earlier census, where k is the interval between the two censuses. Then the deaths among those born during the census interval is obtained by a proportion of the deaths calculated above and the sum of the two figures gives the total number of deaths during the interval. A death rate can then be calculated. Using the death rates by sex we can convert the rates into expectation of life at birth values (under suitable assumptions) from the Coale-Hoover 3/ formula :

$$(e_o^1 \ / \ e_o^2) = .35 + .65 \ (D_2 \ / \ D_1)$$

where D_1 is the death rate as obtained earlier, e_o^1 is the expectation of life at birth to be estimated corresponding to the death rate D_1 and e_o^2 and D_2 is a set of expectation of life at birth and death rates from stable population models with growth rate equal to that of the country under consideration such that D_2 is close to D_1.

Unfortunately, in the case of Ghana even the relation between deaths among births and deaths among already born persons is difficult to obtain, as the registration system is defective. However, there are 3 approaches to solve this problem.

The first one is to accept whatever results are provided by the available vital statistics. In Ghana for the period 1962-67 the proportion of deaths among births during a decade to deaths among already born persons is .8 for males and 1.1 for females. Even though the male figure looks small and the female figure slightly large, the actual figures may not be much far from .9 to 1.0.

Secondly we can use analogy. We may borrow the values from another country similarly situated with regard to demographic parameters and which has such data readily available. This method is very risky as the demographic parameters of Ghana are as yet, in our analysis, not determined to enable us to fix a country or region as analogous to Ghana.

Thirdly we can use model populations and find out the relationship. One such model was used from the North family of stable populations of Coale-Demeny and the proportion was found to be around 1.0 for both sexes.

3/ Coale A.J. and Hoover E.M., Population growth and economic development in low income areas, Princeton University Press, 1958.

Using this value of 1.0 we get the male and female crude death rates during 1960-70 in Ghana as 28.9 and 24.5 respectively. The Coale-Hoover formula gives the e_o values as 35.3 and 39.7 respectively for males and females. However, if we use the values available from the registration system, then we find the male and female death rates as 26.0 and 25.6 respectively and the e_o values as 37.9 and 38.6. These values actually look better.

Thus we note that mortality is approximately depicted by North model level 9 for both sexes. The levels could have been slighly higher, as there is the possibility of some people aged 10 and above in 1970 being reported as aged 5-9 and hence the death rates would be actually lower.

Next we apply a method based on Coale-Demeny models. This method consists in the comparison of percentage age distribution of observed with model values for a given growth rate. When we take the North model with rate 2.74 for males and 2.85 for females, we find that level 9 for males and level 10 for females produce the least sum of absolute deviations when percentages are compared up to age 40-44. Even though, as noted earlier, discrepancies occur from one age to the other, the over all deviation is minimum when level 9 is used for males and 10 for females. A modification would be to consider sum of absolute percentage deviations. This method also indicates that mortality around 1965 in Ghana was approximately levels 9-10 for both the sexes.

When we apply the Coale-Demeny method based on cumulated percentages for the known growth rates of population, North model level 9 for males and 10 for females indicate the median values corresponding to CBR of 54.6 for males and 50.3 for females and CDR of 27.2 for males and 21.8 for females.

A third method is the projection of the population for a period of 10 years using model life tables and fertility schedules and finding that set which fits the enumerated pattern. Here it seems that level 8-9 for males and 9-10 for females with fertility as measured by GRR of 3.4 fits the data. The CBR for males and females come out to be 56.1 and 51.5 and the CDR as 28.7 and 23.0 respectively. Here also because of the possibility of some people aged 10 and above reporting themselves as aged 5-9, the estimates of birth and death rates would be lowered.

A fourth method is that based on the reverse survival projections. Using appropriate mortality schedules we project the 1970 age sex data to 1960 and select that mortality level which reproduces the 1960 enumeration to a large extent. Level 8-9 for males and level 9-10 for females, more or less approximate the enumerated population figures. Here also the over enumeration in age 5-9 and a corresponding under enumeration in age 10-19 would affect our estimates. The birth rates based on enumerated 0-4 population is around 52.6 for males and 49.6 for females where as those based on 5-9 population the rates come out around 60. Perhaps the birth rates based on 0-4 population is on the lower side due to some omission of infants and young children, whereas those based on the 5-9 age group is on the high side due to shifting of some persons from age 10-14 or 15-19 to ages 5-9. A birth rate around 51-53 for both sexes together seems to depict the situation.

Another method which is similar to the Hardy method is the one based on "over all survival ratio" 4/. This method consists in the comparison of survival ratios of all persons (by sex) in 1960 to those aged 10 and above in 1970. This method also is affected by the error in age data especially in the age group 5-9.

In addition to calculating over all survival ratios of all persons in 1960 to those aged 10 and above in 1970, one can calculate survival ratios (by sex) of persons aged 5, 10, 15 ... and above in 1960 to those aged 15, 20, 25 ... and above in 1970 and compare the values with tabulated values. The mortality level for the decade is then chosen as the median value of these.

The Ramachandran-Nair tables available for carrying out this procedure is unfortunately based on Coale-Demeny west model life tables. Preliminary calculations carried out with North model life tables indicated that level 8-10 fit the age-sex statistics of 1960 and 1970. The male level is lower than the female level. Perhaps 8-9 for males and 9-10 for females would be indicated.

A very similar method is the one suggested by Coale-Demeny in Manual IV. They suggest the projection of the earlier census data under varying mortality levels and then selecting those levels for which the population aged 0, 5, 10, 15, ... and above in the later census are near the enumerated values and then selecting a median value out of these. It is found that this gives level 11 for males and females.

Still another method applied to the data is that due to Arriaga 5/. Preliminary calculations indicated level 9 for males and level 10 for females. The birth rates were 54 for males and 51 for females.

Incidentally, it may be mentioned that the current fertility data available from the 1971 supplementary enquiry for 2 regions (Greater Accra and Volta) indicate that even though there is a reduction in fertility at young ages, there is actually an increase at ages 35-49. The total fertility remained the same 6.2 in Volta but declined to 5.6 from 6.0 in Accra. The Brass method of adjustment failed in the case of Accra data but produced a TFR of 6.6 for Volta.

4/ Ramachandran K.V. and Nair P.S.G., The over all survival ratio method for evaluating defective and incomplete data and estimating mortality, Studies in Demography, Edited by A. Bose et. al., George Allen and Unwin, London, 1970.

5/ Arriaga, E.E., New life tables for Latin America in the nineteenth and twentieth centuries, Institute of International Studies, Berkeley, Population Monograph Series, No.3, University of California, 1968.

Using these adjusted fertility rates for Volta in conjunction with the 1965 age sex distribution of Ghana born persons, a CBR of 48 was derived. Now keeping in mind that the country showed a higher TFR than Volta in 1960 (of 2%) we may expect that the CBR was at least 49 in 1965.

But, when we assume that there was an exaggeration of ages by women, especially of those who had a child during the year before the enumeration, then this shift in age produces a fertility schedule which makes $\bar{m}$ larger than what it should be and such a fertility schedule depresses the crude birth rate. The $\bar{m}$ was 29 or more instead of around 27 as anticipated. For example, if we consider that the age distribution of Ghana born persons is stable with a rate of growth of 2.8 and mortality level 9 then an increase of 2 years in $\bar{m}$ from 27 produces a more than 5% reduction in birth rate, even when the TFR is the same. If we take this factor also into consideration then we get the CBR during 1960-70 for Ghana born persons as 51.5.

Again, if we keep in mind that some male children have not been reported among the births, because the sex ratio of reported births is low, then the CBR would go still further up. Thus a CBR of 52-53 is not beyond the realm of possibilities in the country in 1965.

Thus we see that we can conclude that during 1960-70 mortality level in Ghana was near about those corresponding to model North levels 9 and 10 for males and females and that the birth rate was around 52.

Now a word about migration during the decade. We have mentioned that during 1960-70 and especially after the passage of the aliens compliance order, a sizeable number of persons left the country. Even though some statistics have been collected by the country, it seems that they were incomplete.

As mentioned earlier, the numbers reported by Niger and Nigeria as having entered into their country from Ghana during the period are about double the figure reported by Ghana. The total number of out migrants estimated by the government of Ghana is in the neighbourhood of 200,000-300,000 for all part of the world. If we assume that this figure represents only a part of the total migrants, and the ratio of recorded to non recorded is similar to those for Niger and Nigeria, then the actual figure could have been anywhere between 400,000-600,000.

One way to estimate the total number of net out migrants is to project the total population of 1960 by sex by assuming that their rates of growth should be similar to those of Ghana born persons. Actually, it may be slightly higher or lower depending on age sex structure, fertility, mortality, etc.

Under this assumption we calculate that 350,000-400,000 persons left the country during the decade. Assuming some fresh in migration and return migration just before the census, the actual number involved in the movement could have been 400,000.

V. Population projections

Population projections and estimates for Ghana have been made by several individuals and organisations during the period 1960-70. All these projections utilised the 1960 census and post enumeration statistics and some even used the 1968 demographic survey data.

The Population Division of the United Nations as part of their work programme in connection with the assessment of world population prospects projected the population of Ghana with base period 1965.

The latest contribution for populations for Ghana is that made by Gaisie 6/. He projected the population of Ghana origin for the period 1960-2000 under varying assumptions in regard to mortality and fertility.

Because in 1970 the question on origin was deleted and instead the data collected was on nationality, the projected figures cannot be compared with the census results. However, it looks, on the basis of the preliminary 1970-71 data, that his mortality assumptions were on the optimistic side and his fertility assumptions for the period 1960-70 may have been correct, but between 1970-85 his assumption that there will be no reduction in fertility as measured by TFR is questionable on the basis of recent developments on the family planning front. A slight reduction in fertility is at least indicated for Greater Accra and perhaps in the other urban areas of the country, if not for other areas as well.

We have attempted to project the 1970 Ghana born population by quinary ages and sex upto 1985 the following assumptions :

(i) mortality conditions will improve and that between 1970-75, 1975-80 and 1980-85 the levels will be those corresponding to Coale-Demeny model North levels 12, 13, and 14 respectively for both the sexes.

(ii) fertility which was high and has shown some indications of decline will decline faster in the years to come as the family planning programme catches on and general education becomes more widespread. The effect of the spurt in education after independence is just being felt in the early reproductive ages now, but will soon be felt by the other ages as the years roll by.

The GRR is assumed to be 3.2 in 1970-75, 2.95 in 1975-80 and 2.70 in 1980-85.

(iii) Sex ratio at birth is assumed to be 103 males per 100 female births. The projected population figures are given in Tables 3 and 4.

6/ Gaisie, S.K., Determinants of Population growth in Ghana, a thesis presented for the degree of Doctor of Philosophy at the Australia National University, Canberra, February 1973 (mimeographed).

These projected populations will have to be revised after the data from the census and supplementary enquiries become available. This is the reason why we did not adjust the age-sex statistics for the types and patterns of errors. Again, this is the reason why we have not attempted any further analyses of these projections in terms of estimating pre-school, school, labour force and other age groups.

Population projections for Ghana born persons, 1970-85

Male

Age Group	1970	1975	1980	1985
0 - 4	760,134	879,993	967,164	1,080,017
5 - 9	708,436	694,580	813,818	904,018
10 - 14	522,260	684,732	674,013	792,594
15 - 19	387,892	509,313	669,284	660,249
20 - 24	305,371	375,386	494,130	650,979
25 - 29	262,651	293,507	361,895	477,843
30 - 34	231,907	251,859	282,354	349,282
35 - 39	193,345	221,434	241,359	271,551
40 - 44	155,478	183,158	210,688	230,592
45 - 49	126,696	145,632	172,482	199,347
50 - 54	100,247	116,758	135,039	160,777
55 - 59	75,979	90,202	105,821	123,146
60 - 64	65,932	65,813	78,839	93,204
65 +	140,691	156,944	171,247	195,038
Total	4,036,964	4,669,311	5,378,133	6,188,637

Female

Age Group	1970	1975	1980	1985
0 - 4	766,162	901,059	987,768	1,100,974
5 - 9	700,439	703,329	836,886	927,583
10 - 14	502,141	677,430	683,108	816,123
15 - 19	387,895	490,175	662,933	670,197
20 - 24	346,681	377,503	478,204	648,428
25 - 29	315,560	335,882	366,737	465,924
30 - 34	256,887	304,194	324,845	355,889
35 - 39	210,154	255,843	292,741	313,833
40 - 44	162,260	200,342	244,911	281,377
45 - 49	127,501	153,879	190,796	234,179
50 - 54	98,417	119,746	145,177	180,754
55 - 59	74,453	90,648	110,930	135,167
60 - 64	67,378	66,261	81,317	100,184
65 +	146,678	168,477	186,723	216,140
Total	4,172,476	4,844,768	5,593,076	6,446,752

When the full demographic and socio-economic data become available, in the not too distant future, we can project not only the total population by age and sex; we can also estimate the rural-urban components, the number of children in schools, those entering the labour force, those needing housing and so on.

VI. Conclusion

This paper is only a preliminary and partial report on the evaluation and analysis of the data from the 1970 population census of Ghana. Detailed evaluation of the coverage of the census and the estimate of the coverage error have not been discussed here, mainly because only fragmentary results from the coverage error evaluation programme of the census are at present available. It is not possible to use these partial and inconclusive results for the type of evaluation and analysis that we have attempted to do in the preceding paragraphs.

With respect to the other component of the total error of the census, namely the content error, we have given extensive consideration only to two of the items on the census questionnaire, viz., age and sex, which admittedly are two of the most important basic demographic characteristics.

Unfortunately, age also is the most unreliable information collected in a population census in most developing countries, especially Africa. The other items on the census questionnaire have not yet been evaluated, but it would appear from the results of the evaluation programme of the 1960 census that occupation (an possibly industry) will require extensive evaluation in 1970. Also, in view of the effects of the Alien's Compliance Order on the data on nationality, elaborate evaluation of that information will be necessary.

Again, because the information so far available from the census and supplementary enquiries have not been sufficient, no attempt have been made here to adjust the age-sex statistics as obtained from the census, even though there are serious doubts about age reporting in some of the age-sex segments and there may also be some omission of infants and very young children of one sex.

Finally, we wish to state that some of the conclusions reached in this paper may have to be revised as more information from the supplementary enquiry becomes available.