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Differential Fertility Amongst Urban Africans in Northern Rhodesia

BY

J. CLYDE MITCHELL. D.PHIL. (Oxon.)

Head of the Department of African Studies, University College of Rhodesia and Nyasaland.

Demographers have long appreciated that there are distinct differences in fertility amongst different types of social groups. These differences are due to both biological and social factors and it is reasonable to expect that they would be found in African as in other populations. Unfortunately there is very little information about the reproductive behaviour of various categories of African people. The aim in this paper is to discuss some of the differences in fertility among certain social categories and to pose the problem of the origin of these differences.

In Europe and in America there are differences in fertility amongst people in different social classes, religious groups and racial groups and also between people living in towns and those in rural areas, those who are foreign born and those who are natives, and so on. In general these differences in fertility fall into line with the hypothesis that as children lose their economic value and become instead a liability, so the number of children parents have declines. This is intimately related to higher expenses of rearing children due to the cost of lengthy education and consequent postponement of financial independence, especially as the levels of living improve. Hence the professional and white-collar classes (until recently) had fewer children than manual workers because the cost of rearing children to take positions commensurate with those of their parents had become onerous. People living in towns had fewer children than those living in rural areas, partly because the professional and white-collar classes were concentrated there and partly because children contribute to the family income earlier in rural areas than in the towns. Negroes and foreign-born immigrants in the United States have more children than native-born Whites because on the whole they predominate in the lower socio-economic strata where, as we have seen, fertility rates are high. In the United States, Roman Catholicism is characteristic of the foreign-born immigrants and is associated with the more fertile elements of the population. But while Roman Catholic manual workers have more children than Roman Catholics employed in the professions, Roman Catholic professional and white-collar workers have more children than their Protestant colleagues, so that religious beliefs exert an influence independent of socio-economic status.

The detailed causal nexus between these social factors and fertility is not straightforward. Reproduction is an aspect of behaviour which is influenced by both biological and social factors, and frequently it is difficult to distinguish the effects of one from the other. It is all too easy to attribute to one set of factors the effects which are really due to the other.

It is necessary to draw the distinction between two different aspects of reproduction. The physical capacity for child-bearing known as fecundity is essentially a biological concept. There are a variety of factors affecting fecundity such as disease, individual malfunction of the reproductive organs, diet and possibly genetic factors. Fertility, on the other hand, or achieved reproduction, is a sociological or demographic concept. We measure fertility by the number of live-born children a woman bears or a man begets. Fertility is affected both by fecundity and by volitional control of reproduction.

In Europe and America the biological factors, except possibly for genetic influences, are probably reduced to a minimum because of the high level of medical care available. The control of parenthood through contraceptive practices of various types, on the other hand, seems to have had the major effect on different sections of the community. In Africa we know little about the variation in fertility or its causes.

This paper is concerned with fertility, i.e., with the combined effects of both biological and social factors on reproductive behaviour. Its purpose is to make a preliminary exploration of the variations in fertility in different social categories. I hope these findings will stimulate both medical scientists and sociologists to start asking the appropriate questions leading to an explanation of the differences in reproductive behaviour.

THE DATA

The data presented here were collected in a social survey conducted between 1951 and 1954 in the line-of-rail towns of Northern Rhodesia (except Livingstone) as part of the research programme of the Rhodes-Livingstone Institute. The main concern of the survey was with urbanisation, but data on fertility also were obtained from the women interviewed. A ten per cent. random sample was selected from all African dwellings in the urban areas, including mining townships, municipal townships, domestic quarters, industrial areas and settlements on private lands near towns such as Lusaka and Ndola. The adult occupants (i.e., aged 15 or over) of these dwellings were interviewed by full-time African research assistants on a variety of topics related to their social background and mobility between town and country. Detailed employment histories were collected from men, but women were questioned about the number of children they had borne, the sexes of those children, their dates of birth, their residences, the number of plural births and, in the case of the death of the child, how old it was when it died.

An attempt was made to estimate the exact dates of birth of the women and their children. Where the woman did not know her birth date, her age was determined by her memory of outstanding events whose dates of occurrence were known. The reliability of these estimates was almost certainly dependent on the age of the woman herself, so that the estimates of the ages of the older women are probably less accurate than those of younger women. The majority of the younger women, or their husbands, knew the dates of birth of their younger

Table I

TOTAL BIRTHS TO WOMEN IN FIVE-YEAR AGE GROUPS

Age	0	1	2	3	4	5	6	7	8
15-19	500	260	86	14	2	2	—	—	—
20-24	393	375	385	233	75	23	2	—	—
25-29	155	149	197	207	136	88	32	7	2
30-34	93	92	104	134	101	73	63	26	7
35-39	27	31	33	45	40	37	33	20	14
40-44	20	14	19	21	28	18	30	11	6
45-49	3	7	8	7	5	10	7	3	3
50-54	3	3	4	7	6	2	6	4	1
55-59	1	1	—	—	—	2	—	—	—
60 +	—	2	—	1	—	—	—	1	—
	1,195	934	836	669	393	255	173	72	33
Unknown	10	3	2	3	5	1	1	1	—
TOTAL	1,205	937	838	672	398	256	174	73	33

children, particularly those born in the last five years.

There was some resistance to the mentioning of dead children and it is likely that the number of children reported is understated because the women had omitted to mention children who had died. It is difficult to say to what extent this understatement has taken place. There was also a problem in deciding whether a child was born dead or not, since many women seemed to make no distinction between children who lived for only a few hours and a still-born child.

We made no attempt to collect information about miscarriages and abortions experienced by the women. This question appeared to be too delicate a matter to pursue in a social survey which was really directed towards securing information on urbanisation and in which the interviewers were all men. Data on miscarriages and abortions, of course, are highly relevant in a study of fecundity. Fertility, however, is measured by the number of live-born children. Pregnancy losses must be counted as one of the underlying factors influencing fertility either as a biological factor when the losses are involuntary, or as a sociological one when they are deliberately induced, but they do not affect the measurement of fertility itself.

The analysis is based on the fertility data of all women in the sample over the age of 15. Of the total of 4,621 women interviewed, age-estimation was unsuccessful because the woman was either absent or unco-operative in only 26 or 0.6 per cent. of the cases. By far most women in the sample were married (97.2 per cent.), only 2.6 per cent. had never been married and all except one were under the age of 25. The rest were widowed or divorced.

This analysis is based on two indices of fertility which had been recorded for every woman in the sample. The first is the total number of children the woman had ever borne. This reflects the actual fertility of the woman over the whole of her reproductive life up to the time of the survey. The other measure was the number of children born per 1,000 women aged 15 to 50 over the last five years who were still alive at the time of the survey.

NUMBER OF CHILDREN

9	10	11	12	13	14	Total Children	Total Women	Ratio
—	—	—	—	—	—	492	864	0.57
—	—	—	—	—	—	2,271	1,486	1.53
—	—	—	—	—	—	2,405	973	2.47
5	1	—	—	—	—	2,142	699	3.06
2	5	1	—	—	—	1,106	288	3.84
5	1	1	1	—	2	728	177	4.11
2	3	—	—	2	—	275	60	
2	—	—	—	—	—	156	38	
1	—	—	—	—	—	20	5	4.38
—	1	—	—	—	—	22	5	
17	11	2	1	2	2	9,617	4,595	2.09
—	—	—	—	—	—	54	26	
17	11	2	1	2	2	9,671	4,621	

These are crude measures of fertility, but they are simple to tabulate. A more detailed study is now in progress which will involve a type of cohort analysis in which the reproductive performance of every woman will be considered over the five years before the survey date. This analysis will also include an analysis of the mortality of the children up to the age of 15 and so enable a more accurate survival rate to be computed. This more detailed analysis, however, involves punching a separate card for every child born and will take some time to complete. It seems worth while to present a preliminary analysis on the basis of the summary measures of fertility which are immediately available on the cards.

THE MEASUREMENT OF FERTILITY

Fertility may be measured in several different ways. With the data we have available we may use the following methods:

(a) *Completed Fertility*

Table I sets out the total number of children born to women in five-year age groups.

The average number of children which women who have passed menopause have borne during their reproductive life (say, 15-50) will with certain assumptions give us an approximate estimate of what is called the total fertility rate, i.e., the number of children a woman may expect to bear during her reproductive life. From Table I we see that on the average each woman over the age of 45 had had 4.38 children. By African standards this is not high,* but we should be aware that there are two difficulties in this as a figure reflecting current fertility. Firstly, since it is based on the older women in the sample, it is affected by the memory of these women. If they have forgotten to mention children who died in infancy a long time ago, the figure will underestimate the true rate. The second difficulty is that it reflects the fertility of the women over the last 30 or 35 years instead of in the recent past. Medical services have probably improved recently, so that current fertility as measured by this figure is probably underestimated.

(b) *The Average Number of Children Born per annum to Women aged 15 to 50*

A more useful measure of fertility not affected by past fertility is the average number of children born in a year to women aged 15 to 50. This measure, however, cannot be computed from the data which was available for this study. An estimate of it can be made by correcting the fertility ratio described below for mortality and treating the figures so obtained as an annual fertility rate averaged over five years. I use this to compare my figures with census figures, but because of the uncertainty of the mortality rate I do not make further use of it in this paper.

(c) *The Total Fertility Rate*

The most useful measure of fertility is the total fertility rate which estimates the total number of children a woman may expect to bear on the basis of current fertility. To compute this measure, however, we need to know the age of the mother at the time of birth of her children. This calls for more detailed analysis of the data than is possible at present. Like the average annual number of children per woman aged 15 to 50, the total fertility rate may be estimated from the fertility ratio by allowing for mortality in the first five years of life. But in the absence of information on the mortality this measure also has not been used in this paper.

(d) *The Fertility or Child-Woman Ratio*

The fertility (or child-woman) ratio is a simple measure of fertility which may be quickly computed. It is simply:

$$\frac{\text{Total number of living children under the age of five} \times 1{,}000}{\text{Total number of women aged 15 to 50}}$$

This measure refers to the cumulative fertility over the last five years and is therefore a measure of recent fertility. Since it aggregates fertility over the last five years, it tends to smooth out fluctuations which might appear if annual rates alone were used. However, it measures the effect of both fertility *and* mortality since it takes account of the living children only. If mortality in the first five years of life does not differ appreciably from one group to another and the age distribution of the women within the ages 15 to 50 is reasonably similar, the fertility ratio is a useful measure of fertility to use in comparisons.

(e) *Age-standardised Fertility Ratio*

The influence of differing age distributions may be eliminated by standardising the fertility ratio to a given population. For the purpose of this paper a hypothetical population, that of the stationary life table with a mortality commensurate with an expectation of life at birth

* Myburgh (Table III) computes total fertility rates as follows: Northern Rhodesia (1950), 5.9; Southern Southern (1953), 5.7; Ghana (1948), 5.1; Swaziland (1946), 4.5; Angola (1940), 3.6. The recent census report of Uganda gives 5.06 in 1959.

of 40, is used, which was the estimated approximate expectancy of life of Northern Rhodesian Africans at birth in 1950 (Myburgh, 1956). It does not matter much which age structure is used, providing that all measures of fertility to be compared are standardised to the same population. Table II sets out the fertility ratios of the whole sample in five-year age groups and illustrates the method of standardising the rate for age.

Where fertility ratios are used in this paper they have all been standardised in the way described.

DIFFERENTIAL FERTILITY

As a starting point we may consider the differences in fertility among women who have come from different districts in Northern Rhodesia. These are set out on Map I.

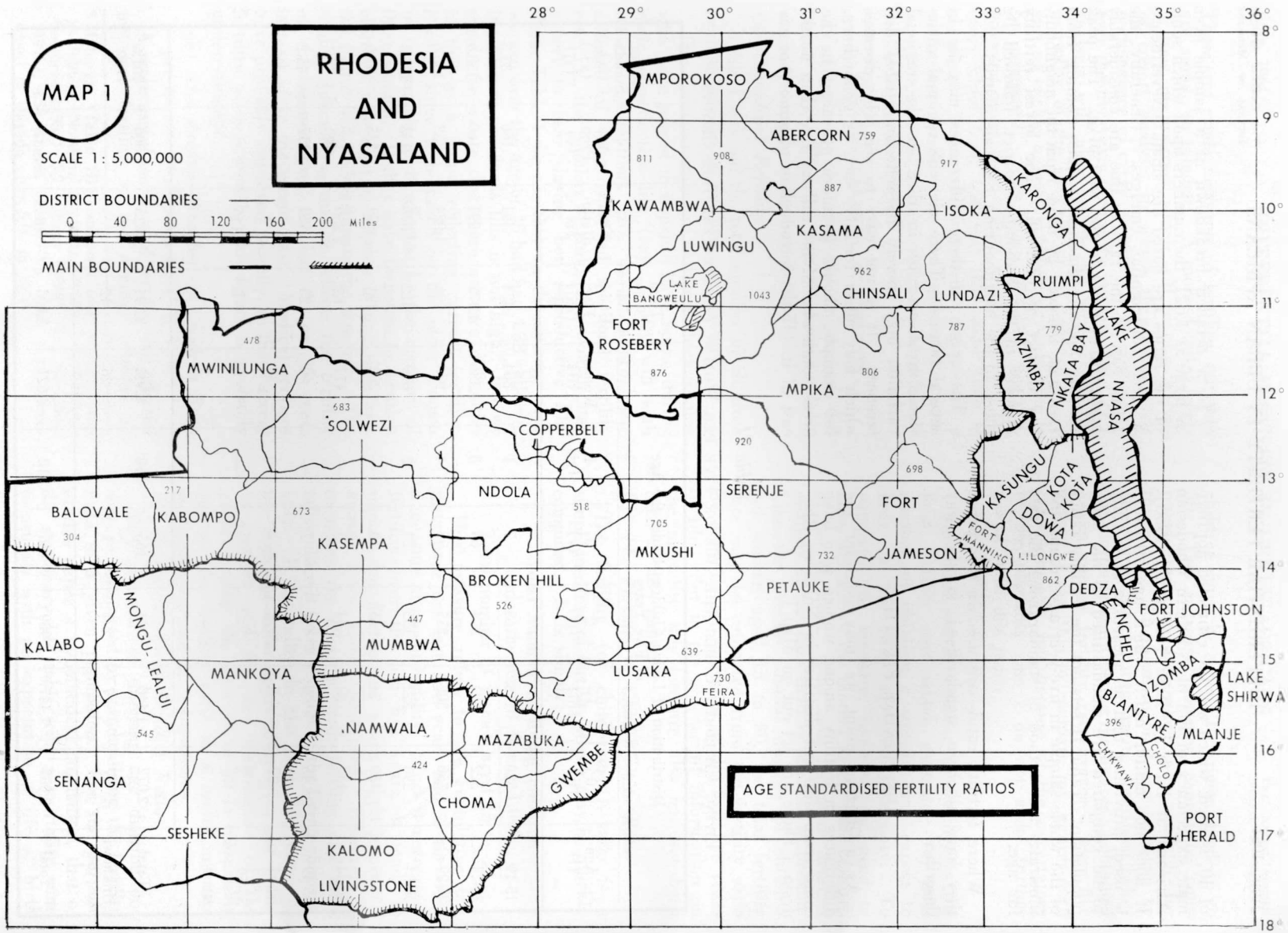
In a detailed breakdown of a sample even as large as 4,621, the numbers upon which some of the ratios are based are small. Nevertheless a clear differential emerges. Generally the ratios east of the railway line are considerably higher than those to the west of it. The peak fertility appears amongst women coming from Luwinga, followed by those from the neighbouring district of Chinsali. The lowest fertility appears in the Kabompo district, followed by those in the neighbouring Balovale district.

The origin of these differences may lie in several factors. There may be regional variations in disease or in diet, or the regional variation may merely be reflecting tribal differences. It is not easy to see why diseases which may affect fertility, such as gonorrhoea, for example, should be more prevalent in the areas south-west of the railway line than north-east of it. If the introduction of gonorrhoea is

Table II

LIVING CHILDREN UNDER THE AGE OF FIVE PER WOMAN IN FIVE-YEAR AGE GROUPS

Age (i)	Distribution of Living Children Under the Age of Five Years: 0 (ii)	1 (iii)	2 (iv)	3 (v)	4 (vi)	Women (vii)	Total Living Children Under Five (viii)	Fert. Ratio (ix)	Age Prop. (x)	Age Standard ((ix) × (x)) (xi)
15-19	520	273	63	7	1	864	424	491	.166	81.5
20-24	522	524	374	63	3	1,486	1,473	991	.160	158.6
25-29	356	302	255	56	4	973	996	1,024	.152	155.6
30-34	296	222	155	24	2	699	612	876	.143	125.3
35-39	159	74	45	10	—	288	194	674	.135	91.0
40-44	132	31	11	3	—	177	62	350	.127	44.4
45-49	45	9	4	2	—	60	23	383	.117	45.2
50-54	32	5	1	—	—	38				
55-59	5	—	—	—	—	5	7	146		
60 +	5	—	—	—	—	5				
Total	2,072	1,440	908	165	10	4,595	3,791	825	1.000	701.6
Unknown	17	7	1	1	—	26	12			
Total	2,089	1,447	909	166	10	4,621	3,803			


MAP 1
RHODESIA AND NYASALAND
SCALE 1 : 5,000,000
DISTRICT BOUNDARIES
0 40 80 120 160 200 Miles
MAIN BOUNDARIES
28° 29° 30° 31° 32° 33° 34° 35° 36°
8° 9° 10° 11° 12° 13° 14° 15° 16° 17° 18°
MPOROKOSO
ABERCORN 759
811
908
917
887
KAWAMBWA
ISOKA
KARONGA
KASAMA
LUWINGU
LAKE BANGWEULU
962
1043
CHINSALI
LUNDAZI
RUIMPI
787
779
FORT ROSEBERY
876
806
MZIMBA
NKATA BAY
LAKE NYASA
MPIKA
478
MWINILUNGA
683
SOLWEZI
COPPERBELT
920
698
217
NDOLA
SERENJE
FORT
KASUNGU
KOTA KOTA
DOWA
BALOVALE
KABOMPO
673
518
705
304
KASEMPA
MKUSHI
FORT MANNING
LILONGWE
732
JAMESON
862
BROKEN HILL
PETAUKE
DEDZA
FORT JOHNSTON
526
MONGU
LEALUI
NCHEU
KALABO
447
MUMBWA
639
ZOMBA
LAKE SHIRWA
MANKOYA
LUSAKA
730
FEIRA
BLANTYRE
396
MLANJE
545
NAMWALA
MAZABUKA
CHIKWAWA
CHOLO
424
GWEMBE
SENANGA
CHOMA
AGE STANDARDISED FERTILITY RATIOS
PORT HERALD
SESHEKE
KALOMO
LIVINGSTONE

to be attributed to infected labour migrants returning from town, then the Northern Province, which has had the highest rate of migration over the last 60 years, should presumably have been infected earlier and have had a heavier infection than areas where the labour migration rate has been lower. It should therefore have shown a lower rate of fertility. In fact, of course, women from the Northern Province have proved to be the most fertile of all.

Malaria may be thought to be an important factor, partly through its possible effect on pregnancy loss, but especially because of its effect on the mortality among children under the age of five. But it should not be forgotten that the sample was an urban one and that the majority of children under the age of five had been born and bred in the towns where malaria control is effective. Even if malaria were the effective agent, we still have to explain why the children of mothers of particular tribal origins and not others should be affected.

It would also be difficult to explain regional differences in fertility as being due to diet. The possible correlation between a high proportion of cassava in the diet of the Lwena peoples and low fertility may be noted, but we know that the fertility of the Luapula people amongst whom there are a large number of cassava eaters is high. Also the fertility ratio amongst the people from Broken Hill and Mumbwa who are primarily maize eaters is low.

The possibility that these differences are related to tribal origin must therefore be considered. Diagram I shows the age standardised fertility ratios in 12 broad tribal groups.*

Variations in fertility are considerable. We may distinguish four rough categories as follows:

High Fertility.—Eastern patrilineal (Mambwe type) and central matrilineal (Bemba type).

Moderate Fertility.—Central matrilineal (Aushi type, Luapula type and Lamba type), eastern patrilineal (Tumbula type), eastern matrilineal (Nsenga and Nyanja type) and Ngoni.

Low Fertility.—Western composite (Lozi), central matrilineal (Ila Tonga type, Langa type), western matrilineal (Ndembu type).

Very Low Fertility.—Western matrilineal (Lwena type).

The differences in fertility by geographical region and tribal origin in this urban sample parallel those noted in the demographic survey of the African population in Northern Rhodesia in 1950 (C.A.S.O.: 1952 Table XI revised). Table III sets out the rates for comparison.†

The demographic survey was conducted all over the territory and not only in the towns.

Table III

COMPARISON OF FERTILITY OF TRIBAL GROUPS IN URBAN SAMPLE AND IN DEMOGRAPHIC SURVEY

Tribal Group	Births per Year per Adult Woman	
	Demographic Survey	Urban Sample
Northern Eastern (Mambwe, etc.)	.322	.288
Bemba and Bisa	.223	.256
North Central (Luapula peoples)	.174	.190
Tonga, Ila, Lenje	.188	.125
Chewa and Ngoni	.178	.190
South Eastern (Nsenga)	.177	.243
Western (Ndembu, Luvale, etc.)	.103	.109
North Western (Lamba, Kaonde)	.171	.189

† Fertility was measured in the demographic survey by the average number of births per year to each woman. In order to compare findings we need to convert the fertility ratios into the average number of births per woman of child-bearing age. To do this we use the expression

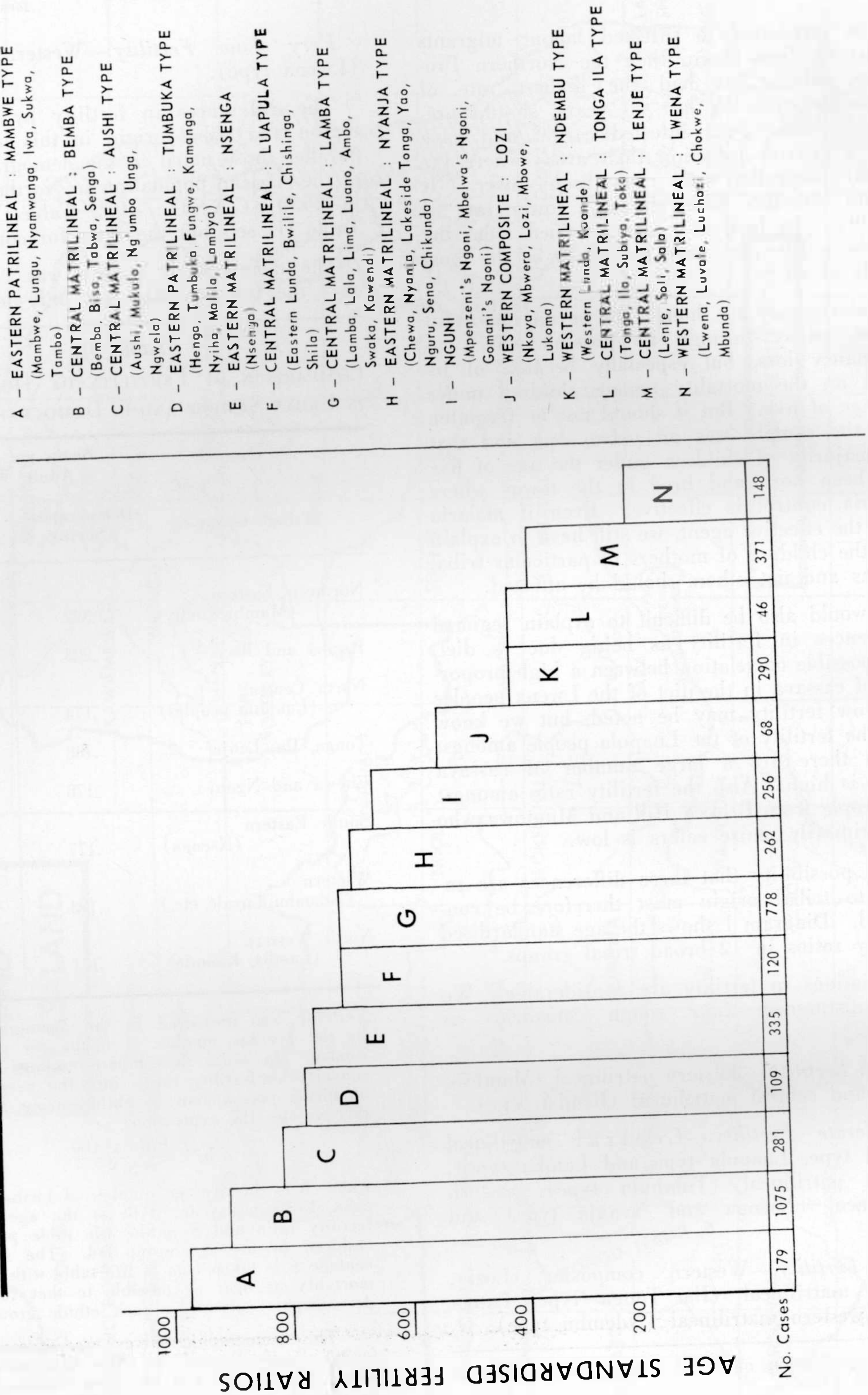
$$b = \frac{F.R. \times 100}{5\ S}$$

where b is the average number of births per woman aged 15-50 per year; F.R. is the age-standardised fertility ratio and S is the life table percentage of children in the age group 0-4. The survival percentage S is taken from a life table with an infantile mortality as near as possible to that found in the demographic survey for each ethnic group.

The demographic survey used a somewhat different classification of the tribes than used here. In Table III the material has been classified as nearly as possible as in the demographic survey.

* The classification of tribal groups follows that in Mitchell (1961).

DIAGRAM 1: AGE STANDARDISED FERTILITY RATIOS IN DIFFERENT TRIBAL GROUPS



The similarity of fertility rates of the tribes both in the towns and in the rural areas suggests that the environmental factors do not affect fertility as much as those related to the ethnic origin of the mothers. It is almost impossible, however, to test this statistically, since tribal distributions coincide almost exactly with districts and it is difficult to separate out one from the other.

Other factors than tribe, however, may have an effect on the level of fertility. Following the findings in the United States and Europe, we might expect to find differences by religion, proportion of time spent in town, the educational level of the woman, the husband's education and so on. The age-standardised fertility ratios for women in these categories are set out in Tables IVa and IVb.

In interpreting these figures it should be borne in mind that the fertility ratio incorporates an element of mortality in it, since it is measured by the number of *living* children under the age of five.

In summary we note that:

(a) Those who professed to be Roman Catholics had a higher fertility rate than any other group and that those who said they were pagan had the lowest ratio. The rate for pagans was lower than the rate for the Christians as a whole.

(b) There was a trend towards a lower fertility ratio amongst those women who had spent a greater proportion of their life in town. The trend may be due either to a higher mortality rate amongst children of those women who have spent more time in towns or due to a real lower fertility among these women. It seems unlikely that the mortality among children under five years of age is higher in towns than in the country, so that it appears that fertility declines with increasing contact with towns.

Table IVa

FERTILITY RATIO BY RELIGION

Religion	Number Women	Fert. Ratio
Roman Catholic	1,176	842
Protestant (Mission Churches)	1,127	745
Watch Tower	649	689
Other Christians	299	788
Pagan	1,265	609
	4,516	
Over 50	48	
Unknown	57	
	4,621	

Table IVb

FERTILITY RATIO BY PROPORTION OF TIME IN TOWN SINCE TURNING FIFTEEN YEARS OF AGE

Proportion of Time	Number Women	Fert. Ratio
One-third or less	1,738	752
Between one-third and two-thirds	1,189	787
Over two-thirds	622	726
All adult life in town	979	563
	4,528	
Over 50	48	
Unknown	45	
	4,621	

Table IVc

FERTILITY RATIO BY EDUCATIONAL LEVEL

Number Years' Schooling	Number Women	Fert. Ratio
Nil	3,678	711
One to four years	623	701
More than four years	211	730
	4,512	
Over 50	48	
Unknown	61	
	4,621	

(c) There appeared to be little trend with the education of the woman. There was a slightly higher fertility ratio amongst the better educated women, but this may have been due to lower mortality among their children.

(d) The trend of lowered fertility with increasing residence in town noted in connection with the proportion spent in town was confirmed when the data were classified by period of residence in town.

Table IVd

FERTILITY RATIO BY LENGTH OF CONTINUOUS RESIDENCE IN TOWN

Length of Residence	Number Women	Fert. Ratio
Under 5 years	2,362	769
5 to 9 years	905	819
10 to 14 years	570	731
15 to 19 years	355	608
Over 20 years	344	479
	4,536	
Over 50	48	
Unknown	37	
	4,621	

Table IVe

FERTILITY RATIO BY HUSBAND'S OCCUPATION (Married Women Only)

Occupation	Number Women	Fert. Ratio
Unskilled	2,292	735
Artisans and semi-skilled	1,717	774
White collar	258	837
	4,267	
Over 50	36	
Unmarried	265	
Unknown	53	
	4,621	

(e) There was a distinct relation between the occupations of the husbands and the fertility of their wives. The wives of men in the "white-collar" occupations had the highest fertility ratio, the wives of those in skilled and semi-skilled occupations somewhat lower fertility, and those of men in unskilled occupations the lowest of all. This may be due, however, to a lower mortality amongst the children of men earning higher wages and better able to make use of medical services. More information is needed to illuminate this relationship.

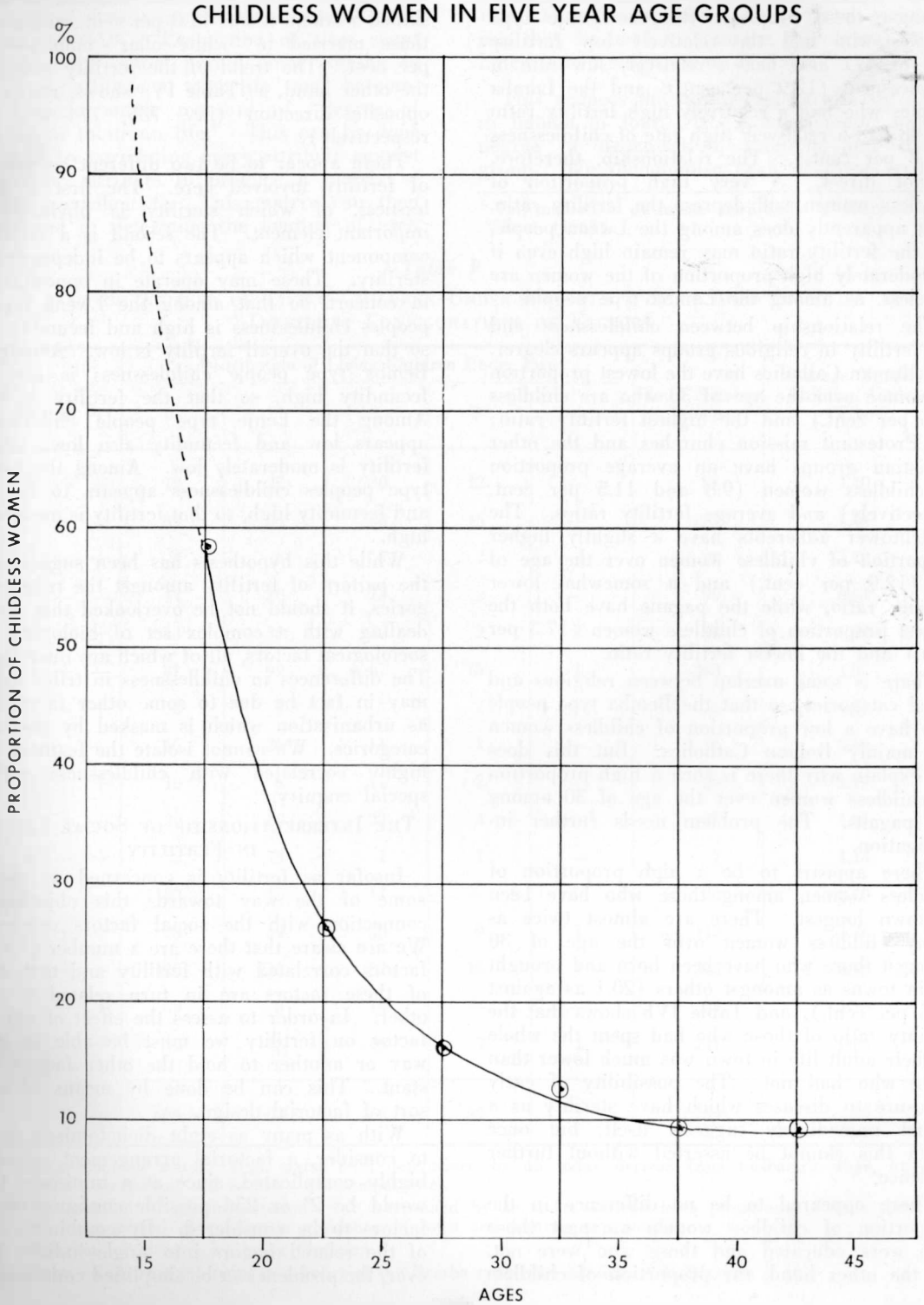
CHILDLESSNESS AS A FACTOR IN FERTILITY

From Table I we are able to compute the proportion of women in each five-year age group who have never borne a living child. These proportions are plotted on Diagram II.

From this diagram we see that the proportion of childless women appears to stabilise at about 9 per cent. after the age of 30. This is the proportion over the age of 30 who have never borne a living child. This is not to say that these women are sterile in the medical sense, though it is almost certain that the majority are. All these women are married and have been married and have therefore been exposed, we assume, to the possibility of impregnation. Some may have deliberately avoided conception, but in the light of the high cultural emphasis on child-bearing amongst these women this seems unlikely. Some may have had a series of miscarriages and abortions, but no successful pregnancy. On the whole, therefore, while we may not look upon this percentage as the proportion of sterile women in the sample, we may consider it as the proportion of women who are unavoidably childless.

The extent of unavoidable childlessness is obviously an important factor in the level of fertility, but the relationship is not a simple one. If we consider the proportion of women over the age of 30 in the different tribal groups who are childless, we find that there is considerable variation from one group to another. The central matrilineal people in the Northern Province who have high fertility ratios also have a lower than average proportion of childless women over the age of 30. A high proportion of women from the western matrilineal peoples over the age of 30 were childless. Nineteen per cent. among the western Lunda and Kaonde were childless and no less than 17.8 per cent. among the Lwena type people

DIAGRAM 2: PROPORTION OF CHILDLESS WOMEN IN FIVE YEAR AGE GROUPS



were childless. These high proportions no doubt explain relatively low rates of fertility amongst these peoples. But the Lenje type peoples who had the relatively low fertility rate of 477 also had a relatively low rate of childlessness (12.9 per cent.), and the Lamba peoples who had a relatively high fertility ratio of 698 had a relatively high rate of childlessness (15.8 per cent.). The relationship, therefore, is not direct. A very high proportion of childless women will depress the fertility ratio, as it apparently does among the Lwena people, but the fertility ratio may remain high even if a moderately high proportion of the women are childless, as among the Lamba type peoples.

The relationship between childlessness and low fertility in religious groups appears clearer. The Roman Catholics have the lowest proportion of women over the age of 30 who are childless (6.6 per cent.) and the highest fertility ratio; the Protestant mission churches and the other Christian groups have an average proportion of childless women (9.8 and 11.5 per cent. respectively) and average fertility ratios. The Watchtower adherents have a slightly higher proportion of childless women over the age of 30 (12.9 per cent.) and a somewhat lower fertility ratio, while the pagans have both the largest proportion of childless women (17.3 per cent.) and the lowest fertility ratio.

There is some overlap between religious and tribal categories, so that the Bemba type people who have a low proportion of childless women are mainly Roman Catholics. But this does not explain why there is such a high proportion of childless women over the age of 30 among the pagans. The problem needs further investigation.

There appears to be a high proportion of childless women among those who have been in town longest. There are almost twice as many childless women over the age of 30 amongst those who have been born and brought up in towns as amongst others (20.1 as against 10.5 per cent.), and Table IVb shows that the fertility ratio of those who had spent the whole of their adult life in town was much lower than those who had not. The possibility of early exposure to diseases which have sterility as a sequel immediately suggests itself, but once again this cannot be asserted without further evidence.

There appeared to be no difference in the proportion of childless women amongst those who were educated and those who were not. On the other hand, the proportion of childless women over the age of 30 married to unskilled workers was 10.7 per cent., married to semi-skilled workers it was 11.3 per cent., and among those married to "white-collar" employees 14 per cent. The trend of the fertility ratios, on the other hand, as Table IVe shows, ran in the opposite direction (i.e., 735, 774 and 837 respectively).

There appear to be two different components of fertility involved here. The first is childlessness, of which sterility is obviously an important element. The second is a fecundity component which appears to be independent of sterility. These may operate in opposition or in concert, so that among the Lwena type of peoples childlessness is high and fecundity low, so that the overall fertility is low. Among the Bemba type people childlessness is low and fecundity high, so that the fertility is high. Among the Lenje type people childlessness appears low and fecundity also low, so that fertility is moderately low. Among the Lamba type peoples childlessness appears to be high and fecundity high, so that fertility is moderately high.

While this hypothesis has been suggested by the pattern of fertility amongst the tribal categories, it should not be overlooked that we are dealing with a complex set of biological and sociological factors, all of which are interrelated. The differences in childlessness in tribal groups may in fact be due to some other factor such as urbanisation which is masked by the tribal categories. We cannot isolate the features most highly correlated with childlessness without special enquiry.

THE INTERRELATIONSHIP OF SOCIAL FACTORS IN FERTILITY

Insofar as fertility is concerned we can go some of the way towards this objective in connection with the social factors concerned. We are aware that there are a number of social factors correlated with fertility and that many of these factors are in turn related to each other. In order to assess the effect of any one factor on fertility we must be able in some way or another to hold the other factors constant. This can be done by means of some sort of factorial design.

With as many as eight dichotomised factors to consider, a factorial arrangement would be highly complicated, since at a minimum there would be 2^8 or 256 possible configurations of factors to be considered. By combining some of the related factors into single indices, however, the problem can be simplified considerably.

"Husband's wage," "husband's occupation" and "woman's educational level," for example, may be combined into a single measure of "socio-economic status." "Proportion of time spent in town," "the actual period since coming to town" and "attitude to town life" may be combined into a single measure of "degree of commitment to urban life." This can be done first of all by correlating every attribute against every other attribute to produce a matrix of correlation coefficients. This matrix can then be analysed to determine the loading of each attribute with the factors of socio-economic status and degree of urbanisation. These loadings, after manipulation to produce weights, can then be used to combine the several attributes into a single score or index.*

This reduces the number of factors we have to handle to four, viz., socio-economic status, degree of urbanisation, religion, and tribal group. We dichotomise each of these factors

* The method is discussed more fully in Mitchell and Shaul (1963).

Table V

AVERAGE NUMBER OF LIVING CHILDREN UNDER FIVE PER WOMAN AGED 20-29 BY DIFFERENT CONFIGURATIONS OF FACTORS

S	U	R	T	Distribution of Living Children Under Five 0	1	2	3	4	Total Number Women	Average Number Children Under Five
+	+	+	+	19	27	30	12	—	88	1.40
+	+	+	—	82	86	68	15	—	251	1.06
+	+	—	+	6	6	6	2	—	20	1.20
+	+	—	—	44	30	23	2	—	99	0.83
+	—	+	+	18	35	32	2	1	88	1.24
+	—	+	—	81	99	67	15	1	263	1.07
+	—	—	+	2	8	3	2	—	15	1.33
+	—	—	—	36	26	11	1	—	74	0.69
—	+	+	+	10	6	11	2	—	29	1.17
—	+	+	—	29	30	22	4	—	85	1.01
—	+	—	+	2	3	1	1	—	7	1.14
—	+	—	—	20	15	11	—	—	46	0.80
—	—	+	+	28	39	36	9	1	113	1.26
—	—	+	—	129	116	82	15	1	343	0.96
—	—	—	+	9	8	14	—	—	31	1.16
—	—	—	—	90	73	46	7	1	217	0.88
				605	607	463	89	5	1,769	1.03

S = Socio-economic status. High status (+) determined by an index derived from husband's wage, husband's occupation and woman's educational level.

U = Urbanisation. High urbanisation (+) determined by an index derived from proportion of time spent in town, period of continuous residence in town and attitude to town life.

R = Religion. Positive (+) being Christian.

T = Tribe. Positive (+) being a member of the Bemba type tribe as defined in Diagram I.

into high and low socio-economic status, high and low degree of urbanisation, Christian and pagan religion, and being and not being a member of the Bemba group of tribes. We indicate the aspect of each of these dichotomies which is probably positively associated with fertility by means of a plus sign and the aspect probably negatively associated with a minus sign.

In order to set up a factorial design in which we can test the statistical significance of the independent contribution of the various factors to fertility we must use a measure of fertility from which we can compute sums of squares. We can do this by using the average number of living children under the age of five per woman. In order to control the possible differences in age distributions in different configurations of factors we consider women aged 20 to 29 only. A factorial arrangement derived in this way is set out in Table V.

We may now proceed to estimate the effect of each of these factors on fertility while holding the others constant. This can be done by a method used by Keyfitz (1953) in a study of family size in Canada. This method considers the difference between configurations of patterns in which a specified factor varies. For example, if we consider the patterns (+ + + +) and (+ + + —) we note that here the factors of socio-economic status, urbanisation and religion are held constant while the factor of tribal origin is allowed to vary. In this case the difference in the mean number of living children under the age of five per woman is 1.40 — 1.06 = 0.34. There are eight possible differences of this sort in which the three factors of socio-economic status, urbanisation and religion are constant while the tribal factor is allowed to vary. The average of these differences estimates the effect of the tribal factor on fertility. But Table V shows that the averages are based on different numbers of women in each comparison. This means that the variance is likely to differ in each comparison. The overall average, therefore, must be one in which the individual differences are weighted according to the size of the sub-samples in which the comparisons are made.*

The results of this operation are set out in Table VI.

The ratio of differences of means to the standard errors shows that only two factors affect the fertility rate to any degree of statistical significance. Tribal membership makes a difference to the mean number of living children under the age of five of 0.287. The religious factor makes a difference of 0.170, while the differences due to socio-economic status and urbanisation are small and statistically insignificant. The effects of the interactances of each factor with every other factor are small and statistically insignificant.

* Keyfitz explains how this is done in his paper.

FACTORS IN FERTILITY

Establishing the association between high or low fertility and a variety of social or other factors, however, merely poses the problem; it does not solve it. The associations or correlations I have established are *surface* correlations, i.e., they state that high or low fertility is associated with certain factors, but this does not tell us how the association comes about. For this we need more detailed research involving both social and medical scientists. The most that I can do here, however, is to make some suggestions of possible lines of enquiry.

I might begin by considering those factors which have emerged as the least directly associated with fertility. These are socio-economic status and urbanisation. In Tables IVb and IVd fertility was negatively correlated with urbanisation, i.e., those who were more committed to urban living on the whole had lower fertility ratios than those who were less committed. It is not likely that this is due to differential mortality in the first five years of life, since we may assume that those women who are committed to urban life would be more familiar with the medical services available in town and more likely to use them. In an earlier paper in which total fertility rates were used, i.e., a measure which is unaffected by mortality, I was able to show that there was little difference in fertility by length of residence in town (Mitchell, 1951). A study of fertility among Africans in a Johannesburg township by Badenhorst and Unterhalter (1961) also shows a slight decrease in the number of live births per woman by increasing period of residence in town. This seems to be in line with what we would expect from American and European studies, but Badenhorst and Unterhalter did not hold other factors constant in their study and they used the average number of live-born children per woman as a measure of fertility. By using the average number of live-born children per woman as a measure of fertility they incorporate into it the fertility of some of the older women before they came to town. It is therefore not strictly a measure of "urban" fertility. By not holding other

factors constant they may be incorporating the effect of other factors hidden in urbanisation. It has been shown in Table VI in this study that the correlation between urbanisation and low fertility disappears when the factors of tribe and religion are held constant. At present, therefore, the relationship between urbanisation and fertility in African towns must remain open.

The relationship between socio-economic status and fertility is the opposite of that found in America and Europe. In these countries the tendency is for fertility to be lower in higher socio-economic status groups. The finding of this study is that fertility appears to *increase* with socio-economic status. This relationship, however, is possibly influenced by differential mortality. It is likely that the mortality rate among children of the higher socio-economic strata because of the generally higher level of education and better living conditions is lower than in the lower strata, so that the fertility ratio would be higher.

Badenhorst and Unterhalter (1961) report a trend in fertility as measured by the average number of live-born children per woman with occupational class in the same direction as in the United States or Europe. This raises the question of whether the longer period of industrialisation in South Africa has begun to affect the reproductive behaviour amongst Africans as it has elsewhere. Before we can draw conclusions, however, we should bear in mind the difficulties raised earlier about the use of completed fertility as a measure of current fertility and the difficulties, as Keyfitz points out, of drawing conclusions from data in which several factors are operating conjointly.

The findings of this preliminary analysis as set out in Table VI suggests that in the urban areas of Northern Rhodesia it is likely that the association of fertility with these two factors is probably due to their correlation with tribal and religious factors, and that the effect of socio-economic status and urbanisation on fertility by themselves is small.

We may now consider in more detail the influence of religion and tribe on fertility. The Sofers (1955) noted that there were more children born alive to women in Jinja who had been married in church than those who had not. The Sofers were able to show that women married in church had been married longer than other women, but since they were unable to obtain information on the ages of these women we do not know whether the larger number of children born to them alive was due

Table VI

ESTIMATES OF FERTILITY DIFFERENCES DUE TO FOUR FACTORS AND THEIR INTERACTION

Factors	Weighted Average of Difference of Average Number of Children	Estimated Standard Error	Ratio of Average to Standard Error
Differences between—			
High and low socio-economic status	+ 0.042	0.046	0.92
High and low degree of urban commitment	+ 0.024	0.047	0.52
Christian and pagan religion	+ 0.170	0.048	3.54*
Bemba and non-Bemba tribes	+ 0.287	0.052	5.52†
Interaction of—			
Religion and—			
Socio-economic status	+ 0.161	0.104	1.55
Urbanisation	+ 0.023	0.109	0.21
Tribe	— 0.124	0.127	0.98
Tribe and—			
Socio-economic status	+ 0.020	0.111	0.18
Urbanisation	+ 0.025	0.114	0.22
Socio-economic status and urbanisation	+ 0.062	0.099	0.63

* Significant at the 0.001 level. † Significant at the 0.0005 level.

to a real difference in fertility or to the difference in age. Denis (1958), reviewing data from Congo towns, points out that the size of families of couples who were married in church were larger than others—a fact which he attributes to the stability of Christian marriages which favours family life. But we cannot deduce from the size of the family alone that Christian women are more fertile than non-Christian; for this we need more detailed information. From Table IVa in this paper we saw that Roman Catholics showed the highest fertility ratios, followed by the Protestant Mission Church members and other Christians, and that the Watchtower adherents and pagans had the lowest ratios. The explanation of this may be sought in several directions. One of these is the possibility that Christian parents other than Watchtower adherents might have been more willing than pagan parents to use medical services and so ensure a greater survival rate of their children. Alternatively, Christian parents possibly may no longer adhere to tribal customs which abjure sexual relations whilst a child is suckling. We need more information about the spacing of children before we can come to a conclusion regarding this.

It is less easy to explain the differences in fertility amongst tribal groups. It is probable that some of these differences are by no means modern phenomena. For example, Springer, writing about the Luvale in 1909, said: "The women are not prolific as in most of the tribes and the absence of little children in the villages was notable."* Low fertility rates have persisted among the Luvale; and White (1959), who reviews the data concerning fertility among them for the last quarter of a century during which statistics have been available, states that their numbers have been stationary with a rate of replacement just at unity.

Whatever factors have led to the low fertility, insofar as the Luvale are concerned, they have been operating for a long time. One of these factors, of course, may be disease. Grave, who has worked among the Luvale, has commented that most barren women he examined and treated had some form of pelvic sepsis and salpingitis with consequent infertility. This infection, in his opinion, was due to a number of practices such as childhood intercourse, early marriage resulting in difficult labour and consequent vaginal manipulation by village midwives, frequent abortions, herbal remedies and gonorrhoea.† On the other hand, Gilges, who has also worked among the Luvale, was not able to diagnose gonorrhoea or syphilis clinically or serologically in many of the cases he examined. Nor was he able to identify bilharziasis or tuberculosis in the reproductive organs as causative agents. Dr. Gilges noted the intra-vaginal use of irritating and toxic herbs in the folk-treatment of disease, but was not able, with the facilities at his command, to detect the after-effects of their use, such as chronic irritation or scarring. Dr. Gilges comments: "In my own mind I became convinced that a genetic factor was at play.‡

White (1959), after reviewing the patterns of child-bearing amongst Luvale women, concluded that "the consensus of medical opinion to date is that the low fertility cannot be explained solely in terms of venereal disease or other infections," and that the reason for this low fertility was unknown.

The situation amongst the Ila is similar. Evans, writing in 1950, appears convinced that the low fertility amongst the Ila was due to venereal disease. Syphilis, however, was far more common amongst the Ila than gonorrhoea, so that it is doubtful if the cause of the infertility lay there. Subsequently, with the extensive use of penicillin, the incidence of venereal disease of all kinds has fallen dramatically, but we do not know whether the birth rate has increased or not. Evans, in answer to an enquiry, writes: "I think my final impression about the high incidence of syphilis and the fertility rate among the Ila is that any relationship between the two has 'not been proven.' I suggest that, at the most, V.D. was only one factor among many, of which genetic factors might well be of greatest importance."*

A convincing explanation of fertility in this sample of urban women requires the identification and interrelationship of the various factors involved. These factors are sociological as well as biological.

We cannot attribute differences in fertility to tribal customs unless it can be demonstrated that the same customs are not followed amongst people who have high fertility rates. Herbal remedies are used, for example, amongst most

* I am grateful to Mr. Gervas Clay, of the Rhodes-Livingstone Museum, for drawing my attention to this reference.

† Personal communication dated 26th September, 1963, from Dr. G. F. Grave, Government Medical Officer, Mazabuka.

‡ Personal communication dated 8th October, 1963, from Dr. W. Gilges, Provincial Medical Officer, Ndola.

* Personal communication dated 16th October, 1963, from Dr. A. J. Evans, Surrey, England. I had suggested to him that genetic factors may be involved.

peoples in Northern Rhodesia. If we aim to explain variations in fertility in terms of these remedies we would need to understand how they are used from one tribe to another and how the differences in use operate to reduce fertility.

Similarly, since the sample was one of urban women many of whom had lived in town for more than five years, the immediate differential influence of the environment, such as the standard of medical care available, the incidence of malaria, the extent to which women were involved in heavy physical labour, and so on, was neutralised. Insofar as dietetic factors are concerned, it would be necessary to demonstrate that the diet of Bemba women in towns, for example, differed significantly in a way related to fertility from that of Luvale women in order to explain the differences in fertility between the two groups of women. We have no evidence that this is so.

The social factors we have isolated as being significantly associated with fertility differences, however, may both be linked with some third factor which is contained in the other two. One such factor could be the voluntary control of procreation, whether by contraception, coitus interruptus or simply by restraint. While differences in contraceptive practices may help to explain differences in fertility between religious groups, it would be difficult to explain tribal differences in terms of this factor. In any case it is likely that the voluntary control of parenthood would be confined to a small proportion of the population in the higher socio-economic categories. Our analysis has shown that there were no significant differences in fertility between these categories.

The fact that differences in fertility in the same direction as those that occur in the tribal areas persist in women who have been in town for relatively long periods points to the operation of factors which came into being before the women came to town. These may be diseases from which the women suffered before they came to town, or an inherent low fertility, possibly due to genetic factors. So far not much evidence has been assembled to show that the morbidity patterns in tribal areas differ markedly from one area to another. On the other hand, there is, as far as I know, no proven connection between fertility and genetic factors.

The sociologist working alone is in no position to explain differential fertility fully. Equally, the geneticist or the medical scientist cannot explain the pattern of fertility from the point of view of his specialism alone. I have been able to demonstrate that there are marked differences in fertility among the African peoples and suggest that some of the facile and common explanations of these variations are probably not valid. When we begin to examine in detail the problem of differential fertility we become embarrassingly conscious of our lack of knowledge of the subject and correspondingly acutely aware that this is a field in which we need desperately the close co-operation and pooling of research skills of both medical and social scientists.

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