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Measurement of Effect on Fertility of Shifts in Age-at-Marriage : A Case Study of India[1]

MARRIAGE marks the formal entry into sexual union and thus the beginning of the reproductive life of a couple. A rise in age-at-marriage tends to affect the level of fertility and the resulting rate of population growth. The contribution which a rise in age-at-marriage[2] makes in this respect is not known, since several complex factors affect this relationship. Different demographers have shown different degrees of change in fertility due to rise in age-at-marriage. In India, this range is from 10% to 50% if the minimum age at marriage were to be raised to 20, from the present average level of around 16 years[3]. Obviously this large

1. This paper is a modified version of a paper, "Effect of Shifts in Age-At-Marriage on Fertility," written jointly with Dr. K. C. Seal, Director of Planning, Department of Family Planning, India. The original paper was prepared when the author was working with the Ford Foundation, India, on the Indian Family Planning Program. We also had the benefit of discussions with Drs. R. S. Kurup and N. R. Parthasarthy of the Department of Family Planning.

2. The age-at-marriage in this paper refers to effective age at female marriage.

3. See for instance, K. G. Basavarajappa and M. I. Belvalgidad, "Changes in age at marriages of females and their effect on the birth rate in India", *Eugenics Quarterly* 14(2), March 1967. Prem P. Talwar, "A Note on Changes in Age at Marriage of Females and their Effect on the Birth rate in India", *Eugenics Quarterly* 14(4), December, 1967, S. N. Agarwala, "Fffect of a Rise in Females Marriage on Birth rate in India", *Proceedings of the World Population Conference*, 1965, Volume II.

range is due to methodology adopted in these studies and assumptions made therein.

This paper consists of two parts. In the first, an attempt is made to present a method of measuring impact of rise in age-at-marriage on fertility. The second part applies the methodology to determine the changes in the level of birthrate that would occur if the minimum age at marriage of females in India were to rise to 18, 20 and 25 years, under a set of simplifying assumptions regarding other changes which are likely to accompany shifts in age-at-marriage.

There are two approaches to the study of relationship between the shifts in age-at-marriage and the level of fertility. The first, straightforward approach is to collect and analyze data on actual reproductive performance of females marrying at different ages. The difference in the level of fertility for cohorts of women marrying at different ages is taken as the effect of differences in age-at-marriage. This approach is obviously open to criticism since the results cannot be attributed solely to effects of shifts in age-at-marriage but also to differential socio-economic status and other related factors which affect differentials in age-at-marriage for the cohorts.

The second approach is an indirect one and determines, at first, changes in the age specific fertility rates resulting from shifts in the age-at-marriage. The level of fertility is then derived from these. The latter approach is followed here, though, as it will be seen later, it involves a set of asumptions.

Methodology

The methodology comprises the following steps:

1. Determine the age distribution of marriages so that current average age at marriage is known. On the other hand, if only current average age-at-marriage is known, the percentage distribution of age-at-marriage is simulated on the basis of known information. This distribution would provide average current age-at-marriage and

would be similar in cumulative form to the distribution of age-specific ever-married women in the population.

2. On the basis of assumed change in the minimum age at marriage, an assumption is made about the postponed marriage pattern of those females who married before the assumed minimum age. One simple assumption is that all those who married before the assumed minimum age would now (under changed conditions) marry at the minimum age. An advantage of this assumption is that it will provide a conservative estimate of the effect of shift in age-at-marriage since it is more likely that the postponed marriages will have a distribution starting from the assumed minimum age-at-marriage upwards.

3 The assumption on the marriage pattern of those who delayed their marriages will be indicative of the changed mean (or median) age-at-marriage as a result of the shift in the minimum marriage age from the present level.

4. The changed distribution of age-specific marriages is likely to affect the age-specific fertility rates because of changes in (*i*) proportion of women currently married in different age groups, and (*ii*) proportion of women fecund (non-sterile).v The former component will be affected by changes in the ever-married proportion (because of the marriage pattern of the shifted marriages) as well as by the reduced incidence of widowhood (because of shift in marriages and resulting shorter period of exposure). The second component would tend to rise since onset of sterility is a function of age and parity and age-specific parity is likely to decline under the changed conditions. New set of age-specific fertility rates (derived for changed conditions of age-at-marriage) would take into consideration changes in these two components.

5. In a specific year, the age-specific fertility rate (ASFR) of only those ages will change which have been affected by the shifted pattern of marriage. For example, if ASFR are considered after *n* years of the shift in age-at-marriage, only first *n* ASFR will change leaving others unchanged. Hence, the new set of ASFR will operate at

all reproductive ages after 30 years if it is assumed that reproductive life of a women extends from 15 years to 45 years of age.

6. Once ASFR under changed marriage conditions are obtained, at least two indices of fertility can be considered to measure effect of changes in age-at-marriage. Total fertility rate is obtained by adding ASFRs and the levels of crude birth rate are obtained by projecting the age composition in the future and obtaining the total births.

Assessment of the Effect on Fertility of Shifts in Age-at-Marriage in India

The method described above was applied to Indian data to assess the effect of shifts in age-at-marriage on fertility from the 1961 level of around 16 years to the level of 18 years, 20 years and 25 years. In the last case, three variants of reproduction were considered. The first assumed that the pattern of reproduction remains the same as before the shift in age-at-marriage except for changes in the proportion married and changed sterility conditions associated with the shifts. The other two variants raised age-specific reproduction by 10% and 20% which might result when age-at-marriage were to rise to as high as 25 years. The following set of assumptions were made :

1. At the initial time t_0, the nuptiality pattern was similar to that observed in the 1961 Indian census. In other words, the distribution of age-at-marriage in the period t_0 was so taken that the mean age-at-marriage of females was 16.4 years and the age-specific propor-of ever-married women agreed with the marital status distribution obtained in 1961 census. Time t_0 marks beginning of the change in age-at-marriage.

2. All marriages occurring before the assumed minimum age were taken to have occurred at the minimum age[4]. Total numbers of births to these marriages were distributed between the minimum age and the next higher age in the ratio 1:3.

4. This assumption keeps proportion of ever-married at different ages unchanged though, in general, there might be changes in these proportions with the shift in age-at-marriage.

3. The initial age-specific fertility rates were taken to correspond to those of India in 1961 and are in five year age groups. It was assumed that these rates are uniform for individual ages within each quinquennial age group.

4. The changed levels of ASFR were obtained on the following considerations : (i) the proportion of ever-married women in each age group remained unchanged, *(ii)* there was a slight increase in the proportion of currently married women at each age and was obtained by considering the decreased exposure of the risk of death of the spouse. The necessary fraction was determined by dividing the probability of survival from changed average age at marriage to the age under consideration, by the average age at marriage in period t_0 to the age under consideration, and *(iii)* the proportion fecund at each age was raised. This increase was in proportion to the reduction in the length of reproductive life exposed to sterility (difference betwen the age at marriage at the period t_0 and the age under changed conditions).

5. The age composition, necessary for determining the level of crude , birth rate was determined by projecting the female population at the period t_0 which was assumed to correspond to the 1961 female population of India, to future five-year periods. For such projection, the expectation of life at birth for the periods (t_0, t_5), (t_5, t_{10}), (t_{10}, t_{15}), (t_{15}, t_{20}), (t_{20}, t_{25}) and (t_{25}, t_{30}) were assumed to be 45, 50, 55, 60, 65 and 70 years respectively. Survival ratios were taken from the Western Model Life Tables of Coale and Demeny. This increase of one year of $e°_0$ every year was assumed mainly because of ready availability of the model Life Tables at these $e°_0$. The assumption is that slight changes in e^0_0 will not affect the results.

Results

Results are given in two tables given at the end. The upper half of Table 1, gives levels of the total fertility rates under various patterns of shifts in the age-at-marriage over different time periods. The lower half shows the levels of the crude birth rates. Table 2 shows the percent age change in the levels of fertility. It may be noted that the fertility shows greater decline in the short-period than in the long-term.

TABLE 1-LEVELS OF TOTAL FERTILITY RATES AND CRUDE BIRTHRATES IN INDIA WHEN THE FEMALE AGE AT MARRIAGE IS 16.4 (INTIAL LEVEL), 18, 20 AND 25 YEARS IN TIME PERIODS t_0 TO t_{30} AT FIVE YEAR INTERVALS

Fertility indices under various assumptions on age at marriage	*Time periods*						
	t_o	t_5	t_{10}	t_{15}	t_{20}	t_{25}	t_{30}
Total fertility rates for							
C_o	5.68	5.68	5.68	5.68	5.68	5.68	5.68
C_1	5.68	5.20	5.23	5.26	5.28	5.30	5.31
C_2	5.68	4.67	4.90	4.94	4.97	4.99	5.00
C_3	5.68	4.39	3.24	3.52	3.58	3.63	3.66
C_4	5.68	4.45	3.37	3.66	3.83	3.95	4.02
C_5	5.68	4.45	3.38	3.38	4.07	4.27	4.38
Crude birth rates for							
C_o	42.6	41.8	41.2	40.9	40.4	39.9	39.7
C_1	42.6	37.4	38.1	38.2	38.4	37.4	36.4
C_2	42.6	33.0	35.5	36.3	36.3	35.7	34.4
C_3	42.6	34.7	21.8	25.1	27.0	28.4	28.4
C_4	42.6	34.7	22.8	26.2	28.8	30.4	30.4
C_5	42.6	34.7	23.0	27.3	30.5	32.4	32.2

C_0=Initial levei when average age at marriage was 16.4 years; C_1=when minimum age at marriage is 18 years; C_2=when minimum age at marriage is 20 years; C_3=when minimum age at marriage is 25 years but no change in reproduction; C_4=when minimum age at marriage is 25 years but reproduction increases by 10%; C_5=when minimum age at marriage is 25 years but reproduction increases by 20%.

If the age at marriage rises to 18 years, the long-term effect over a period of 30 years is a reduction in the total fertility rate of 7%. The reduction in cases 2, 3, 4 and 5 is 12, 36, 29 and 23% respectively. The short-term reduction in each case is higher.

The total change in the crude birth rate can be decomposed into the contribution of (0 changes in the age distribution of the population, and (ii)

TABLE 2-PERCENTAGE REDUCTION IN THE LEVELS OF FERTILITY (OVER INITIAL LEVELS) IN INDIA IN VARIOUS TIME PERIODS WHEN FEMALE AGE AT MARRIAGE IS 16.4 (INITIAL LEVEL), 18, 20 AND 25 YEARS

Percentage change in fertility indices under various assumptions on age at marriage	*Time periods*					
	$t_0 - t_5$	$t_0 - t_{10}$	$t_0 - t_{15}$	$t_0 - t_{20}$	$t_0 - t_{25}$	$t_0 - t_{30}$
Changes in total fertility rates for						
C_1	8.5	8.0	7.4	7.1	6.7	6.6
C2	17.8	13.8	13.1	12.5	12.2	12.0
C3	22.8	43.0	38.1	37.0	36.1	35.6
C4	21.7	40.7	35.6	32.6	30.5	29.3
C5	21.7	40.5	33.1	28.4	24.9	22.9
Changes in crude birth-rate for						
C0	1.9	3.3	4.0	5.2	6.4	6.9
C1(a)	10.3	7.3	6.3	4.7	5.9	7.8
C1(b)	12.3	10.6	10.3	9.9	12.3	14.6
C2(a)	20.6	13.4	10.8	9.6	9.5	12.5
C2(b)	22.5	16.7	14.8	14.8	16.2	19.3
C3(a)	16.7	45.6	37.1	31.5	27.0	26.5
C3(b)	18.6	48.9	41.1	36.7	33.4	33.4
C4(a)	16.7	43.2	34.5	28.2	22.3	21.8
C4(b)	18.6	46.5	38.5	33.4	28.7	28.7
C5(a)	16.7	42.8	32.0	23.3	17.6	19.6
C5(b)	18.6	46.1	36.0	28.5	24.0	24.5

NOTE 1. C0 to C5 have been defined in Table 1

2. *C, (a)* denotes the exclusive effect of shift in age at marriage excluding the effect of change in the age composition.
C, (b) denotes the total change which is composed of (i) shift in age at marriage, and (ii) change in age composition.

shifts in the age-at-marriage. Such decomposition will be useful as it is seen that the crude birth rate declines by about 7% even without any shift in the age-at-marriage. The total long-term change (over a period of 30 years) in the level of birthrate is 15, 19, 33, 29 and 25% under cases 1, 2, 3, 4 and 5 respectively. But when the effect of changing age composition is excluded and only effect of shift in age-at-marriage is measured, the magnitude of reduction in crude birth rates is 8, 13, 27, 22 and 20% only, for cases 1 through 5.