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The Estimation of Mean Completed Family Size and Total Fertility Rates by Birth Order Ratio Techniques

INDIA has a long tradition of carrying out censuses since 1872 at a regular interval of 10 years but till recently no data were collected on fertility, which is one of the main components of population growth. It was only in the year 1972 that a national survey on fertility was carried out in a sub sample areas of National Sample Registration System by the office of Registrar General, India. The survey provided data for estimating various demographic measures through indirect techniques. Many researchers have made attempts in the recent past to estimate the true levels of fertility around the 1970's.

Another technique is applied here to derive estimates of fertility in India. The census data show that India's population grew during last two decades at the rate of 2.2 percent per annum. The Population Projection Committee, estimated a population of 672 million for 1981[1] by assuming certain declining pattern in fertility and mortality but the 1981 census revealed a population of 684 million which was 12 million more than the projected population. The excess of the actual population over the officially projected can be attributed to three reasons (i) improvement in mortality may have been at a faster rate than anticipated, (ii) improvement in enumeration of the 1981 Census as compared to 1971 and (iii) decline in fertility may have been less than anticipated. On the first two reasons some arguments have been put forward by Visaria (1981) and

1. The report of the Expert Committee on population Projection, paper 1 of 1979, recommended for the official purposes cited on page 10.

Dyson (1981). However, this paper makes an attempt to provide some explanation for the last possibility of fertility decline in India.

This paper provides new estimates for fertility levels in a few selected states of the country using mainly the data sources from the 1972 and 1979 fertility surveys. It is divided into four sections; the first section deals with the data sources; the second gives the methodology for deriving fertility estimates; the third highlights the results; and the final one provides a summary and concluding remarks.

Data Sources

Data for this paper come from the Indian Fertility Surveys of 1972 and 1979. Both the surveys provide information on the distribution of live births by order of birth at state level along with the rural urban differentials. The proportions of rural and urban population to the total population of the 1971 and 1981 Censuses are used as weighting factors for calculating the total mean completed family size for the year 1972 and 1979 for a state as a whole.

Method

The mean completed family size and the fertility estimates have been derived by applying Brass's Birth Order Ratio technique (Brass, 1971, 1974 and 1975). This technique is mainly based on the ratio of all births during the year to the first births in the same year. On the assumption that the reporting of births by birth order is accurate, then the ratio of all births to the first birth will provide some form of fertility index no matter what level of birth registration existed in the population, where the first birth's registration is higher as compared to that of the later birth orders.

Brass suggested that one should consider births by second birth order to check the results of mean completed family size (Fm) derived from the first birth against the results based on the second birth order. Usually, the birth order reporting can be examined while looking into the raw data by birth orders; within a given year some times the total number of first births is lower than the second births, or second births are lower than the third births. In such cases one must also derive the mean completed family size from both the first and second birth order data. Brass (1975) provided equations for deriving Fm from the first and second birth order as follows:

First Birth:

$$Fm = 1.5\ (B/B_1) - 1.25 \qquad (1)$$

Second Birth:

$$Fm = 1.5\ (B - B_1)/B_2 - 0{,}75 \qquad (2)$$

Where as;

Fm = Mean completed family size
B = All Births in a year
B_1 = First Births in a year
B_2 = Second Births in a year

The result from both equations are given in columns 2-5 of Tables **1** and 3

TABLE **1**—STATE-LEVEL ESTIMATION OP MEAN COMPLETED FAMILY SIZE *(Fm)* BY RURAL-URBAN DIFFERENTIALS USING THE 1972 INDIAN FERTILITY SURVEY DATA

Name of State	*Rural*[1]	*Rural*[2]	*Urban*[3]	*Urban*[4]	*Total Fm*		*Total Fertility Rate**	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	9
1. **Andhra** Pradesh	5.32	5.41	5.03	6.36	5.27	5.61	4.90	5.22
2. Assam	7.57	6.91	4.45	4.88	7.30	6.73	7.08	6.53
3. **Bihar**	6.29	5.74	5.96	6.75	6.26	5.85	5.88	5.50
4. Gujarat	6.05	5.97	6.11	5.25	6.07	5.77	5.83	5.54
5. **Haryana**	7.44	6.87	5.68	6.14	7.13	6.74	6.85	6.47
6. Karnataka	6.62	J.SO	5.54	5.45	6.35	5.72	5.97	5.38
7. Kerala	5.64	5.65	4.28	5.61	5.42	5.64	5.26	5.47
8. Madhya Pradesh	6.29	7.18	6.35	6.81	6.30	7.12	6.05	6.84
9. **Maharashtra**	6.41	6.52	6.30	5.04	6,37	6.06	5.99	5.70
-10. **Orissa**	6.71	5.75	7.81	5.18	6.80	5.70	6.32	5.30
1f. Punjab	6.56	5.77	5,56	5.86	6.32	5.79	6.13	5.62
12. **Rajasthan**	6.60	7.28	7.48	6.84	6.75	7.20	6.35	6.77
13. Tamil **Nadu**	5.52	4.95	5.59	4.90	5.54	4.93	5.15	4.58
14. Uttar Pradesh	8.11	7.00	6.57	6.83	7.90	6.97	7.66	6.76
15. **West** Bengal	6.00	6.24	4.53	5.91	5.64	6.16	5.30	5.79
All-India	6.31	6.14	5.69	5.70	6.18	6.06	5.87	5.76

Note. 1 **and** 3 derived **by** using the equation Fm = 1.5 (B/B1) —1.25
7 and 4 derived by using the equation Fm = 1.5 (B/B!)/B2 -0.75
Pm* = Proportion of mothers **calculated** from the table 50 of the 1972 fertility **survey** report p. 78.

TABLE 2—STATE-LEVEL ESTIMATION OF TOTAL FERTILITY RATES USING THE 1972 FERTILITY SURVEY DATA

Name of State	*Survey TFR*[1]	*Birth Order Ratio TFR*[2]	*Intercensal 1961-71 TFR*[3]	*P/F Ratio Dyson TFR*[4]	*India Panel TFR*[5]
1	*2*	*3*	*4*	*5*	*6*
1. Andhra Pradesh	4.70	4.90*	5.23	4.88	4.80
2. Assam	5.54	6.53	7.11	6.53	6.35
3. Bihar	4.96	5.50	5.64	5.01	4.75
4. Gujarat	6.16	5.83*	5.90	6.19	5.97
5. Haryana	6.96	6.47	6.99	6.68	6.64
6. Karnataka	4.35	5.38	5.59	5.68	5.50
7. Kerala	4,50	5.47	4.71	5.43	4.49
8. Madhya Pradesh	6,87	6.05*	6.39	6.38	6.16
9. Maharashtra	4.73	5.70	5.43	5.16	4.92
10. Orissa	4.82	5.30	5.83	5.65	5.54
11. Punjab	5.63	5.62	5.40	6.37	5.57
12. Rajasthan	6.67	6.35*	6.34	6.32	6.38
13. Tamil Nadu	4,31	4.58	4.73	4.97	4.58
14. Uttar Pradesh	7.14	6.76	6.37	6.85	6.89
15. West Bengal	N.A.	5.79	6.00	N.A.	N.A.
All-India	5.45	5.76	5.78	5.78	5.80

Notes.

SOURCES. 1. Weighted on the basis of proportion of rural and urban population to total population.

2. From Table 1.
3. Panel report (forthcoming). Figures are the mean of TFR's obtained by indirect standardization from forward and reverse projection procedures.
4. Dyson (1979).
5. Panel report (forthcoming).

*Based on the equation (1).

TABLE 3—STATE-LEVEL ESTIMATION OF MEAN COMPLETED FAMILY SIZE (*Fm*) BY RURAL-URBAN DIFFERENTIALS, USING THE 1979 **INDIAN FERTILITY SURVEY DATA**

Name of State	*Rural Fm*	*Rural Fm*	*Urban Fm*	*Urban Fm*	*Total (Fm)*		*Total Fertility Rate*	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1. Andhra Pradesh	4.82	4.28	3.95	3.67	4.62	4.14	4.30	3.85
2. Assam	4.73	4.99	4.08	3.44	4.67	4,85	4.53	4.70"
3. Bihar	4.92	4.73	6.57	5.10	5.13	4.78	4.82	4,49
4. Gujarat	5.52	5.32	5.04	4.43	5.37	5.04	5.15	4.84
5. Haryana	5.26	5.02	3.77	3.67	4.93	4.12	4.73	4.53
6. Karnataka	3.35	5.13	4.91	4.19	5.22	4.86	4.91	4.57
7. Kerala	3.78	3.40	3.28	3.35	3.69	3.39	3.58	3.29
8. Madhya Pradesh	5.45	5.31	5.78	4.53	5.52	4.86	5.30	4.67
9. Maharashtra	4.28	3.72	4.62	3.83	4.40	3.76	4.14	3.53
10. Orissa	5.43	4.94	5.36	4.48	5.42	4.89	5.04	4.55
11. Punjab	5.21	4.33	3.83	3.15	4.83	4.00	4.69	3.88
12. Rajasthan	5.90	5.57	4.78	4.59	5.67	5,36	5,33	5.04
13. Tamil Nadu	4.81	4.37	4.25	3.55	4.63	4.10	4.30	3.81
14. Uttar Pradesh	7.10	6.54	6.02	5.21	6.91	6.30	6.70	6.11
15. West Bengal	4.40	4.55	4.30	3.70	4.37	4.32	4.24	4.19
All-India	5.15	4.82	4.58	4.02	5.01	4.63	4.76	4.40

SOURCE: Col. 2 and 4 are based on the equation $Fm = 1.5(B/B1) - 1.25$.
Col, 3 and 5 are based on the equation $Fm = 1.5\,(B\text{-}B1)/B2 - 0.75$.
Col. 8 and 9 are obtained by multiplying the mean completed family size *(Fm)* by the proportion of mothers *(Pm)* at state JeveJ during 1972 fertility survey.

for rural and urban areas separately at state level for the years 1972 and 1979. To derive the total fertility rates from the mean completed family size *Fm* for rural and urban areas at state levels, we have multiplied the *Fm* (values of columns 6-7) by the proportion of women who became mothers. The proportion of mothers was worked out from the number of women who have been married for a period of last 25 and more years and are 49 years of age or above, and ultimately who have failed to give a live birth. The total fertility rates for the state as a whole from the both equations are shown in the columns 8 and 9 of Tables 1 and 3. We have also weighted rural and urban mean completed family size to estimate the total *Fm* (cols. 6 and 7) for the state as a whole by the proportions of rural and urban population to the total population at the time of 1971 and 1981 Censuses in calculating *Fm* of 1972 and 1979 respectively.

The total fertility rates for some of the states are based either on the second equation or first depending upon the reporting of the first and second births order in the year. However, in some cases results at state levels are based on both the first and second births due to the reporting fluctuations by birth order in rural and urban areas respectively. Fluctuations by birth order may be a cohort effect on a period data.

Comments on Results

Tables 2 and 4 give a comparative summary picture of fertility estimates at the state level along with corresponding all-India estimates for the years 1972 and 1979. There have been a number of fertility estimates at the all-India level for the same years derived by several researchers adopting different approaches, using the same sources of the 1972 and 1979 fertility surveys data. Some estimates at the all-India level for the year 1972 are as follows:

Dyson, T. P. (1979)	5.7 to 5.9 (TFR)
Jain and Adlaka (1982)	5.75 ,,
India Panel (forthcoming)	5.80 ,,

The current fertility estimates derived by the birth order ratio techniques are 5.87 and 5.76 based on the first and second birth order ratio respectively. The birth order ratio technique results for the year 1972 are in fact quite close to the other available estimates. As all the estimates indicated that the all-India level total fertility rate was just under 6 children per women during 1970's; the figure of 5.45 from the survey certainly under-estimated the level of fertility.

The state level fertility estimates derived from the *P/F* ratio and the birth order ratio techniques are quite close for the states of Andhra Pradesh, Assam, Haryana, Karnataka, Kerala, Rajasthan and Uttar Pradesh.

The all-India estimate derived by the India panel is similar to Dyson's (1979)

TABLE 4—STATE-LEVEL ESTIMATION OF TOTAL FERTILITY RATES USING THE 1979 FERTILITY SURVEY DATA

Name of State	Survey TFR	Dyson and Somawat	R. G. Model TFR	Present (TFR) Estimates
1	2	3	4	5
1. Andhra Pradesh	3.77	4.00	4.16	4.30*
2. Assam	3.89	N.A.	4.02	4.70
3. Bihar	4.10	N.A.	4.56	4.49
4. Gujarat	4.30	4.76	4.90	4.84
5. Haryana	4.29	5.10	4.81	4.73*
6. Karnataka	3.50	4.09	4.00	4.57
7. Kerala	2.71	3.39	2.96	3.29
8. Madhya Pradesh	5.00	N.A.	5.49	5.30*
9. Maharashtra	3.55	3.97	3.97	4.14*
10. Orissa	4.21	4.53	4,46	4.55
11. Punjab	3.85	4.69	4.54	4.69*
12. Rajasthan	5.17	5.79	5.84	5.33*
13. Tamil Nadu	3.30	3.67	3.67	3.81
14. Uttar Pradesh	5.48	6.13	6.23	6.11
15. West Bengal	3.24	N.A.	3.68	4.19
All-India	4.27	5.02	4.80	4.76*

SOURCE: Co). 2 calculated from rural and urban fertility data based on 1979 survey and weighted by rural-urban population distribution in the year 1981.
Col. 3 Dyson and somawat (1983).
Col. 4 based on the Relational Gompertz model.
Col. 5 is calculated from the cols. S or 9 oftable 3 while weighted by rural-urban distribution of population in the year 1981.
*Based on equation (1).

estimate which is also based on the *PfF* ratio technique, but in some cases substantial changes have been made in the state level fertility estimates by the panel. This discrepancy in the estimate was mainly in three states, namely Kerala, Punjab and Tamil Nadu. It is interesting to note that except for Kerala, for the other states panel's estimates are quite close to those based on the birth order ratio technique. This may partly explain Dyson's higher fertility estimate derived by applying the *P/F* ratio method, where the shape of the age specific fertility (ASFR's) distribution is taken from data on current births by age of women and the level of fertility is determined on the basis of the reported mean parities of women in the younger reproductive age groups (usually 20-24 and 25-29). The *P/F* ratios for younger reproductive age groups 20-24 and 25-29 indicate for Kerala, Punjab and Tamil Nadu states[2] that the ratios have been quite high. Since *this shows that* the current fertility *rates* may have started to decline around the 1970's in these states, the strong assumption of the *PfF* ratio method that fertility is constant in the each age group does not hold; the correction factors from the *PfF* ratio will be higher and it will over-estimate the total fertility,

It is also clear from the 1979 survey data that in fact the fertility decline was under way, at least in Kerala, Tamil Nadu and Punjab states and it was greater in Kerala and Tamil Nadu as compared to other states during the 1970's.[3] la the case of Kerala, the following estimates have been derived by various techniques: 5.26 (birth order ratio), 5.43 (*P/F* ratio) and 4.49 by the Panel on India. It appears from the 1979 survey and other sources that the Panel estimate is more plausible than the other two estimates, which certainly over-estimate the fertility levels for the Kerala state during 1972. Moreover, it is also of interest to note that Kerala's total fertility rate from the survey as well as the India panel is identical for the year 1972.

Table 4 gives a comparative picture of fertility estimates at the state level along with all-India for the year 1979. Fertility levels derived from birth order ratio techniques for the year 1979 are 4.40 and 4.76 based on the first and second birth order ratio respectively as against the survey figure of 4.27 solely from the data on current fertility, which is too low. This lower figure may be due to the births missed by the enumerator in the survey which were not adjusted against those recorded by the Registrar in the sample areas.[4] The available estimates at

2. See *Dyson* (1979) revised India panel Paper table 3 which provides for Kerala 1.17 and 1.20, Punjab 1.21 and 1.14 and Tamil Nadu 1.24 and 1.17 *P/F* ratio for each state by 20-24 and 25-29 age groups respectively.

3. Dyson and Somawat have suggested that there is a strong reason to believe that fertility had started declining for Kerala and Tamil Nadu states prior to the 1972 survey. In the case of *PjF* ratio discrepancy for Punjab see foot note 33 cited by Dyson paper above at 2 that fall in the child woman ratio suggest decline in fertility for Punjab also.

4. See foot note cited under the All-India statement 2 on page 3, it has been stated that the events netted by enumerators in the SRS, but missed by computer supervisor in the survey have been excluded.

all-India level for the same year are as follows:

Dyson and Somawat (1983)	4.9 to 5.0 (TFR)
Jain and Adlaka (1982)	4.90 to 5.24 ,,

Jain and Adlaka have preferred 4.90 figure for all-India level for the the year of 1978. After fitting the Relational Gompertz Model (Zaba's ratio technique 1981) to the current fertility data, the estimated total fertility level is found to be 4.80 which is a mean of (20-40) age specific estimates.

The state level fertility estimates derived from the Bongaarts model by Dyson and Somawat and the birth order ratio techniques are quite close except in four states of Andhra Pradesh, Haryana, Karnataka and Rajasthan. But the estimates derived for Andhra Pradesh and Kerala from birth order techniques seem to be more plausible than those based on Bongaarts's model.[5] The estimates derived at state level by Zaba's ratio method are also quite close to the estimates calculated from the birth order ratio techniques except in Assam, Karnataka, Kerala, Rajasthan and West Bengal. The explanation of the same deviation can be attributed mainly to the following causes. The estimates of TFR's based on the Gompertz Model must be treated with considerable caution, because fertility is probably changing, and to a lesser extent because the precise figure obtained would vary according to the fitting procedure employed. The lower estimate for Haryana by Birth Order ratio techniques as compared to Bongaarts Model is possibly due to the fact that 54% births belong to first and second birth order for 1979 as against 39% for 1972. It can also be observed that faster increase in the proportion of lower order births, has forced lower fertility estimates. Moreover, the birth order ratio techniques do not allow changes in number of births by order of birth. At the same time we have also used weighting factors to derive fertility estimate at the aggregate level. It is rather difficult to find out whether the deviation is due to the technique or due to the procedure we have adopted to calculate the total fertility rate for the state as a whole, since data are only available for rural and urban areas and not for the state as a whole.

Distribution of Live Births by Order of Births

The data on distribution of live births (percent) by order of births occurring during 12 months preceding the 1972 and 1979 surveys are used to investigate the nature of changes experienced by Indian states between the 1972 and 1979

5. The other evidence from SRS, change in growth rate between 1961-71 and 1971-81 suggests that small decline for Andhra Pradesh and Karnataka states particularly in urban areas was underway. The figure based on Bongaarts model is lower because of some descripencies in the data. See also Dyson and Somawat (1983) cited in foot note 21.

period. From these data it is clear that the proportion of women who have first, second and third births have been increasing in the rural and urban areas, and correspondingly the proportions of higher order of births have been steeply declining between 1972 and 1979. This phenomenon was common in rural and urban areas of each state. But the degree of change differs greatly from one state to another state. The increase in percentage in lower order of births and decrease for the higher order births relationship are most prominant features in Haryana, Kerala, Maharashtra and Punjab states, The data for Bihar, Uttar Pradesh and Rajasthan states suggest that the general change in the distribution of births by birth order has occurred at slower rate between 1972 and 1979. This has led to smaller change at All-India level also.

Change in *the* Higher Order Births

From the same set of data, it is seen that the percentage of fourth order of births increased in seven states, namely Gujarat, Karnataka, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal between 1972 and 1979. This increase of percentage was mainly in rural areas, in all these states except Tamil Nadu. In the case of Karnataka, Tamil Nadu and Uttar Pradesh the increase was close to 20%, and a very small increase was also observed in Gujarat, Punjab and Rajasthan states. The decrease in urban percentage was more pronounced than that in rural areas of all states, except Assam and Bihar, in whose case the decline in the percentage was comparatively much lower. However, the increase in the fourth birth order percentage for Tamil Nadu and Karnataka is rather more problematic because fewer births of fourth birth order have been reported, as compared to births of fifth birth order during 1972 survey.[6]

In urban areas of Bihar and Gujarat, the percentage has increased for the births of fifth order between 1972 and 1979. This increase is similar to Tamil Nadu and Karnataka states in respect of births of the fourth order; in both these states fewer births have been reported in urban areas in the 1972 survey.[7] It has been also observed that the decline in urban areas is greater than in rural areas, except for Haryana, Karnataka, Maharashtra and West Bengal states. However, rural Uttar Pradesh has also experienced a small increase in percentage of fifth order births.

The percentage of 6th and above order of births to the total births in the year has started declining in all the states under study. It has also been observed that the decline in percentage is greater for Punjab, Haryana, Maharashtra, Kerala

6. It is clear from the table 53 (a) and *(b)* of the Fertility Differentials in India 1972 survey, Govt. of India (1976), that for rural Karnataka and urban Tamil Nadu the percentage of fourth birth order is lower than fifth. This may be due to reporting fluctuation or may of cohort effect. This lower figure has forced the faster change between 1972 and 1979.

7. See foot note 6 cited above.

and Karnataka and lower for Orissa, Tamil Nadu, Rajasthan, Madhya Pradesh and Uttar Pradesh states.

There has been an increase in the percentage of higher order births for several states between 1972-79 period. It is a matter for discussion whether the increase of percentage was real or due to reporting error by birth order in the 1972 survey. As stated earlier in some of the states, namely Bihar, Gujarat, Karnataka and Tamil Nadu, there have been fewer births for the fourth or fifth birth orders. These fewer births were observed either in rural or urban areas of the state. There has been an increase in the proportion of fourth order births in rural areas of Punjab, Rajasthan, Uttar Pradesh and West Bengal. Uttar Pradesh has also recorded increase in the fifth birth order. These increases were not in all probability due to any reporting fluctuations by birth order in different states.

If the increases in percentage for the higher order births during 1972-79 are real, it may imply that population growth rate increased in those states. This was examined by looking at the population growth rate for these states during the 1971-81 decade. From the percentage change in growth rate between 1961-71 to 1971-81, it is observed that the increases in percentage at state level are in Andhra Pradesh, Bihar, Karnataka, Punjab, Rajasthan and Uttar Pradesh states.[8] These states, with the exception of Bihar and Andhra Pradesh, have also experienced increases in the percentage of higher order births either in rural or urban areas. However, the increase in growth rate (during the 1971-81 decade) can not be attributed solely to the increase in percentages of higher order births. There are some other possibilities which might also be responsible for the increase in the growth rate, namely: (i) better enumeration or coverage in the 1981 Census compared to that 1971, (ii) further improvement in the mortality rates, and (iii) migration between these states.

Other studies confirm that in the three states of Bihar, Rajasthan and Uttar Pradesh, no fertility decline is under way.[9] Family planning performance in these states is very poor as compared to other states[10] and they also tend to be net outmigrating states. The possibility of mortality improvement in these states is discounted by SRS data which does not suggest any further mortality improve-

8. The percentage change in growth rale between 1961-71 to 1971-81 can be seen from the Provisional Population Total for India 1981 Paper No. 1. The Registrar General of India, Ministry of Home Affairs, New Delhi.

9. Dyson and also others believe that there is scant reason (o think there was any fertility decline in states in Bihar, Rajasthan and Uttar Pradesh. And also see Dyson cited in foot note 25 EPW, 15th August 1981.

10. The percentage of couples effectively protected through various methods is always low for Bihar, Rajasthan and Uttar Pradesh states. See the Monthly Bulletin on Family Welfare Statistics, published by Department of Family Welfare, Govt. of India, New Delhi. (various issues).

ment.[11] There is a strong possibility of fertility increase and better enumeraion and coverage level for the 1981 Census in these states which may be the main contributory factors behind their increases in growth rate.[12]

The increase in intercensal growth rate for Punjab is rather puzzling. Although there has been a small increase in the percentage of fourth order births for rural areas, other factors like greater decline in the sex ratio as compared to any other state between 1971 and 1981 may imply a poor enumeration in 1971, followed by an improvement in 1981. The increased growth rate is most likely to be due to a sizeable permanent and seasonal migration in Punjab during 1971-81.[13] The small increase in intercensal growth rate for Punjab is not likely to be due to fertility increase but could be ascribed to other factors mentioned above. The minor increase in growth rate for Karnataka and Andhra Pradesh must be considered as indeterminate in their implication.

To sum up, the analysis of birth order data of the 1972 and 1979 years shows that percentage increases in growth rate for some of the states are partly due to the increase in the fertility particularly for the Bihar, Rajasthan and Uttar Pradesh states and partly due to improvement in Census coverage in the 1981as compared to that of 1971 level. Therefore, the fertility decline turned out to be slower than that anticipated by the Projection Committee and the SRS fertility level for All-India and Indian States was too low. Nevertheless, fertility has started to decline in India but the tempo is slower at the all-India, for which mainly three northern states of Bihar, Rajasthan and Uttar Pradesh are responsible. They constitute nearly 31.4 percent of the total population of India, and as such, they tend to depress the national level estimate.

Conclusion

The application of birth order ratio techniques has shown that the fertility estimates based on the mean completed family size are quite close and plausible,

11. The decline in the mortality for Bihar, Rajasthan and Uttar Pradesh can be observed from the crude death rates based on the Sample Registration System, given in various issues of Sample Registration Bulletin.

12. If the differentials in the Census coverage between the 1971 and 1981 Censuses is real then these states also experience increase in sex ratio because females are more likeiy to be missed in the census count than males. Indeed, sex ratio did increase for these states between 1971 and 1981. Visaria (1971) suggested that in these three states the 1971 count was seriously deficient, EPW, 29th July 1971.

13. Punjab state is the recepient of sizeable number of people mainly agricultural labourer from the northern states, particularly Bihar, Rajasthan and Utlar Pradesh, as a seasonal and permanent migrant. Probably this migrant ratio may increase in the year where these states suffer from severe drought or flood situations and no doubt the 1980-81 year was also one of the bad year for these states.

and are in agreement with the other available fertility estimates. The birth order ratio technique was mainly developed for estimation of mean completed family size *Fm.* If the women have the current birth ratio on the basis of all the births to the first or second births in the same year then they should end with the similar *(Fm)* value provided other factors which might affect the fertility behaviour remain constant. To calculate the total fertility rates from the *Fm* values, one needs additional information about the proportion of women who became mothers to give weight to the mean completed family size.

The birth order ratio technique provides quite reasonable fertility estimates. However, it has not been possible to compare the *Fm* values because of the lack of similar estimates from other sources. Nevertheless, it is a very useful technique to estimate the mean completed family size and the fertility levels particularly for those countries where the information on women at risk during their reproductive ages is lacking and the registration of births is also incomplete. However in situations where fertility behaviour is changing at a faster rate, this method may underestimate the mean completed family size. Civil registration data also underestimate it if the tempo of the reporting of birth registration by birth order fluctuates greatly within the same year or from year to year.

Finally, repeated use of the technique will certainly provide more empirical evidence and reveal shortcomings in the technique. Because there were speculative elements in its derivation and in the parameters considered, there obtains a further opportunity for improvement in the technique by wider application and re-interpretations of parameters,

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