

Quantifying the Effect of the Proximate Determinants of Fertility in India: An Application of Bongaarts (1978) and Bongaarts and Potter (1983) Method

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ABSTRACT

Fertility rate of Indian states are cross the below replacement level and many states are very close to lowest low fertility level. To quantify the effect of proximate determinants of fertility in India and its states by using Bongaarts and Pooter method, it is observed that the proportion accounted for by the fact that not all women in the childbearing age are married is equal to 11% for India, proportion accounted for by the use of contraception is equal to 39% for India, and proportion accounted for by the long periods of breastfeeding is equal to 50% for India. It is observed that long periods of breastfeeding is principal determinants of fertility in India and Indian states.

Keywords: Proximate, Determinants, Fertility, nuptiality, breastfeeding, birth control.

INTRODUCTION:

It is estimated that the present total fertility rate of India is 2.3, where as it was 5.2 in the year 1971. Fertility level of almost all the states of India has cross the below the replacement level of 2.1 and Himachal Pradesh, Jammu Kashmir, Karnataka, Kerala, Maharashtra, Tamil Nadu, Telangana, Punjab, Rajasthan, West Bengal, Sikkim, Manipur, Mizoram, Puducherry are very close to lowest-low fertility rate of 1.3. Fertility decline in all states of India is a matter of concern for demographer, policymakers and government. In this paper we tried to investigate the effect of social, economic and cultural factors on fertility level.

Fertility level in most of the population can be explained by looking at a relatively small number of intermediate factors. The model of the determinants of fertility that is used most often by demographer's states that fertility is determined ultimately by social, economic and cultural factors, but that these operate through a number of intermediate factors (Davis and Blake, 1956; Bongaarts, 1978). Demographers generally call them proximate determinants of fertility. There are, broadly three intermediate factors or proximate determinants. First is nuptiality, specifically the age of women at marriage and the proportion of women ever marrying. Second is breastfeeding together with period of abstinence from sexual intercourse after the birth of each child. Third is birth control, by which meant the use of contraception and induced abortion. These factors have important effect on the level of fertility and the distribution of births within the reproductive age range. The main purpose of this research is to apply Bongaarts and Potter (1983) model to quantify the effects of proximate determinants of fertility in India. Also to estimates the values of proximate determinants of fertility for Indian states, compare the effects of these determinants on fertility level of India, Identify the principal determinants of fertility in India.

LITERATURE REVIEW:

Bongaarts (1978) and Bongaarts and Potter (1983) have proposed a clever method of quantifying the relative effect of the proximate determinants of fertility in a given population. Their model is based on the view that the effect of each of proximate determinants is to reduce fertility in given population from some hypothetical level which might be achieved. This hypothetical level Bongaarts and Potter (1983) refer to as the total fecundity rate. In their model they consider the four fertility rate as follows.

Total Fertility Rate (TFR): The total number of children a woman would have in her life provided that she survives until age 50 years.

Total Fecundity Rate (TF): It is defined as the average number of children which each woman in a population would have if marriage were universal in the childbearing age range, if breastfeeding and postpartum abstinence from sexual intercourse did not occur, and if no contraception and induced abortion were practised.

Total Marital Fertility Rate (TMFR): The TMFR is the number of children a woman would end up with exact age 50 years (the end of her childbearing age range) assuming that she marries at exact age 15 years, that she remains married all the time from her 15th birthdays, and that she has, at each age x last birthday from ages 15 to 49, the $ASMFR_x$ s used in the calculation. Clearly, it also supposes that the woman survives until her 50th birthday.

Total Natural Marital Fertility Rate (TN): It is defined as, fertility which would be achieved in the population with the TMFR in the absence of contraception and induced abortion.

It is clear that the difference between TF and TN is accounted for by the prevalence of breastfeeding and postpartum abstinence in a population. Bongaarts and Potter refer to their joint effect by the term *postpartum infecundability*. The difference between the TN and TMFR is accounted for by the prevalence of contraception and induced abortion. Finally, the difference between the TMFR and TFR measures the fertility-inhibiting effect of delayed marriage, non-marriage and marital disruption. The model proposed following four indices to be calculated which quantify these fertility effects.

Index of Marriage (C_m):

The index C_m is estimated using a weighted average of the proportions currently married by age, where the weights are the age-specific marital fertility rates at each age.

Thus,

$$C_m = \frac{\sum_{x=15}^{x=49}(ASMFR_x \times \Pi_x)}{\sum_{x=15}^{x=49}(ASMFR_x)} \quad (1)$$

Where Π_x are the proportions currently married at each age. Five-year age group are often used in above equation instead of single year of age.

Index of Contraception (C_c):

The index C_c is calculated using the formula

$$C_c = 1 - 1.08 \sum u_m e_m \quad (2)$$

where u_m is the proportion of married women of reproductive age currently using m -type contraception, and e_m is the average use-effectiveness of m -type contraception. Bongaarts and Potter (1983, p.84) suggest that suitable values for e_m for different contraceptive methods, for the pill 0.9, for intra-uterine devices 1, for sterilization 0.8, for periodic abstinence methods 0.9, for condom 0.9, for other traditional methods such as withdrawal 0.7.

Index of postpartum infecundability (C_i):

The index C_i is estimated as,

$$C_i = \frac{20}{18.5+i} \quad (3)$$

where i is the average duration (in months) of postpartum infecundability produced by breastfeeding and postpartum abstinence. This formula take account of the fact that even when breastfeeding and postpartum abstinence do not occur in a population, a short period, of postpartum infecundability (lasting 1.5 months) will

occur for physiological reason. Bongaarts and Potter (1983, p.25) provide an equation for estimating i from a knowledge of the average duration of breastfeeding, d_b as,

$$i = 1.753\exp(0.1396d_b - 0.001872d_b^2)$$

Index of induced abortion (C_a):

The index C_a may be estimated using the formula

$$C_a = \frac{TFR}{TFR + 0.4(1+u)TA} \quad (4)$$

where TA is the total abortion rate, or the average number of induced abortions a woman would have in her life. Since TA is rarely known, especially for the populations of developing countries, it is common to assume that C_a is equal to 1.0

Then, the relation between above four indices and the four fertility rates is as follows

$$\begin{aligned} TFR &= TMFR \times C_m \\ TMFR &= TN \times C_c \times C_a \\ TN &= TF \times C_i \\ TFR &= TF \times C_i \times C_c \times C_a \times C_m \end{aligned}$$

RESEARCH METHODOLOGY:

The data sets are from National Family Health Survey, India (NFHS). NFHS have seven folders giving information about Birth, Children record, Couples records, Individual records, Household member records, House hold record and Male records. The micro level is data used in this research from the folder "Individual records" which contains information on women's. The information on 124385 number of women's is available from NFHS-3. The state samples of the NFHS is based on the population size of the states and ranged between 3281 respondent women in Jammu and Kashmir and 12183 in Uttar Pradesh. The variables used for calculations are caseid, state, date of interview, date of birth, age, births in past year, current marital status, current contraceptive methods, etc.

To estimate the index of marriage C_m , first age-specific marital fertility rate (ASMFRs) is estimated. ASMFRs are based on the births during the past year before the survey. Then the index of marriage is estimated by putting values of ASMFRs and the proportions currently married at each age (Π_x). Five year age group is used in equation 1 instead of single year. The marriage index C_m shows the fertility-inhibiting effects of late marriage and non-marriage.

The index of contraception C_c is estimated from the information available on currently used contraceptive methods in data sets. From the available information, a proportion of currently married women using m -type method u_m are estimated. Bongaarts and Potter (1983, p.84) suggest that suitable values for e_m for different contraceptive methods, for the pill 0.9, for intra-uterine devices 1, for sterilization 0.8, for periodic abstinence methods 0.9, for condom 0.9, for other traditional methods such as withdrawal 0.7. By using u_m and e_m in equation 2 the values for C_c is estimated for all states.

To estimate the index of postpartum infecundability C_i , the average duration in months of postpartum infecundability produced by breastfeeding and postpartum abstinence is measured using equation $i = 1.753\exp(0.1396d_b - 0.001872d_b^2)$. Then by using values of i for all states in equation 3, C_i are estimated for all states.

Here, it is assumed that the index C_a is equal to 1 the values of TA is not known also in many countries induced abortion is illegal.

FINDINGS AND DISCUSSION:

The table 1 shows the estimated values for proximate determinants of fertility for Indian states.

Table I

Sr. No.	State	TFR	C _m	C _c	C _a	C _i	TMFR	TN	TF
1	Jammu and Kashmir	2.13	0.51	0.46	1.00	0.59	4.18	9.02	15.19
2	Himachal Pradesh	1.80	0.48	0.24	1.00	0.57	3.72	15.60	27.29
3	Punjab	2.08	0.54	0.36	1.00	0.60	3.87	10.78	17.98
4	Uttaranchal	3.07	0.61	0.39	1.00	0.55	5.01	12.83	23.31
5	Haryana	2.86	0.67	0.35	1.00	0.54	4.24	12.21	22.53
6	Delhi	2.27	0.54	0.35	1.00	0.60	4.22	11.87	19.64
7	Rajasthan	3.38	0.72	0.49	1.00	0.57	4.70	9.55	16.79
8	UP	3.54	0.69	0.53	1.00	0.55	5.16	9.66	17.70
9	Bihar	3.75	0.76	0.61	1.00	0.55	4.91	8.07	14.80
10	Sikkim	1.95	0.47	0.42	1.00	0.52	4.15	9.91	19.17
11	Arunachal Pradesh	3.26	0.63	0.56	1.00	0.50	5.19	9.22	18.36
12	Nagaland	3.44	0.52	0.67	1.00	0.64	6.67	9.93	15.42
13	Manipur	2.85	0.44	0.55	1.00	0.48	6.43	11.68	24.36
14	Mizoram	2.69	0.47	0.37	1.00	0.60	5.77	15.52	25.67
15	Tripura	2.19	0.58	0.37	1.00	0.48	3.79	10.17	21.08
16	Meghalaya	3.86	0.50	0.72	1.00	0.61	7.74	10.72	17.50
17	Assam	2.42	0.56	0.46	1.00	0.48	4.29	9.23	19.05
18	West Bengal	2.03	0.59	0.30	1.00	0.48	3.44	11.54	24.01
19	Jharkhand	3.31	0.73	0.60	1.00	0.48	4.53	7.57	15.86
20	Orissa	2.35	0.59	0.47	1.00	0.48	3.95	8.46	17.76
21	Chhattisgarh	2.72	0.62	0.42	1.00	0.50	4.37	10.34	20.52
22	MP	2.93	0.71	0.37	1.00	0.57	4.15	11.31	19.73
23	Gujarat	2.35	0.60	0.32	1.00	0.58	3.92	12.40	21.44
24	Maharashtra	2.07	0.55	0.30	1.00	0.59	3.76	12.68	21.52
25	Andhra Pradesh	1.78	0.56	0.28	1.00	0.57	3.16	11.17	19.45
26	Karnataka	2.21	0.58	0.32	1.00	0.62	3.82	12.00	19.47
27	Goa	1.85	0.43	0.52	1.00	0.62	4.25	8.13	13.16
28	Kerala	1.85	0.59	0.30	1.00	0.55	3.15	10.64	19.41
29	Tamil Nadu	1.83	0.48	0.32	1.00	0.71	3.82	12.09	17.06
	India	2.56	0.59	0.41	1.00	0.56	4.34	10.54	18.71

It is observed that C_m is ranged between a low values 0.4348 for Goa to high value 0.7639 for Bihar. It is observed that the high value of C_c 0.7222 for Meghalaya and low value 0.2386 for Himachal Pradesh. Since high value of C_c is associated with low use of contraception, we can say that the use of contraceptive methods is low in Meghalaya and high in Himachal Pradesh. Among the states, the estimate of C_i ranged from a high of 0.70 in Tamil Nadu to a low of 0.48 in Orissa. Since the total abortion rate or the average number of induced abortions would have in her life is unknown, the value of C_a is assumed equal to 1. We calculated the three indices C_m, C_c and C_i for all states and for all India. It is being 0.59, 0.41 and 0.56 respectively for India. We assumed that C_a equal 1. The total fecundity rate was obtained by TF = TFR/C_mC_cC_i. Following are the estimated for India and similarly we calculated all indices and rates for Indian states.

$$TF = 2.56 / (0.59 \times 0.41 \times 0.56) = 18.71$$

The total marital fertility rate is equal (TMFR) to TFR/0.59 = 2.56/0.59 = 4.34

The difference between the TFR and TF gives the proportion accounted for by the fact that not all women in the childbearing ages are married is equal to $(4.34 - 2.56)/(18.71 - 2.56) = 11\%$. The proportion accounted for by the use of contraception is $(10.54 - 4.34)/(18.71 - 2.56) = 38.3\%$. The remaining 50.6 of the difference is accounted for by the long periods of breastfeeding. Similarly the results for all state are tabulated in the table II.

Table 2

Sr. No.	State	Proportion accounted for by the fact that not all women in the childbearing ages are married	Proportion accounted for by the use of Contraception	Proportion accounted for by the long periods of breastfeeding
1	Jammu and Kashmir	0.157	0.370	0.473
2	Himachal Pradesh	0.075	0.466	0.459
3	Punjab	0.113	0.435	0.452
4	Uttaranchal	0.096	0.386	0.518
5	Haryana	0.070	0.405	0.525
6	Delhi	0.112	0.441	0.447
7	Rajasthan	0.098	0.362	0.540
8	UP	0.114	0.317	0.568
9	Bihar	0.105	0.286	0.609
10	Sikkim	0.128	0.334	0.538
11	Arunachal Pradesh	0.127	0.267	0.605
12	Nagaland	0.270	0.272	0.458
13	Manipur	0.167	0.244	0.590
14	Mizoram	0.134	0.424	0.442
15	Tripura	0.085	0.338	0.578
16	Meghalaya	0.285	0.218	0.497
17	Assam	0.112	0.297	0.591
18	West Bengal	0.064	0.369	0.567
19	Jharkhand	0.098	0.242	0.660
20	Orissa	0.104	0.293	0.603
21	Chhattisgarh	0.093	0.335	0.572
22	MP	0.073	0.426	0.501
23	Gujarat	0.082	0.445	0.473
24	Maharashtra	0.087	0.459	0.455
25	Andhra Pradesh	0.078	0.453	0.468
26	Karnataka	0.093	0.474	0.433
27	Goa	0.213	0.343	0.445
28	Kerala	0.074	0.426	0.500
29	Tamil Nadu	0.130	0.543	0.327
	India	0.111	0.383	0.506

It is observed that the proportion accounted for by the fact that not all women in the childbearing age are married is equal to 11%, proportion accounted for by the use of contraception is equal to 39%, and proportion accounted for by the long periods of breastfeeding is equal to 50% for India. Proportion accounted for by the fact that not all women in the childbearing age are married low compare to proportion accounted for by the use of contraception and proportion accounted for by the long periods of breastfeeding for all Indian states. It is interesting to see that for Himachal Pradesh, Maharashtra, Karnataka, and Tamil Nadu proportion accounted for by use of contraception is high than proportion accounted for by the long periods of breastfeeding. Since 50% of the difference is accounted for by the long periods of breastfeeding in India, we can say that long periods of breastfeeding is principal determinants of fertility in India.

CONCLUSION:

Among all the Indian states there is great difference in total fertility rate ranged high value 3.86 for Meghalaya to low value 1.78 for Andhra Pradesh. Similarly there is great difference among all Indian states in four indices which quantify these fertility inhibiting effects. The marriage index C_m ranged low value 0.43 for Goa to high value 0.76 for Bihar. The index of contraceptive C_c ranged high value 0.72 for Meghalaya to low value 0.24 for Himachal Pradesh. The index of postpartum infecundability C_i ranged high value 0.71 Tamil Nadu to 0.48 for Orissa. The proportion accounted for by the fact that not all women in the childbearing age are married is equal to 11%, proportion accounted for by the use of contraception is equal to 39%, and proportion accounted for by the long periods of breastfeeding is equal to 50% for India. The proportion accounted for by use of contraception is high than proportion accounted for by the long periods of breastfeeding for Himachal Pradesh, Maharashtra, Karnataka, and Tamil Nadu. Since 50% of the difference is accounted for by the long periods of breastfeeding in India, we can say that long periods of breastfeeding is principal determinants of fertility in India.

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