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APPLICATION OF DEMOGRAPHIC ESTIMATION MODELS TO FERTILITY IN A NIGERIAN ETHNIC GROUP: IMPLICATIONS FOR POPULATION GROWTH AND FAMILY PLANNING PROGRAMMES*

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This study examines the current level of fertility in a Nigerian ethnic group, the Igbo in Eastern Nigeria, using various modern demographic estimation techniques. The aim is to control for the validity and reliability of estimates derived from these techniques with a view to arriving at more robust estimates .

The analysis was from data collected for the study of lactation and birth-spacing dynamics in the Igbo area of Eastern Nigeria. About 1,000 women were selected for subsequent interviewing, out of which the responses of 816 were finally processed.

The result of this analysis shows that completed family size in the Igbo area is 6.1. Application of various techniques show that Igbo fertility level remains high — higher than that of other ethnic groups in Nigeria. The estimated total fertility rate is between 6.8 and 7.4. Explanation for this observed level is sought within the cultural milieu of the area. For instance, there are various names in the area that depict the cultural value placed on having children.

That the Igbo still cherish high numbers of children is a strong impediment to the implementation of a successful family planning programme in the area. Efforts should be mounted to discourage high fertility in the area. For instance,in areas where people celebrate the high number of children they have had, they should be made to pay taxes to the government anytime when they want to hold such a celebration.

INTRODUCTION

The primary objective of this paper is to estimate the level of fertility among the Igbo of Eastern Nigeria using the most revised and sophisticated demographic techniques, and to assess the implications of this estimated fertility level for population growth and family planning programmes. The techniques used here for assessing fertility levels and patterns are based on survey questions concerning current and retrospective fertility. By current fertility, we mean the number of children born during a twelve-month period prior to the survey. Retrospective fertility refers to the total number of

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live births by each woman (Shryock and Siegel 1970).

Various techniques for the estimation of fertility levels have been developed, notably by Brass, Coale and Trussell. Although these techniques are powerful, they are based upon shaky assumptions in consideration of developing societies in which accurate data are hard to acquire. It is risky, therefore, to depend on the reliability of estimates derived by a method without cross-checking the results with estimates from other methods. The results of different methods should be compared in order to enhance the reliability of our estimates.

Igbo fertility has been estimated before (Coale and Page 1968; Ukaegbu 1974; and Omideyi 1983). Apart from Omideyi(1983), there is no indication of the methods by which these estimates were made. These studies estimated Igbo fertility to be high and even the highest among Nigerian ethnic groups. Apart from the fact that the methods of the estimation and their assumptions were stated, these studies were conducted in the early 1970's and 1980's. Since then, socioeconomic progress could be expected to have affected fertility levels in this area, as it has in other societies passing through socioeconomic transformation. It therefore becomes imperative to re-estimate Igbo fertility levels using the well-known Brass P/F method and other techniques for comparative purposes. The results of the calculations should be checked for consistency, strengthening the results. The aims of this paper, therefore, are:

1. To estimate fertility level of the Igbo of Eastern Nigeria using a variety of modern estimation techniques
2. To compare the results from different techniques and different sources in order to note trends in the area's fertility levels.
3. To offer explanations of the estimated level of fertility among the Igbo
4. To examine the implications of the observed fertility level for population growth and family planning programmes in Nigeria.

The use of more refined and sophisticated techniques is intended to obtain a more robust and current level of fertility in the area, representing on improvement over previous estimates.

The Igbo cultural group is located in South-Eastern Nigeria between latitude 5 to 7 degrees North and longitude 6 to 8 degrees East. They occupy an area of some 15,800 square miles. The Niger River divides the Igbo country into two unequal parts with the greater part lying in what is called Eastern Nigeria while a smaller part, west of the Niger constitutes what is called Delta Igbo.

The territory of the Western Igbo is marked off from Bini and Warri and that of the Eastern Igbo stretches from the Niger Delta where the Ijaw and

Ogoni are the Southern neighbors. The Igalas and the Tiv are the neighbors to the north. Though separated by the Niger and thus falling into two separate political units, the two Igbo units have retained their cultural and psychic unity.

The Igbo nation exhibits a wide variety of physical features. It has a number of rivers, the main one being River Niger. Igboland has a tropical climate, with an average annual temperature of about 80°F. The rainy and dry seasons are well marked. There are presently five Igbo states in Nigeria — Abia, Anambra, Imo, Enugu, Ebonyi States. There are some Igbo communities in the Delta and Rivers States of the country.

This study was conducted in the Imo State, which has a population of 2,485,499 according to the 1991 Census. In the area, marriage is universal and many traditional rites are involved in the consummation of marriage. Attitudes to issues are conservative.

DATA SOURCE AND METHODS

The data for this analysis were obtained from a survey in some parts of Imo State, Nigeria. The study was conducted in the communities of Owerri, Orlu and Awo-Idemili. The study was originally intended to examine the dynamics of breast-feeding and birth-spacing in the area. The data were used for a doctoral dissertation. There were 1,000 eligible women who are married and are of reproductive age group 15-49 and have had at least one live-birth. Of these, 819 women were finally interviewed and their responses processed. A systematic random sampling method was used to select eligible respondents. Questions were asked concerning all births in the five year period preceding the survey, and addressed general individual and household characteristics, fertility, breast-feeding and the use of contraceptives.

The basic source of information for fertility analysis, including the present analysis is the question on children ever born. Response to this question are often unreliable, due to the problem of memory lapse. In most cases, children who died soon after birth are likely to be omitted, as are illegitimate children and children living outside the home. On the other hand, some respondents include their foster children, leading to an overcount. The accuracy of reports of the number of children ever born tends to vary inversely with the age of the respondent (Shryock *et al.* 1971).

In relation to African data, Brass and Coale (1968) observed that “the number of children ever born is reported with good accuracy by younger women. The events which the young women are asked to recall have hap-

pened recently: the total births to each are typically not more than two or three so that the difficulties of counting large number in an illiterate society do not arise; living children will often be present at the interviews and few will be omitted because they have grown up and left the household. There is also the problem of outright failure to report the number of children". Thus there is always the need to assess the data carefully. Various methods have been developed to assess the reliability of the responses to the questions concerning the number of children ever born.

The methods used are based on survey questions concerning information on current and retrospective fertility, and include the Brass P/F technique, the Brass consistency check, the Brass Relational Model, and the Coale and Demeny techniques. The application of these techniques to the Igbo data is discussed in the preceding sections.

Brass' method was developed as a device for comparing lifetime fertility to cumulative fertility. The ratio of the two under certain logical relationships and assumptions is used as a correction factor for current fertility estimates. This rests on the assumption that there is a logical relationship between the two types of data used in its computation. As a cohort of women moves through life, the average parity at each exact age equals the cumulative total of age-specific fertility rates to that age, provided the fertility of surviving women is equal to that of women dying during that interval. If the current fertility of the population is constant, the age-specific fertility rate of each cohort will be the same as the current ones. This holds for all ages. In real populations, if fertility declines are not clear, the theoretical result will not hold.

The Brass technique was developed on the basis of the above logical relationships. It tries to estimate total fertility using parts of the two sets of data which are likely to be reliable. The following assumptions hold for the model :(1) fertility for the population under study remained constant for sometime in the past, (2) the reported number of children for women in the early ages is more or less accurately reported (3) the reported number of births in the last year may suffer from errors resulting from inaccurate perception by the respondents of the reference period. This last assumption means that the reported age-specific fertility rate based on data on births in the twelve months prior to the survey may underestimate or overestimate the fertility level, but their age structure is correctly reported.

Under the assumption of constant fertility, the cumulated current fertility up to a certain age x (F_x), which is deduced from data on births last year should be equal to the lifetime fertility (mean number of children ever born) to the same age x. Any difference between the two can be attributed to

errors that are normally present in the data on mean number of children ever born and births in the twelve-month period prior to the survey. Thus any deviation of the P/F ratio from unity for various age groups can be taken as an indication of the presence of errors in the data.

The technique uses the age-structure of the fertility depicted by current data on births in the previous year (which are reliable according to our third assumption), and compares or adjusts it according to the data on mean number of children ever born by age of young women. In other words, the most reliable pieces of information from the current and lifetime fertility data are combined to yield an adjusted current fertility estimate.

Brass, and later Coale and Trussell, developed a set of multipliers with which to derive comparable parity equivalents from current fertility rates (UN 1983). From the various multipliers, it is possible to obtain parity equivalents of current fertility rates (F_i) for ages above 20, and to compare them with lifetime fertility data (P_i). The traditional P/F ratio recommended the use of the f_1/f_2 value for interpolation. This analysis uses a different f_1, because the value obtained with f_1/f_2 is not within the range of values in the multipliers table provided by Brass. The value of f_2/f_3 was used due to the continued reliability of information from this group. The f_2/f_3 is 0.618 and m = 29.8. The various f_1 values were used to multiply the mid-values of the age group; summed and divided by the total of f_1 values. The results are presented in Table 3.

Coale and Trussell also developed a method for adjusting fertility data in order to estimate fertility rates. An essential component of the technique is the adjustment of the age pattern of fertility, derived from information on recent births (births in the past year preceding the survey) and the level of fertility implied by the average parity of women in age groups 20-24, 25-29 and 30-34. (Procedural steps not recorded) (UN 1983).

Another method used in this estimation is the Brass relational Gompertz model. The model was developed in the early 1960s to represent age-specific fertility rates (Kohl and Oman 1985). The model fits the data quite well over the central range. Brass (1977) modified the model by introducing a fixed empirical transformation of the age-scale. This modification greatly improves the fit to observations at early and late ages in the reproductive period. This modified model is called relational Gompertz model. Zaba (1981) made an advancement by providing the methods for separating the examination of fertility patterns from estimation levels.

According to Zaba, the model provides a tool for adjusting and correcting fertility distributions derived from reports of births in the last year and/or children ever born. A key advantage of this method is its rigidity. The fertili-

ty measures can be linearised, and errors and corrections can thus be assessed by convenient graphical procedures. The basic equation of the relational model is

$$f_{(x)} / F = A^{Bx} \quad (1)$$

where $F_{(x)}$ is cumulative fertility by age X and F is the total fertility rate by the end of the reproductive life. A and B are constants and lie between zero and unity. The F values can be taken as cumulative fertility derived from age-specific rates or parity data. This reduces the above function to a linear function of age by taking logarithms twice, thus:

$$Y_{(x)} = -\ln[-\ln(F_{(x)} / F)] = a + bX \quad (2)$$

where $F_{(x)}$ is fertility up to age X and F is the total fertility.

This function gives a broad representation of the pattern of fertility with age but the shape is not quite right, thus requiring a more efficient method to improve. This is done by transforming the age scale. If $Y_{s(x)}$ represents a standard value, then the relational Gompertz Model,

$$Y_{(x)} = a + bY_{s(i)} \quad (3)$$

where a and b are constants reflecting the fertility patterns of the population in question. The 's' in $Y_{s(x)}$ denotes the transformation for a standard age-specific fertility schedule.

Brass suggested two procedures for fitting the above equation. One is done by using parity data, whereas in the second, both lifetime and current fertility data are used. The estimation equations are defined thus:

$$Z(i) = -\ln[-\ln (P_i / P_i + 1) \quad (4)$$

$$Z(x) = -\ln[-\ln(F_x / F_x + 1)] \quad (5)$$

where i = 1, 2, 3, . . . 7 refers to the five age groups and x = 20, 25, . . . 50 refers to the age.

The model shown by equation 2 holds if $F_{(x)}$ is replaced by P_i, where P_i is the mean parity of an age group of women.

$$\text{Hence, } Y_{(i)} = \alpha + \beta Y_{s(i)} \quad (6)$$

and

$$Y_{(i)} = -\ln[-\ln P_i / F] \qquad 7$$

and β is an inverse measure of the width or spread of the age-specific fertility distribution, and α is an index of central location (Henin *et al.* 1982) and F is the estimated total fertility rate.

The model is used to examine the age patterns of average parity. It is also used to compare the observed and calculated mean parity predicted by fertility models. It operates as follows: take the estimated total fertility rate, and express the mean parity each age group as a proportion of the total fertility estimate. Each proportion is transformed by taking its natural logarithm and changing the sign of the answer; taking the natural logarithm again and changing the signs once more. Equations 6 and 7 are utilized in this manner. $Y_{(i)}$ is the transformed relative parity for age i and its values are compared with the model $Y_{s(i)}$ ratio.

Observed age-specific rates can also be compared with the model. Observed age-specific fertility rates are cumulated upward to estimate cumulative fertility to the upper limit of each age group. The cumulative fertility to each limit is then expressed as a proportion of total cumulative fertility over the whole range. The equation is the same but with only minor changes:

$$Y_{(i)} = -\ln[(-\ln(F_{(x)} / F_{(x+5)})] \qquad 8$$

The series

Z_i equal to $-\ln[-\ln(P_i / P_{i+1})]$

is calculated and the $Z_i - e_i$ compared with the g_i. The values of e_i and g_i, calculated from standard distributions, are used.

Column 4 of Tables 7 and 8 is obtained by the relation

$$Z_{(i)} = -\ln[-\ln P_1 / P_{i+1}]$$

Columns 5 and 7 are standard values provided by Brass. For columns 8 and 9, the parameters a and b are estimated when we plotted a graph of $Z_i - e_i$ against $g_{(i)}$ values, and obtained the intercept a = –0.3 and the slope b = 1.351 which is equal to putting a line to Z_i, Z_2, Z_3 and Z_4 which represent the first four age groups. The $Y_{s(i)}$ values are taken from Brass schedules. The fitted Y_i are computed accordingly. Column 10 is computed by the rela-

tion $P_i/F = \text{Exp}(-\text{Exp}(-Y_{(i)}))$ while column 11 is computed by dividing the mean parities by the estimated P/F ratios. The estimate of total fertility resulting from fitting the relational Gompertz model to mean parities of younger women of the age range is 6.0, and is obtained by averaging the first four values in column 11.

The same procedure applied for Table 8, except that column 2 is obtained by multiplying by 5 the cumulated observed age-specific fertility rate data of the survey. The values of the parameters a and b are –0.44 and 1.46. These are used to estimate $Y_{(i)}$. The estimated total fertility is 6.2. The two estimates are close to each other and closer to the mean number of children even born for women aged 45-49.

To check the accuracy of our estimates,the Brass Consistency Check, a method developed by him to check for the accuracy of the estimate, is used. The Brass consistency check of the TFR estimate is given as

$$\frac{CT}{W} = F\left[\frac{n-m}{n} + \frac{P}{2n}(m(n-m) - 40)\right]$$

where

W = total number of women aged 15 – 44 = 845

CT = number of children ever born to women 15 – 44 = 2350

M = mean age of period fertility distribution minus 15 years, and $\bar{m} = (17 \times 0.0053) + (22 \times 0.288) + (27 \times 0.466) + (32 \times 0.353) + (37 \times 0.252) + (42 \times 0.088)$

$$= \frac{43.3241}{\Sigma f_i} = \frac{43.3241}{1.452} = 29.8$$

so, $M = \bar{m} - 15$ years $= 29.8 - 15 = 14.8$

P = average proportional change in the year in the number of women aged 15 – 44,

$$2(W_{30-45} - W_{15-30})/15W = 0.036$$

F = Total fertility rate

n = 30 year age range.

Substituting,

$$\frac{2350}{845} = F\left[\frac{30-14.8}{30} + \frac{0.036}{60}(14.8\,(30-14.8) - 40\right]$$

$$= F\left[\frac{15.16}{30} + \frac{-0.036}{60}\ (224.97 - 40)\right]$$

$$= F\ (0.5054 + - 0.110982)$$

$$2.8902 = 0.394418F$$

$$F = 2.8902 / 0.394418 = 7.05$$

The result is still very close to what is obtained using the other techniques.

The various estimation techniques used here indicated that the Igbo fertility level is high. It is also shown that childbearing peaks at age group 25 – 29. This shows an early peaked pattern, indicating intensive childbearing in the age group. A consistency check of the result indicated that the estimated total fertility rate in the Imo State is 7.05.

Comparing this with earlier estimates for the same area from other studies, it is clear that the estimate of Ukaegbu (1976) for Ngwa-Igbo which was 7.68 and Omideyi (1983) which was 7.26, gives an indication of a stable population, though still the highest when compared with other Nigerian ethnic groups.

Table 9 presents the summary estimates of Igbo fertility level, using data on mean parities and births in the twelve months prior to the survey date. The estimates are by various methods

RESEARCH FINDINGS

Table 1 indicates that 33 percent of the respondents are less than 30 years of age, while 86 percent are less than 40 years of age. Eight percent is aged 40-44 and 4.8 percent aged 45 – 49. 21.2 percent did not indicate their ages. The overall mean age is 32.1 years. 10.3 percent did not go to school while 27.3 percent had primary level of education; 29.8 percent secondary and 32.6 percent tertiary education. The population is rural as 54% of the respondents live in the rural areas, while 45.8 percent live in the urban area. There are three major religious groups in the survey area namely Roman Catholics, Protestants (Anglicans, Methodists, Baptists etc) and the traditionalists.

Table 1 also shows that 48.6 percent are working for pay (i.e full employment) while 51.4 percent have not worked since marriage. Among those working, 43.8 percent work away from home; 40.1 percent work near home and 5.6 percent are work at home. A greater percentage of our respondents are married as can be seen from the table. The mean age at marriage is 22.2 years indicating an increase from a mean of 18.5 years obtained by Omideyi

TABLE 1. PERCENT DISTRIBUTION OF RESPONDENTS BY CURRENT AGE, IGBO, NIGERIA, 1997.

Characteristics	Number	Percent
Current Age		
15 - 19	3	0.4
20 - 24	51	7.9
25 - 29	159	24.7
30 - 34	204	31.6
35 - 39	140	21.7
40 - 44	57	8.8
45 - 49	31	4.8
Mean Age	32.1	
Education Level		
No Education	73	10.2
Primary	196	27.3
Secondary	214	29.8
Tertiary	234	32.6
Adult Education	1	0.1
Place of Residence		
Rural	444	54.2
Urban	375	45.8
Religion		
Catholics	309	49.0
Protestants	224	35.5
Pentecostal	94	14.9
Traditional Religion	4	0.6
Work Status		
Working for Pay	324	48.6
Not Working for pay	342	51.4
Employment Status		
Private Employee	33	10.2
Government Employee	224	69.1
Self-Employed	37	11.4
Artisans/Trader	30	9.3
Place of Work		
Away from Home	142	49.0
Nearer Home	130	44.8
At Home	18	6.2

TABLE 1. CONTINUED

Characteristics	Number	Percent
Marital Status		
Married	653	95.2
Widowed	21	3.1
Divorced / Separated	12	1.5
Mean age at Marriage	22.2	
Mean Children ever born (age 45-49)	6.1	
Mean age at first birth	23.3	

Note: Some of the totals may not add up to 100 because of rounding. Also, no response categories were excluded.

in 1983. The mean age at first birth in the survey area is 23.3 years.

The mean number of children ever born reported here is comparable to earlier studies. Omideyi (1983) reported the mean number of children ever born as 6.3 for the oldest cohort 45 - 49, and Odimegwu (1990) reported 6.2 for those aged 45 - 49, with an overall mean of 4.9. This indicates that the Igbo fertility may have remained stable over the years.

Fertility Level

The analysis of cumulative fertility shows that the average number of children ever born is 4.1 and the completed family size, indicated by the mean number of children ever born for the oldest cohort (45-49), is 6.1.

Though children ever born yields information on lifetime fertility, it does not take into account the rate of the birth of the children. Thus to measure the current fertility, we used age-specific fertility rate for the twelve months preceding interview. A total of 219 births were reported by currently married women as occurring during the twelve months preceding the survey. Among these, 106 were female births while 113 were male births, giving a sex ratio at birth of 107. This is comparable with what obtains in other developing societies (UN 1987; Shryock et al. 1971).

Based on the information available, indices of current fertility were estimated. Table 2 presents the estimate of fertility levels based on births in the 12 months prior to the survey.

Consider the pattern of age-specific fertility rate in Table 2. Igbo women tend to have their children early in the reproductive period, having half of their children before age 30. An Igbo woman is more likely to have an average of about four daughters during her lifetime if she passed through her

TABLE 2. ESTIMATES OF FERTILITY LEVELS FROM THE NUMBER OF BIRTHS OF THE RESPONDENTS, IGBO, IMO STATE, NIGERIA, 1997.

Age	No. of women	Children ever born	Births in past year	Female Births	ASFFR*	Mean Children ever Born	Age specific fertility rate
15-19	181	3	1	1	0.0055	0.0166	0.005
20-24	111	98	32	15	0.1351	0.8830	0.288
25-29	174	432	81	36	0.2068	2.4630	0.466
30-34	187	786	66	31	0.1658	4.2030	0.353
35-39	135	692	34	21	0.1558	5.1300	0.252
40-44	57	339	5	2	0.0351	5.9500	0.088
45-49	30	179	-	-	-	6.1000	-
Total	875	2,529	219	106	0.7039		1.452

*Age-specific female fertility rate

Sex Ratio = Female births / Male births $\times$ 100 = 113 / 106 $\times$ 100 = 107

Total fertility = ASF = 1452.3

$$TFR = 5 \sum_{i=1}^{7} ASFR = 5 \times 1.4523 = 7.26$$

Gross Reproduction Rate = 0.7039 $\times$ 5 = 3.5

General Fertility Rate = 219 / 875 $\times$ 1000 = 250.

TABLE 3. BRASS P / F RATIO METHOD APPLIED TO IGBO DATA, NIGERIA, 1997

Age	i	Mean Parity P_i	ASFR f_i	O_i	K_i	F_i	P_i / F_2	Adjusted ASFR
15-19	1	0.017	0.005	–	2.66	0.014	1.18	0.005
20-24	2	0.883	0.288	0.027	2.93	0.870	1.02	0.294
24-29	3	2.483	0.466	1.467	3.06	2.893	0.86	0.475
30-34	4	4.203	0.353	3.797	3.08	4.884	0.86	0.360
35-39	5	5.130	0.252	5.562	3.19	6.366	0.81	0.257
40-44	6	5.950	0.088	6.822	3.38	7.119	0.84	0.090
45-49	7	6.000	–	7.262	3.92	7.262	0.82	–

Summation of the adjusted ASFR = 1.4814

Summation of the Adjusted TFR = 5 $\times$ ASFR= 5 $\times$ 1.4814 = 7.4

childbearing years conforming to the age-specific fertility rates of a given year (Gross Reproduction Rate is 3.5)

The P / F values fall constantly with age. The P / F average for the 20-24 age-group is 1.02, implying that the fertility level based on retrospective reports is about 2 percent higher than that indicated by current fertility rates. The values for the 25-34 age group are static and decline thereafter. This may be a problem of memory lapse which occurs with increase in age. The observed and adjusted TFR are 7.26 and 7.4 respectively. The difference

TABLE 4. ADJUSTMENT OF AGE-SPECIFIC AND TOTAL FERTILITY RATES USING COALE-TRUSSELL METHOD IN UN MANUAL X, IGBO DATA, IMO STATE, NIGERIA, 1997.

Age Group	Mean Parity P_i	Period Fertility f_i	Cumulated Fertility O_i	Estimated Parity F_i	P/F Ratio	K= Multipliers	Adjusted ASFR
1	2	3	4	5	6=2×5	7	8=3×7
15-19	0.0166	0.0053	0.0266	0.0233	0.712	0.987	0.005
20-24	0.8830	0.2880	1.4670	0.7488	1.180	0.987	0.284
25-29	2.4830	0.4660	3.7970	2.8760	0.863	0.987	0.460
30-34	4.2030	0.3530	5.5620	4.8900	0.859	0.987	0.348
35-39	5.1300	0.2520	6.8220	6.3900	0.802	0.987	0.249
40-44	5.9500	0.8800	7.2620	7.1700	0.829	0.987	0.087
45-49	6.0000	-	7.2620	7.3000	0.822	0.987	–

Summation of ASFR is 1.4332
Adjusted Total fertility rate = 5 × 1.4332 = 7.2

TABLE 5. MEAN PARITY, TRANSFORMED RELATIVE PARITY, $Y_{(i)}$ AND STANDARD TRANSFORMED RELATIVE PARITY GOMPERTZ MODEL, IGBO, IMO STATE, NIGERIA 1997.

Age Group	Mean Parity	Parity as a Population of TFR*	$Y_{(1)}$**	Standard Transferred Relative Parities $Y_{s(i)}$
15-19	0.0166	0.00231	–1.80	–1.0787
20-24	0.8830	0.12260	–0.74	–0.3119
25-29	2.4830	0.34200	0.06	0.3538
30-34	4.2030	0.58375	0.62	1.0569
35-39	5.1300	0.71250	1.08	1.9534
40-44	5.9500	0.82640	1.66	3.4130
45-49	6.0000	0.83330	1.70	6.0557

*Estimated fertility rate of 7.2 was used. A comparative result will be obtained if the Brass P/F TFR of 7.4 is used.
** $Y_{(i)}$ values are obtained by applying equation 8.

is probably a result of computation errors.

Tables 3 and 4 yield similar total fertility rates. The difference between the Total Fertility Rate by Brass P/F ratio (7.4) and that by Coale-Trussell (7.2) is a negligible 0.2.

The P/F ratios for the age-group 15 -19 show erratic fluctuations when compared with those of the middle age groups. This may be as a result of

TABLE 6. EXAMINATION OF AGE-SPECIFIC FERTILITY RATES USING GOMPERTZ MODEL, IGBO AREA, IMO STATE, NIGERIA, 1997

Age Group	Fertility Rates	Fertility Cumulated to the end of age interval $F_{(x)}$	Ratios F_x / F_{x+5}	$Y_{(x)}$*	Transformed Standard Cumulative Fertility $Y_{s(1)}$
15-19	0.0053	0.0265	0.0181	1.389	–0.7773
20-24	0.2880	1.4665	0.3863	0.050	–0.0396
30-34	0.3530	5.5615	0.8159	1.592	1.3901
35-39	0.2520	6.8215	0.9394	2.772	2.4781
40-44	0.0880	7.2815	1.0000	–	4.5256

*$Y_{(i)}$ is calculated with the equation above.

TABLE 7. FITTING BRASS RELATIONAL GOMPERTZ MODEL TO MEAN PARITIES OF WOMEN, IGBO AREA, IMO STATE, NIGERIA, 1997.

Age group	Mean Parity	P_i / P_{i+1}	Z_i	e_i	$Z_i - e_i$	$g_{(i)}$	$Y_{s(i)}$	Fitted Yi	P_1 / F	Estimated F = 2 / 10
15-19	0.0166	0.0188	–1.3798	1.2897	–2.6694	–1.7438	–1.0787	–1.7573	0.00304	5.40
20-24	0.8830	0.3556	–0.0339	1.4252	–1.4591	–1.0157	–0.3119	–0.7214	0.12780	6.90
25-29	2.4830	0.5908	0.6419	1.3725	–0.7306	–0.3355	0.3538	0.1780	0.43303	5.73
30-34	4.2030	0.8193	1.6129	1.1421	0.4708	0.4391	1.0569	1.1279	0.72345	5.81
35-39	5.1300	0.8622	1.9087	0.7061	1.2026	1.5120	1.9534	2.3390	0.90808	5.65
40-44	5.9500	0.9917	4.7873	0.2763	4.5110	3.2105	3.4130	4.6110	0.99010	6.01
45-49	6.0000	–	–	–	–	(5.6460)	(1.1100)	(1.4996)	0.79990	7.50
										a = 0.30
										b = 1.35

TABLE 8. FITTING BRASS RELATIONAL GOMPERTZ MODEL TO CURRENT FERTILITY DATA, IGBO, IMO STATE SURVEY, 1997.

Age Group	Cumulative Fertility	$\frac{F_x}{F_x + 5}$	$Z_{(x)}$	$e_{(x)}$	$Z_{(x)} - e_{(x)}$	$g_{(x)}$	$Y_{s(X)}$	Fitted $Y_{(s)}$		
15–19	0.0267	0.0182	–1.3879	1.3364	–2.7243	–1.4501	–0.7713	–1.56565	0.00883	3.20
20–24	1.4670	0.3864	0.0504	1.4184	–1.3680	–0.7430	–0.0410	–0.49990	0.19234	7.63
25–29	3.7990	0.6827	0.9631	1.2978	–0.3347	–0.0382	0.6290	0.47892	0.53824	7.05
30–34	5.5620	0.8153	1.58887	0.9670	0.6217	0.8356	1.3897	1.58896	0.81540	6.83
35–39	6.8220	0.9394	2.7724	0.4509	2.3215	2.1649	2.4736	3.17146	0.95890	7.11
40–44	7.2620	0.9999	9.2104	0.0462	9.1641	4.4564	4.4984	6.12767	0.99780	7.28
45–49	7.2620	–	–	–	–	–	9.3416	13.19874	0.99990	7.26
										a = 0.44
										b = 1.46

TABLE 9. SUMMARY ESTIMATES OF P/F RATIO AND ESTIMATES OF TFR BY VARIOUS METHODS, IGBO, IMO STATE, NIGERIA, 1997.

Method of Estimation	Total Fertility Rate	Gross Reproduction Rate	Crude Birth Rate
Mean CEB (45-49)	6.3	3.5	56.5
Coale-Trussell Method	7.2	5.1	54.5
Coale-Deneny Method* $((P_3)^2/P_2)$	7.0	4.9	-
Brass-Rachad Method $(P_2)^4(P_4/P_3)^4$*	7.3	5.1	-
Brass P/F Method	7.4	5.1	47.7
Brass Consistency check	7.0	-	-
Relational Gompertz Model (Mean Parities)	6.0	4.2	47.7
Brass Relational Gompertz Model (Current Fertility)	6.2	4.4	47.7

* History and detailed computatioal techniques not provided.

the small number of births in that age group and or of errors in the data collection itself. The total fertility rate estimated by the Coale-Demeny method and Brass-Rachad methods have a difference of 0.27 births between them, but they are higher than the reported parity for the age group 45 - 49.

It is worth mentioning that as far as these birth rates are concerned, there may a possible over-estimation of the observed birth rates due to inclusion of births in the previous twelve months, to errors in age reporting, and/or under-estimation of the childbearing women because of the inability of some of the respondents to fill out the household schedule.

DISCUSSION AND CONCLUSION

The aim of this paper is to derive estimates of fertility levels for the Igbo area of Eastern Nigeria using different estimation techniques with the goal of arriving at the most accurate estimate of fertility in the area. The demographic techniques used here are some of the most promising techniques available for deriving valid fertility measures from census and survey data. Though these techniques are quite powerful, but they do not solve all of the problems of demographic estimation. The reliability of the results from these methods has been checked by comparing their results against one another using Brass Consistency Check (Table 9).

Results show that the fertility rates of Igbo community in Imo State, Nigeria, derived from different techniques, are very close. The reported total fertility rate is 7.34 and the adjusted total fertility rate using Brass P/F method is 7.4. The relational Gompertz model tends to give lower values.

By and large, the total fertility falls in the range between the low of 6.0 and the high of 7.4. The crude birth rate lies between 48 and 56. A consistency check of the results indicates that the estimate of the total fertility rate in Imo State is 7.05. Clearly the estimates appear to be the same despite the fact that different models were used to estimate the fertility level. The estimates derived from these several indirect techniques correspond closely. Considering the variety of assumptions in each method, the results of this comparison are reassuring.

The total fertility rate from this estimation appears to be higher than those of other parts of the country. Explanations for the high fertility in this area can be located in the cultural milieu. The extended family system, the emphasis given to and pride taken in the number of children which one has, male-child preference, and family prospecting distribution are among the possible influences on high fertility observed in this state. In the state populated by the Igbo ethnic group, children are seen as valuable investments. The society values children so much so that infertility regarded with scorn and every effort is made to correct the problem. In most cases, infertility is blamed on the woman, although she may not be the cause. A common saying in the area is that, "a person who has children is far better than a wealthy man."

The strong value placed on children is also reflected in the names which the Igbo bear. Such names include "Nwakaego", "children are better than wealth", "Nwabugwu", children are better than wealth, "Nwaamaka", children are sweet; "Nwabueze", children are king or children make one a king. If a couple has many female children without a male child, intensive efforts will be made to have at least a male child who, the society believes will inherit the parents and continue the family lineage. It is not surprising to observe in Igboland a name like 'Ahamefule', meaning, "my name should not miss or disappear when I must have left this world." Such names and others depict the emphasis Igbos place on having children — paticularly sons.

Because of the high value placed on children in this State, some Igbo communities honour women who have successfully borne ten or more children. The number of children a women has thus becomes a status symbol. The effects of the present harsh economic conditions in the country on this inclination to high fertility are not yet clear. This is an area for further research.

This paper has shown that Igbo fertility remains the highest in Nigeria, despite various campaigns to promote responsible parenthood and reduction of large family size. High fertility among the Igbo remains a concern to demographers in Nigeria, despite the fact that the Igbo have long been

exposed to Western education. There is a need to examine Igbo fertility levels in relation to the value of children, in Igbo society especially in this period of economic hardship. The proposed study must use both quantitative and qualitative data collection methods. As we wait for such a study, government should strengthen present family planning campaign programmes among the various ethnic groups in Nigeria. A well-coordinated programme of information, education and communication should be developed for the Igbo ethnic group, with the goal of drawing attention to the dangers of large families, especially now that the extended family system and the provision of socio-economic services by government are declining. The effects of population growth on family welfare should be emphasized.

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