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Quantification of Intermediate Variables Influencing Fertility Performance

THERE is always a gap between total fecundity and the actual fertility performance in a population. This gap is due to the over-all limiting effect of the intermediate fertility variables. Kingsley Davis and Judith Blake (1956) proposed a set of eleven intermediate variables affecting fertility. These variables provide a useful and comprehensive listing of "factors such as affecting exposure to intercourse", "factors affecting exposure to conception" and "factors affecting gestation and successful parturition". Their main characteristics is that they are direct determinants in contrast with socio-economic and cultural variables which are indirect determinants of fertility. According to the authors any fertility changes in a population can always be traced to variations through intermediate fertility variables as they are the real determinants of fertility differentials. Bongaarts (1978, 1982, 1983) has argued that Davis and Blake's list of eleven intermediate fertility variables can be reduced to a list of eight variables. These eight intermediate variables have been classified by him into three broad categories and are as follows :

(I) *Exposure factors*

1. Proportion married

(II) *Deliberate marital fertility control factors*

2. Contraception
3 Induced abortion

(Ill) *Natural marital fertility factors*

4. Lactational infecundability
5. Frequency of intercourse
6. Sterility
7. Spontaneous intrauterine mortality
8. Duration of fertile period.

As demonstrated by him, the last four variables explain very little variation in total fertility rate. Hence, this model takes into account, only first four variables namely porportion married, contraception, abortion and lactational infecundability. Using this model an attempt has been made in this paper to quantify these four intermediate fertility variables for the state of Maharashtra.

Methods

The model described by Bongaarts, has variables like contraception, induced abortion, marriage and lactational infecundability, and can be written as follows :

$$TFR = Cm * Cc * Ca * Ci * TF \quad (1)$$

where C's, (can range from 0 to 1) are indices of marriage, noncontraception, induced abortion and lactational infecundability. TF stands for total fecundity of a woman, TFR for total fertility rate and TM equals total marital fertility rates. So the overall limiting effect of these four variables brings down TF to a level of actual birth performance. Also TFR equals TF when each of the indices equals unity. The indices have been quantified from the following equations.

$$Cm : \text{Index of marriage} = TFR/TM \quad (2)$$

$$Cc : \text{Index of noncontraception} = 1 - 1.08\,ue \quad (3)$$

where *u*, stands for proportion using contraceptives and *e*, for average effectiveness.

$$Ca : \text{Index of induced abortion} = Tb/TB \quad (4)$$

where *Tb*, stands for total births occurring during time *t* and *TB* stands for total births expected with no abortion during time *t*.

$$Ci = 20/18.5+I \;,\; = 1.753 \exp(01396\ B-.001872\ B^2) \quad (5)$$

Ci stands for Index of lactational infecundability, I and *B* stand for average

durations of post-partum amenorrhea and breastfeeding respectively. These five equations have been used for measuring each of these indices. Total fecundity rate has been estimated as about 12 live births through a computer simulation exercise for a cohort of 100 women. For this simulation, age at marriage equals 18 years, age at menopause; 46 years, infant mortality, 70 per 1000, PPA when infant survives, 12 months and 6 months, if infant died. Fecundability, the monthly chances of conception in any mensturating cycle has been taken as 0.20, in these simulations.

Results

Estimating the Four Indices

The specific measures of these four indices have been attempted, at two points in time namely 1972 and 1978 for Maharashtra by using the expressions given above.

(a) Index of proportion married (Cm) : This has been estimated using values of TFR 4.50 and TM as 5.75 and so it is .782 for 1972. These two measures were not available for the year 1978 so data available from censuses on proportion married by age has been used. This reveals that percent married, during 1971-81, for ages 15-19 and 20-24 have declined by 15 points, and 4 point from 53 to 38 and 88 to 84. Percent married in the age groups 15-44 have declined by 4 points, from 84 to 80 during the decade. This indicated that the overall proportion of married women has declined by 5 per cent and the same has been assumed for *Cm*. So the estimated value of the index of proportion married has been taken as .743.

(b) Index of noncontraception (Ci) : About 19.2 percent of the target couples have been currently protected in the state till 1972 from the family planning programme and it has increased to 34 per cent by 1978. The effectiveness of this contraceptive mix (Sterilization, IUD and conventional contraceptives) was estimated as 95.8 percent in 1972 and 97.0 percent in 1978, assuming that sterilization is, 99 percent, IUD 95 percent and conventional contraceptives, 50 percent effective. So using these values, the index of noncontraception has been estimated as .800 for 1972 and .640 for 1978 from equation 3.

(c) Index of induced abortion (Co) : Abortion was liberalized in 1971 to provide these services on grounds of mother's health. There has been an increasing awareness of the availability for abortion and so the demand has increased. Data provided in Family Welfare Year Books show that around 1.2 lakh abortions were performed during 1972-78; 22 thousands related to 1977-78. However, it has been realized that an abortion reduces reproductive exposure with some period of non-susceptability. It has been estimated that five abor-

tions avert two births irrespective of mother's ages in the societies where effec tive contraceptive is not widespread (Potter 1972). Taking this into account, it has been estimated that around 9 thousand births were averted due to abortions done in 1977-78. The values of index of induced abortion were estimated as 1.0 for 1972 and .994 for 1978 using the equation 4.

(d) Index of lactational infecundability (Ci) : Breastfeeding is believed to be quite prolonged in India. There have been a few studies on this subject in the state. Data given by Baxi (1957), Chitre(1967) and Dandekar (1969) from the parts of Maharashtra state indicated that breastfeeding was around 20 months. However, no data were available for the year 1978. But there has been considerable modernization in the state since 1971. Percent female literacy was 26.4 in 1971 and 35 in 1981 and whereas percent urbanization was 31.2 in 1971 and 35.0 in 1981. So, It has been assumed that breastfeeding has declined by two months by 1978. Based on this assumption, the value of *Ci* the index of lactational infecundability has been arrived at .625 in 1972 and .660 in 1978 using equation (5). Increased value of *Ci* in this case means the increased chances of conception.

Discussion

Data at two points of time namely 1972 and 1978, have been used to quantify each of the four intermediate fertility variables. The four variables taken are postpartum infecundability, contraception, abortion and proportion married. The values of indices of these four intermediate fertility variables have been estimated for the years 1972 and 1978 and given in Table 1. The overall limiting effect of these four intermediate variables was 0.391 in 1972 and 0.312 in 1978, indicating a decline of about 20 percent in fertility during the

TABLE 1—INDICES OF INTERMEDIATE FERTILITY VARIABLES FOR MAHARASHTRA

Index	*1972*	*1978*	*Proportion Change*
	(a)	*(b)*	(b)/(a)
Index of proportion married *(Cm)*	.782	.743	.950
Index of non-contraception *(Cc)*	.800	.640	.800
Index of lactational infecundability (Ci)	.625	.660	1.056
Index of induced abortion *(Ca)*	1.000	.994	.994
(Cm x *Cc* x *Ci x Ca)* Over-all limiting Effect of the combined Indexes	.391	.312	.800

period 1972-78, This is so when we see the actual decline that has occurred in TFR from 4.5 live births to 3.6 live births. Index of noncontraception has declined from .800 to .640, or by 20 percent, index of abortion, from 1,0 to .994 and index of marriage, from .782 to .743 during 1972-78. So increased contraception explains the entire decline in TFR. However the index of lactational infecundability has increased from .625 to .660. The over-all limiting effect of lactational infecundability has been to bring down total fecundity of 12 live births to a level of 7.5 live births in 1972 and 7.9 live births in 1978 respectively, as given in Table 2. These are also values of total natural marital fertility rates in 1972 and 1978 and hence do not include the effects of voluntary fertility control. So a woman can be expected to have 7.5 to 8 live births throughout her reproductive life, if she breastfed her children on an average for a period of 18-20 months. Deliberate fertility control through contraception and abortion has further brought down these fertility levels to 6.0 and 5.0 as total marital fertility rate Over-all limiting effect of these four intermediate fertility variables has brought down total fecundity to levels of 4.7 live births in 1972 and 3.8 in 1978 respectively.

TABLE 2—SELECTED FERTILITY MEASURES FOR MAHARASHTRA FOR THE YEARS 1972 AND 1978

Fertility Measures	*1972*	*1978*
Total Fecundity Rate (TF)	12.0	12.0
Total Natural Marital Fertility Rate (TNM)	7.5	7.9
Total Marital Fertility Rate (TM)	6.0	5.0
Total Fertility Rate (TFR)	4.7	3.8

These estimated values of TFR had been matched with the available estimates of TFR from two national fertility surveys (Registrar General, India, 1972,1978). The values of TFR have been estimated as 4.5 and 3.6 in 1972 and 1978 after applying appropriate rural and urban weighting. The present estimates are found to be slightly higher than the available ones. There could be two possible reasons for this difference. The estimated value of total fecundity may be higher as in computer simulation preliminary results maternal mortality has not been taken into account. Also the available estimates could have been influenced by underregistration of births.

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