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A Model to Study the Socio-cultural Determinants of Fertility: An Extension of Bongaarts' Model

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Introduction

There is a plethora of information on the analyses of fertility differentials by various socio-economic factors. These studies have succeeded in pointing out some of the socio-economic and psychological determinants of fertility. However, the entire picture of variables covering fertility behaviour in different cultural settings is not clear [1][2][3]. Moreover, only a few studies have attempted to explain the causal relationship between socio-cultural factors and fertility, which as a consequence, remains less well understood [4]. For instance, some studies speculate that socio-cultural changes, or degree, of modernity, can create conditions, which tend to increase fertility [5][6][7]. If this is so, there may be a positive relationship at the individual level between modernity and fertility. On the other hand, socio-cultural changes can create conditions, which tend to increase contraceptive practice [8][9][10][11]. If so, when individuals or populations are classified on a scale of modernity, an inverse relationship between modernity and fertility may be found. Thus, relationships differ not only in magnitude but even in direction in different settings and at different times. Such a relationship between socio-cultural, economic and other determinants of fertility may help in understanding the causal relationship and in identifying factors that may be manipulated to influence fertility.

Objectives

In this paper, an attempt has been made to analyse socio-economic and other differentials in the proximate determinants of fertility, so as to separate the negative (fertility inhibiting) and positive (fertility-enhancing) influences of a variable on fertility. The effects of the four principal proximate determinants namely, the proportion married, use of contraception, induced abortion, and postpartum infecundability, have been separately studied by using a model, which is an extension of the model proposed, by Bongaarts and Potter [12]. Variations in the remaining proximate factors (natural fecundability, spontaneous intrauterine mortality and permanent sterility) generally have relatively little influence on fertility.

Data and Methodology

The following section presents a detailed analysis of a fertility differential model that quantifies the negative and positive effects of each of the socio-economic and cultural factors on fertility through various intermediate fertility variables. For illustration, the model is used to explain the observed socio-economic differentials in marital fertility in rural, south Gujarat.

The Fertility Differential Model

The following equations summarise the basic structure of the Bongaarts' model [12] by relating the fertility measures to the proximate determinants.

$TFR = C_m \times C_c \times C_a \times C_i \times TF$ (1)

$TM = C_c \times C_a \times C_i \times TF$ (2)

$TN = C_i \times TF$ (3)

where TFR is the total fertility rate,

TM is the total marital fertility rate

TN is the total natural marital fertility rate,

TF is the total fecundity rate

and C_m ,C_c ,C_a and C_i are the indices of marriage, contraception, induced abortion, and postpartum fecundability respectively. The indices can only take values between 0 and 1. When there is no fertility-inhibiting effect of a given intermediate fertility variable, the corresponding index equals 1, if the fertility inhibition is complete, the index equals 0. These indices can be estimated from measures of the proximate variables and these estimates are given below

$C_m = m(a) \times g(a) / g(a)$ (4)

where m(a) = age specific proportions currently married among females,

g(a) = age specific marital fertility rates.

$C_c = 1 - 1.08 \times u \times e$ (5)

where u = proportion currently using contraception among married women of reproductive age,

e = average use effectiveness of contraception.

C_a = TFR / TFR + .4 x (1+u) x TA (6)

where TA = total abortion rate.

C_i = 20 / 18. 5 + i (7)

where, i = average duration of postpartum infecundability caused by breastfeeding or postpartum abstinence.

In order to understand the negative and positive effects of various socio-economic and cultural factors on fertility through each proximate determinant, the contribution of each to a given change in fertility has to be quantified. Bongaarts [12] decomposition procedure was used to analyse the socio-economic differentials for dichotomous variables. Since socio-economic and cultural variables are likely to have two or more categories the, following procedure has been suggested to study fertility differentials:

Let TFR (k) be the total fertility rate for the k^{th} socio-economic group (k = 1,2,.....n), where n is the total number of subgroups of a variable), for which the decomposition of a trend in the TFR is desired. The decomposition of a trend in the TFR is based on the following equation (see equation 1 in the previous section for details):

$TFR(k) = C_m(k) \times C_c(k) \times C_a(k) \times C_i(k) \times TF(k)$ (8)

where, k = 1, 2,..... n

With a change in the TFR from TFR(1) in the first group to TFR(k) in k^{th}, group and with simultaneous changes in the various proximate determinants of fertility, the ratio TFR(k)/TFR(1) can be expressed as

$TFR(k) = C_m(k)/C_m(1) \times C_c(k)/C_c(1) \times C_a(k)/C_a(1) \times C_i(k)/ C_i(1) \times TF(k)/TF(1)$ (9)

The above equation (9) can easily be turned into a decomposition equation for estimating TFR(k) in the k^{th} group as a result of changes in each of the proximate determinants. Therefore, the adjusted TFR in the k^{th} group due to changes in the index of marriage [from $C_m(1)$ to $C_n(k)$], contraception [$C_c(1)$ to $C_c(k)$], abortion

[$C_a(1)$ to $C_a(k)$] and postpartum infecundability [$C(1)$ to $C_i(K)$], is respectively given by

$TFR(k)_m = C_m(k)/C_m(1) \times TFR(I)$

$TFR(k)_c = C_c(k)/C_c(1) \times TFR(I)$

$TFR(k)_a = C_a(k)/C_a(1) \times TFR(I)$

$TFR(k)_i = C_i(k)/ C_i(1) \times TFR(1)$

Similarly, the adjusted TFR in the k^{th} group due to changes in the remaining proximate variables, natural fecundability, spontaneous intrauterine mortality and permanent sterility, (from TF(1) to TF(k), is given by

$TFR(k)_r = TF(k)_m / TF(1) \times TFR(1)$

Equation (9) can now be rearranged as

$TFR(k)/ TFR(1) = TFR(k)_m/TFR(1) \times TFR(k)_c/TFR(1) \times TFR(k)_a/TFR(1) \times TFR(k)_i/TFR(1) \times TFR(k)_r/TFR(1)$

To obtain proportional change in TFR from TFR(1) to TFR(k), it is further defined as

$P_f = TFR(k)/TFR(1) -- 1$

= proportional change in TFR from group 1 to group k

$P_m = TFR(k)_m /TFR(1) -- 1$

= proportional change in TFR from group 1 to group k due to a change in the index of marriage

$P_c = TFR(k)_c /TFR(1) -- 1$

= proportional change in TFR from group 1 to group k due to change in the index of contraception

$P_a = TFR(k)_a /TFR(1) -- 1$

= proportional change in TFR from group 1 to group k due to a change in the index of induced abortion

$P_i = TFR(k)_i/TFR(1) -- 1$

= proportional change in TFR from group 1 to group k due to change in the index of postpartum infecundability

$P_r = TFR(k)_r/TFR(1) -- 1$

= proportional change in TFR from group 1 to group k due to changes in the remaining proximate variables.

Following Bongaarts' [12] results, the equation (10) can now be expressed as
$P_f = P_m + P_c + P_a + P_i + P_r + X$ (11)

where X represents an interaction factor which is a function of P_m, P_c, P_a, P_i and P_r and can be estimated simply by subtracting the sum of P_m, P_c, P_a, P_i and P_r from P_f. The above results would thus also allow the quantification of the contribution made by each proximate determinant to a given proportional change in fertility between group 1 and group k.

Illustration

The model has been illustrated using fertility survey data to explain observed socio-economic differentials in marital fertility in rural south Gujarat during 1980. Data from the south Gujarat survey (sampling design has been discussed elsewhere [14]) undertaken by the Population Research Centre, Baroda, was used in the absence of recent survey data which includes all the information necessary to analyse the socio-economic differentials in the proximate determinants of marital fertility. Since the aim was to explain the socio-economic differentials in marital fertility, the principal determinants of marital fertility were contraceptive prevalence, practice of induced abortion and the duration of postpartum infecundability. Since the incidence of induced abortion is almost nil in the present sample, its index (C_a) equals 1. Thus, taking $C_m = 1$ and $C_a = 1$ in the earlier presentation, other indices and TF for each of the socio-economic groups are calculated and are given in Table 1. Finally the estimates of the indices and TF are used to calculate the adjusted total marital fertility rate (TMFR) in each socio-economic group as well as to calculate the different P factors.

Results

The socio-economic variables selected for the present fertility differential analysis were caste/religion, education of husband, education of wife, occupation of husband, and annual income of the family. Other covariates (for example access

to mass communications, ownership of modern goods or individual modernity) that we would like to have analysed are not included or were only partially available in the records of the project. Further, the categories of a variable made for the present study have been so defined that there are a sufficient number of cases to compute more or less stable TMFR. Therefore, in case of all variables, the categories are not sharp enough to reflect fertility differentials. Moreover, the variations in the socio-economic indicators are not large enough in the rural areas. Nevertheless, the variations in marital fertility between two extreme categories of a variable were to the extent of 9-33 percent.

The level of TMFR, contraceptive practice, duration of postpartum infecundability as well as various indices of proximate determinants by various categories of selected socio-economic variables are shown in Table 1.

Table 1: Total marital fertility rate (TMFR), proximate determinants and index of proximate determinants by selected socio-economic characteristics, south Gujarat

Socio-economic characteristics	**Level of TMFR**	**Proportion currently using contraception**	**Duration of post-partum infecunability**	**Index of contraception**	**Index of postpartum infecundability**	**Total fecundity rate**
	(TM)	**(u)**	**(f)**	**(Cc)**	**(Ci)**	**(TF)**
Caste/Religion	4.870	.4883	8.69	.4854	.7356	13.6
Upper Caste Hindu	(898)*	.4346	9.25	.5381	.7207	13.3
Lower Caste Hindu	5.15	.3567	9.23	.6340	.7212	12.3
Other than Hindu	(919)					
	5.64					
	(171)					
Education of husband	5.51	.4162	11.09	.5531	.6759	14.7
Illiterate	(371)	.4604	8.57	.5160	.7388	14.4
Literate**	4.91					
	(1617)					
Education of wife	5.28	.4294	10.45	.5405	.6908	14.1
Illiterate	(865)	.4697	7.91	.5087	.7573	13.4
Literate**	4.78					
	(1103)					
Occupation of husband	4.74	.4878	8.65	.4732	.7366	13.6
	(616)	.4565	8.35	.5197	.7449	12.3
White collar	4.76	.4143	10.40	.5560	.6920	14.7
Trader	(782)					
Blue collar	5.65					
	(590)					
Annual income	5.69	.4338	10.22	.5364	.6964	15.2
Less than Rs. 6,000	(907)	.4495	8.66	.5287	.7364	11.8
Rs. 6,000 - 11999	4.61	.4964	6.87	.4826	.7883	10.1

Rs. 12,000 +	(664) 3.83 (417)					
All women	5.02	.4522	9.06	.5226	.7257	13.2

* Figures in brackets denote the number of married women in each category.

** Further classification of the literate group does not increase variability in marital fertility.

It is evident from Table 1 that all the selected variables have the expected pattern and the level of TMFR shows significant variation over the various categories of a predictor. For example, the level of TMFR has a tendency to decrease with an increase in the educational levels of the husband and wife. Similarly, family income was found to be negatively related with fertility. Among other variables considered, it is interesting to note that the fertility of manual workers was higher as compared to that of white-collar workers. The observed socio-economic differentials in the proximate determinants were also in the direction one would expect from their trends during early phases of fertility transition.

The use of contraception has a tendency to increase with an increase in socio-economic status, while the duration of postpartum infecundability has a tendency to decrease. In other words, higher contraceptive prevalence levels and shorter duration of postpartum amenorrhoea are found among women belonging to higher socio-economic groups. Whether these differentials in the proximate determinants lead to higher or lower marital fertility in a socio-economic group depends entirely on the size of the differences. As can be seen from Table 2, the observed socio-economic differential in marital fertility was quite modest.

In the absence of the fertility enhancing impact of a shortening of the duration of postpartum infecundability and other factors, one would expect much lower than average marital fertility among higher socio-economic groups. However, none of the higher socio-economic groups had an adjusted TMFR of less than 4 as a result of higher contraceptive use (Table 2). Contraceptive practice in any socio-economic group cannot compensate for the fertility enhancing impact of other proximate determinants. Nevertheless, in the absence of contraception, the shortening of postpartum infecundability would have resulted in increased marital fertility, a TMFR of about 6 in the higher socio-economic groups.

Table 2: Observed and adjusted total marital fertility rate by various selected socio-economic characteristics, south Gujarat

Socio-economic variable	Observed TMFR	Adjusted TMFR due to changes in index		
		Cc	Ci	Cr
Caste/Religion	4.87	4.32	5.75	6.24
Upper Caste Hindu	5.15	4.79	5.64	6.10
Lower Caste Hindu	5.64	5.64	5.64	5.64
Other than Hindu				
Education of husband	4.91	5.14	6.02	5.40
Illiterate	5.51	5.51	5.51	5.51
Literate				
Education of wife	4.78	4.97	5.79	5.02
Illiterate	5.28	5.28	5.28	5.28
Literate				
Occupation of husband	4.74	4.81	6.01	5.23
White collar	4.76	5.28	6.08	4.73
Trader	5.65	5.65	5.65	5.65
Blue collar				
Annual income	3.83	5.12	6.44	3.78
Less than Rs. 6,000	4.61	5.61	6.02	4.42
Rs. 6,000 - 11999	5.69	5.69	5.69	5.69
Rs. 12,000 +				

A further study of Table 2 reveals that although the marital fertility difference is in the expected direction in case of the educational levels of the husband and wife, the difference in marital fertility between illiterate and literate groups is relatively small, indicating little effect of education in lowering fertility. Nevertheless, other selected variables showed a relatively larger variation as a result of the greater differentials in the use of contraception.

A further explanation for the observed socio-economic differentials in marital fertility is found from Table 3 which summaries a decomposition of the observed fertility difference into the contributions made by the various proximate variables.

Table 3: Decomposition of observed socio-economic differentials in marital fertility, south Gujarat

Socio-economic characteristics	Percentage of difference in TMFP due to factor				
	Contraceptive practice	Postpartum infecundability	Other proximate determinants	Interaction	Total difference
Caste/Religion	-23.40	1.95	10.64	- 2.84	-13.65
Education of husband	- 6.72	9.26	- 2.00	-11.43	-10.89
Education of wife	- 5.87	9.66	- 4.92	- 8.34	- 9.47
Occupation of husband	-14.87	6.37	- 7.43	- 0.18	-16.11
Annual income	-10.02	13.18	-33.57	- 2.28	-32.69

* The decomposition results are obtained by taking the observed differences in TMFR between two extreme categories of a variable. Similarly, decomposition of observed socio-economic differentials in marital fertility between any two categories of a variable can be obtained.

The decomposition results presented in Table 3 clearly indicate how each of the selected socio-economic variables affect fertility, and the negative and positive effects of a predictor on fertility can be separated. For example, caste and religion still appear to be an important determinants of a couple's fertility; upper caste Hindus had a relatively lower fertility as compared to their lower caste counterparts and groups other than Hindu. In order to achieve social status and new ways of life, children become less important. Upper caste Hindu couples practice family planning to a greater extent than other groups. However, socio-economic changes also influence the level of modernisation of individual couples.

Modernisation in the process of removing socio-cultural checks on fertility', reduces the practice of prolonged breastfeeding and in turn postpartum infecundability. There is a monotonic negative association between socio-economic factors and the period of breastfeeding in less developed countries [15]. Thus, there is higher contraceptive prevalence and shorter duration of postpartum amenorrhoea among upper caste Hindu women. Since the fertility inhibiting effect of higher contraceptive use is sufficient to compensate for the decline in postpartum infecundability and for the positive effect of other proximate determinants, lower marital fertility is found among upper caste Hindus. The observed 13.7 percent lower marital fertility among upper caste Hindus as compared to non-Hindu groups can be decomposed into the fertility inhibiting effect of -23.4 percent due to higher contraceptive use among upper caste Hindus and a fertility enhancing effect of 2 percent due to shortened duration of postpartum infecundability among upper caste Hindus. The differentials in the remaining proximate determinants together added 10.6 percent and the interaction factor equaled -2.8 percent.

The negative and positive effects of a variable on fertility with respect to the other socio-economic variables, can be similarly assessed from Table 3. It is evident that the husband’s occupation and family income are also important in causing favourable changes in fertility by offsetting the fertility enhancing effect of modernisation. It is however surprising to note that education of husband and wife had little effect on fertility because of a very modest differential in contraceptive prevalence combined with a relatively large difference in postpartum infecundability. In explaining the observed differentials in marital fertility, the contribution of the remaining proximate determinants viz., natural fecundability, spontaneous intrauterine mortality and permanent sterility, is, as

expected, relatively small in the case of all the socio-economic variables except family income. In the case of family income, the differentials in relation to the other proximate determinants surprisingly contributed a very large proportion (33 percent) to the fertility differential. This was perhaps caused by a greater use of abstinence, coitus interrupts and rhythm methods among the high-income groups; these practices had probably not been reported by the couples as they are not viewed as "true" contraceptives by them or to avoid embarrassment.

The overall results clear indicate the influence of the selected socio-economic variables in explaining the fertility behaviour of couples. The intervention made by the national family planning programmed with a greater emphasis on the adoption of terminal methods, which could not be introduced into the model as a factor, might be responsible for weakening the influence of socio-economic variables particularly education, on fertility. It may be noted that the majority of the couples in the present sample are acceptors of terminal methods and such methods (41 percent out of 45 percent users of all methods) and such methods are popular more among illiterate and lower socio-economic groups.

On the other hand, spacing methods are more popular among the educated are higher socio-economic groups. Nevertheless, the results still seem to indicate that socio-economic changes had an effect in reducing marital fertility in rural south Gujarat. However, this decline in fertility was rather slow as a result of the initial fertility-increasing effects of modernisation. Unless such fertility-increasing effects are fully counterbalanced by the use of contraception, socio-economic changes cannot be expected to show a rapid decline in fertility

Summary and Conclusion

This paper analyses socio-economic and other differentials in the proximate determinants of fertility by separating the negative or fertility inhibiting and positive or fertility-enhancing influence of a variable on fertility. This is achieved by using an extension of the decomposition model suggested by Bongaarts for studying the proximate determinants of fertility. The present model has been illustrated using data from a 1980 fertility survey of rural south Gujarat for explaining the observed socio-economic differentials in marital fertility through its three principal determinants namely, contraceptive prevalence, practice of induced abortion and the duration of postpartum infecundability. Since the incidence of induced abortion was almost nil in the present sample, the effect of contraceptive prevalence, postpartum infecundability and other proximate determinants (natural fecundability, spontaneous intrauterine mortality and permanent sterility) and their interactions were examined to separate the positive and negative effects of various socio-economic factors on fertility.

The results clearly indicate the influence of caste/religion, education of husband, education of wife, occupation of husband and annual income of the family in explaining the fertility behaviour of couples. The couple's religion/caste; husband's occupation and family income were also important in causing favourable changes in fertility by offsetting the fertility-enhancing effect of modernisation. It is however surprising to note that education of husband and wife had little effect on fertility because of a very modest differential in contraceptive prevalence combined with relatively large differentials in postpartum infecundability. Nevertheless, the results still seem to indicate that socio-economic changes had an effect in reducing marital fertility in rural south Gujarat. However, the decline in marital fertility was rather slow as a result of the initial fertility-enhancing effect of such socio-cultural changes. Unless the fertility increasing effects of such modernisation are fully counterbalanced by the use of contraception, socio-economic changes cannot be expected to show low fertility behaviour quickly.

References

1. Das, N.P.: "Socio-cultural determinants of fertility: The case of India". In: B.N. Saxena et al. (eds.), Socio-cultural Determinants of fertility, Indian Council of Medical Research, New Delhi, 1985.

2. Mahadevan, K.: "Sociology of fertility" 'In: Determinants of Fertility Differential in South India, Sterling Publishers Pvt. Ltd., New Delhi, 1979.

3. Mahadevan. K.: Population Dynamics in Indian States, Mittal Publications, New Delhi, 1989.

4. Nag, M.: "Alternative routes of fertility and mortality decline: A study of Kerala and Punjab'. In: S. N. Singh et al. (eds.) Population Transition in India. Vol. 1, B.,R. Publishing Corporation, Delhi, 1989.

5. Mandelbaum, D.G.: Human Fertility in India: Social Components and Policy Perspectives, Oxford University Press, Oxford, U.K., 1974.

6. Nag, M.'1980: "How modernization can also increase fertility", Current Anthropology 21 (4) : 571-87 (1980).

7. Srinivasan, K., Reddy, P. H. and Raju, K. N. M.: Changes Over a Generation in Fertility Levels, and Values in Karnataka: A Comparison of Salient Findings from the Mysore Population Study (1951) and the Bangalore Population Study (1975), mimeographed. India Population Project, Karnataka, Bangalore, 1977.

8. Caldwell, J.C.: "Mass education as a determinant of the timing of fertility decline", Population and Development Review 6(2): 225-255 (1980).

9. Cutright, P.: "The ingredients of recent fertility decline in developing countries", International Family Planning Perspectives: 9(4): 101-109 (1983).

10. Holsinger, D.P. and Kasarda, J.D.: "Education and human fertility: Sociological perspectives". In: R.G. Ridker (ed.) Population and Development, The Johns Hopkins University Press, Baltimore, 1976.

11. Murthy, K.R. and Rao, N.U.: "Female education, modernity and fertility: A study in the Indian context", Demography India, 12(l): 86-97 (1983).

12. Bongaarts, J. and Potter, R.G.: Fertility, Biology and Behaviour: An Analysis of Proximate Determinants, Academic Press, New York, 1983.

13. Davis, K. and Blake, J.: "Social structure and fertility: An analytical framework", Economic and Cultural Change, 4: 211-35 (1956).

14. Gandotra, M.M. and Das, N.P.: Infant Mortality and Its Causes, Himalaya Publishing House, New Delhi, 1988.

15. Nag, M.: "The impact of socio-cultural factors on breastfeeding and sexual behaviour". In:-R A. Bulatao mind R.D. Lee (eds.), Determinants of Fertility in Developing Countries, Vol. 1 Supply and Demand for Children, Academic Press, New York, 1983.