Proximate Determinants of Fertility in India
An Exploration of NFHS Data

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Variations in fertility are generally examined in terms of socio-economic factors such as education, income, caste, place of residence. These factors can affect fertility only through intermediate variables such as proportion of females married, prevalence of contraceptive use, incidence of induced abortion and the fertility inhibiting effect on breastfeeding. This article attempts to estimate the values of the proximate determinants of fertility for major states after examining available evidence and interstate variations in these factors.

I
Perspective

INDIA, the second most populous country of the world, had a population of 846 million at the time of the 1991 Census and an estimated 950 million at the end of 1997. The implicit average annual growth rate during 1981-91 was 2.1 per cent, only slightly lower than the 2.2 per cent observed during the two decades of 1961-81 [GoI 1993a]. The near-stagnation in the growth rate reflects the downward trends in both mortality and fertility. The continuing welcome decline in the death rate (from about 27 per 1,000 population at the time of India's independence in 1947 to about 10 in 1991) has compensated for the decline in the birth rate, which came down from 45 during the 1950s to 30 in 1991. By 1996, birth and death rates were down to 27 and 9, respectively.

Fertility has declined throughout the country, albeit at a varying pace, as is evident from the data available from the Sample Registration System (SRS) of India [GoI 1993b]. This continuous series of fertility estimates available for nearly 30 years for most of the major states enables us to understand the extent of transition from a relatively high level of fertility to moderate or low levels.[1] As shown in Table 1, among the major states of the country, about 10 per cent of the population (in the two southern states of Kerala and Tamil Nadu with a total population of 85 million in 1991) had already attained a below replacement level or replacement level total fertility rate (TFR) of 2.1 during 1991-93.[2] In seven other states with a total population of 338 million (40 per cent of the total), the total fertility rate, or the average number of children born to a woman, declined from 6 or more in the 1960s to half that level of close to 3.0 and ranged in a narrow band between 2.8 and 3.1 in 1993. The seven states are Andhra Pradesh, Gujarat, Karnataka, Maharashtra, Orissa, Punjab and West Bengal. Even in the four large north Indian states of Uttar Pradesh, Bihar, Madhya Pradesh and Rajasthan, with a total population of 336 million (close to 40 per cent of the total), which are regarded as the most backward in terms of demographic transition, the TFR has evidently declined by between 20 to 30 per cent during the past 10 to 20 years and in 1993 ranged between 4.2 and 5.2. Compared to the medium and low variants of the recent 1992 UN projections, [UN 1993, 1994][3] which envisaged for India a TFR of 3.85 and 3.77 during 1990-95, TFR of 3.5 during 1991-93 was nearly 10 per cent lower than the medium projection. At the aggregate all-India level, fertility has declined at a faster rate than was expected by almost anybody.

In 1993, the rural TFR was estimated at 3.8 and urban TFR at 2.8. If rural-urban differences in TFR are presumed to be virtually negligible up to about early 1960s or before fertility began to decline, rural fertility has declined by about one-third and urban fertility by over 50 per cent from a TFR of 6 in three decades. These figures suggest considerable progress of the order of 54 per cent in rural and 87 per cent in urban areas towards a replacement level of fertility or a TFR of 2.1.[4] The state-level estimates of TFR in urban areas are often based on a small sample and, therefore, three-year averages are more stable. Such estimates suggest a sharp decline in urban fertility to near or below replacement level not only in Kerala and Tamil Nadu but also in Assam, Himachal Pradesh and West Bengal. Only the four large north Indian states of Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh reported an urban TFR of between 3.3 and 3.7. This decline in urban fertility, with the urban sector constituting a total population of 215 million according to the 1991 Census (and estimated at 240 million in 1995 [UN 1995]), has considerable significance for the demographic situation in the country as a whole, because continuing interaction between urban and rural populations is likely to generate a fairly strong demonstration effect.

Such variations in fertility are generally examined and understood in terms of socio-economic factors such as education, income, caste, place of residence, etc, and their impact on fertility is measured cross-sectionally or over time, if data permit such an analysis. Research on variables that can explain the maximum variance or on possible pathways that can explain the route to decline in fertility has continued to attract the attention of social scientists, it has also been recognised that socio-economic factors can affect fertility only through intermediate variables, which determine the exposure to intercourse, to conception and carrying the pregnancy to full term such that it results in a livebirth. The analytical framework presented by Davis and Blake (1956: 211-35) nearly 40 years ago listed 11 such intermediate variables. Bongaarts (1982: 179-89) in early 1980s listed seven proximate determinants or the biological or behavioural factors of fertility through which all the socio-cultural and economic processes have to interact with fertility. These are: marriage, natural fecundability or frequency of intercourse, spontaneous intrauterine mortality, induced abortion, post-partum infecundability use and effectiveness of contraception and onset of permanent sterility [Bongaarts and Potter 1983]. However, the available evidence suggests little variation between populations in the proximate determinants of natural fertility such as the risk of spontaneous intrauterine mortality or in the incidence of permanent sterility or in natural fecundability. Bongaarts demonstrated that 96 per cent of the variance in the fertility levels among societies is explained by the remaining four proximate determinants of regulated fertility or the proportion of females married, the prevalence of contraceptive use, the incidence of induced abortion and the fertility-inhibiting effect of breastfeeding.

In the formulation explicated by Bongaarts, the TFR is expressed as the product of four indices measuring their

fertility-inhibiting effect and the total fecundity rate (TF). The total fecundity rate is the average number of livebirths expected among women who during their entire reproductive period remain married, do not use any contraception, do not have any induced abortion and do not breastfeed their children. In such a hypothetical situation the value of TF is found to vary between 13 and 17, but Bongaarts has suggested the mean value of 15.3 births while testing the model. According to the model,

TFR = C(m) * C(c) * C(a) * C(i) * TF

where TFR is the total fertility rate, C(m) is the index of proportion of women married, C(c) is the index of contraception, C(a) is the index of induced abortion, C(i) is the index of lactational infecundability, and TF is the total fecundity rate.

Before estimating the values of each of the proximate determinants of fertility for all the major states of India, we need to examine the available evidence on the level and the observed interstate variations in the marriage patterns, breastfeeding practices, use of contraception, and of abortion which affect fertility.

II
Proximate Determinants of Fertility

(a) *Marriage*: The age at marriage (or entry into sexual union) and the proportion of women remaining single determine the number of women exposed to the risk of pregnancy and the duration of time for which they would be exposed to the risk of pregnancy. Throughout the world, women are at risk of pregnancy between the ages of 15 and 50 or for about 35 years. However, this duration is truncated when age at marriage or entry into sexual union is postponed or exit from marriage is advanced due to divorce, separation or death of a spouse. Further, assuming that there is no child-bearing outside marriage, if some proportion of women do not at all enter marriage, the overall fertility is reduced. In India, marriage continues to be both early and nearly universal, although there is some evidence that in metropolitan cities, the proportion of single women in the age group 40-44 may be going up. However, less than 1 per cent of urban women aged 40-44 were reported as single in 1991. On the other hand, age at marriage has been steadily going up for both women and men; for women it has gone up from 16 years in 1961 to 19 years in 1991, or by about one year in a decade.[5]

In a vast country such as India, there are significant interstate variations in the mean age at marriage. Although throughout the country, marriage for women has tended to be nearly universal, the age of entry into marriage has varied a great deal. Among the major states, the difference between the highest estimate of mean age at marriage of women for Kerala (23.9 years) and the lowest for Rajasthan (17.6 years) was a little over six years according to the 1991 Census data. The proportion of women reported as single in the age group 15-19 was 88.5 per cent in Kerala; it was barely half of that (43.8 per cent) in Rajasthan. In the next age group of 20-24 years, the proportion of women reported as single in Kerala and Rajasthan was 43.4 and 5.8 per cent.

Like most demographic surveys, NFHS has also collected information on the marital status of the sample population for the major states of India. On the basis of the age-specific distribution of women by marital status, singulate mean age at marriage has been estimated for the states. At the time of the tabulation of the NFHS data, the comparable estimates based on the 1991 census were not available. Since the publication of the NFHS data, they have become available and are presented along with the 1981 estimates and those based on the NFHS data, in Table 2. The estimates confirm the upward trend in the mean age at marriage throughout the country.

(b) *Use of contraception*: The major determinant of fertility in modern times in most countries would be the use of contraception to regulate fertility. India has officially accepted a nationwide family planning programme since 1952, but the use of contraceptives did not spread widely for nearly two decades. The programme has, since the late 1960s, been collecting statistics on the distribution and acceptance of four methods provided by the programme (condoms, IUD, oral pills and sterilisation) and has been converting them into couple protection rates (CPR-SS) on a yearly basis for all the major states of India.[6] In India, the couple protection rate has risen from about 13 per cent in 1970 to close to 45 per cent in the mid-1990s. However, we also have three nationwide surveys conducted in 1970, 1980 and 1989, by the Operations Research Group, Baroda[7] and the NFHS survey of 1992-93, which have provided estimates of method-specific contraceptive prevalence rates for the major states. Compared to the official statistics, the contraceptive prevalence rates based on the more recent surveys have indicated lower use of reversible methods and point to exaggeration or over-reporting in the official statistics.[8]

There is, no doubt, that the use of contraception to lower marital fertility has gone up throughout the country, although regional differences persist. According to the NFHS data, among the major states, contraceptive use ranged between a low of 20 per cent in the largest state of India, Uttar Pradesh, and a high of 63 per cent in the southern state of Kerala. However, in the country as a whole, sterilisation, mostly of females but to a small extent of males also, accounted for 75 per cent of all methods and 85 per cent of all modern methods in use. The trend has been similar throughout the country. The reliance on sterilisation is almost as high in Kerala as in the rest of the country. The only exceptions are the north-eastern states of Assam and Tripura, where close to half of contraceptive users reported using traditional methods such as rhythm. Nearly half of the Kerala couples had resorted to sterilisation. Further, for the majority of the users, sterilisation was the first and the last method of contraception; according to the NFHS 82 per cent of women had

TABLE 1: CHANGES IN TOTAL FERTILITY RATE IN MAJOR STATES OF INDIA

State	Total Fertility Rate			Per Cent Change		
	1970-72	1980-82	1990-92	1971-81	1981-91	1971-91
All India	5.2	4.5	3.7	13.5	17.8	28.8
Andhra Pradesh	4.7	3.9	3.0	17.0	23.1	36.2
Assam	5.5	4.1	3.4	25.5	17.1	38.2
Bihar	–	5.7	4.6	–	19.3	–
Gujarat	5.7	4.4	3.2	22.8	27.3	43.9
Haryana	6.4	5.0	3.9	21.9	22.0	39.1
Karnataka	4.4	3.6	3.1	18.2	13.9	29.5
Kerala	4.1	2.9	1.8	29.3	37.9	56.1
Madhya Pradesh	5.7	5.2	4.6	8.8	11.5	19.3
Maharashtra	4.5	3.7	3.0	17.8	18.9	33.3
Orissa	4.8	4.2	3.3	12.5	21.4	31.2
Punjab	5.3	4.0	3.1	24.5	22.5	41.5
Rajasthan	6.3	5.4	4.5	14.3	16.7	28.6
Tamil Nadu	3.9	3.4	2.2	12.8	35.3	41.0
Uttar Pradesh	6.7	5.8	5.2	13.4	10.3	22.4
West Bengal	–	4.2	3.2	–	23.8	–

not used any other method of contraception before accepting sterilisation. While the use-effectiveness of sterilisation is higher than that of other methods and certainly much higher than that of traditional methods, contraceptive use cannot increase very rapidly because couples adopt it only when they are ready to limit their family size.

(c) *Duration of breastfeeding and length of postpartum amenorrhoea*: It is reasonably well established that breastfeeding is the principal determinant of postpartum amenorrhoea and with the increase in the duration of breastfeeding, the duration of amenorrhoea rises. In order to estimate the effect of amenorrhoea on fertility, information on the duration of breastfeeding is essential. Although breastfeeding in India is known to be almost universal and prolonged, until recently very few surveys had collected information on the duration of breastfeeding and the associated postpartum amenorrhoea. According to the recent SRS data for 1990-92, the average birth intervals in India continue to be rather long, with more than 60 per cent of all second and higher order births reporting an interval of 24 months or more and only less than 5 per cent of the births occurring within 10 to 12 months of the previous birth [GoI 1993b: 25-26].

Jain and Adlakha (1982: 589-606) reviewed the data available from a few surveys conducted in the 1970s and concluded that the average duration of breastfeeding had declined by about two months from 22 months in the early 1970s to 20 months in the late 1970s. In a survey of four districts undertaken in Gujarat in 1989, the estimated mean duration of breastfeeding ranged between 21 and 26 months [Visaria et al 1995: 156]. It is often said that compared to rural women, urban women tend to breastfeed their children for a shorter duration, and the Gujarat data do confirm that the urban women tended to breastfeed their children for a shorter period (by two to three months) than rural women. The studies compiled by Jain and Adlakha did not conclusively support the existence of such rural-urban differentials in the 1970s. The size of the samples of some of the studies was perhaps not large enough to derive stable estimates for rural and urban areas separately.

The NFHS asked a set of questions to women who had children less than four years old which enabled them to derive estimates of median or mean duration of breastfeeding. For the country as a whole, the mean and median duration of breastfeeding was estimated at 26 and 24 months, respectively. However, there were significant interstate differences in the mean duration of breastfeeding, which ranged from a low of 17 months in Tamil Nadu to 33 months in West Bengal. In the eastern region of the country, women tended to breastfeed their children for a somewhat longer duration than women in most other major states of the country. (See International Institute for Population Sciences, 1995; and NFHS 1992-93, p 279.)

Admittedly, breastfeeding of this long duration does not protect women from conception for the entire duration, partly because women do not exclusively breastfeed the children when they are a little older but supplement breast-milk with other feeds. The NFHS has estimated that in India, the median duration of postpartum amenorrhoea is nine months with a sizeable interstate variation. However, the period of lactational or postpartum amenorrhoea tends to overlap with that of abstinence from sexual relations between spouses. Throughout the country childbirth is almost always followed by several months of abstinence and its duration, which is ritually determined, does not vary a great deal. The NFHS has estimated the overlap between postpartum amenorrhoea and abstinence and derived the duration of net postpartum non-susceptibility for the country as a whole as well as for the major states. For all India, the median duration of net non-susceptibility to conception was estimated to be 10 months.

The NFHS does not take into account the likely overlap between the postpartum amenorrhoea and the use of modern methods of contraception, other than abstinence, because some women do start using contraception prior to resumption of their menstruation. For example, health workers do encourage women to accept an IUD, within a few months of childbirth. When women have attained the desired number of children, a permanent method like tubectomy is also promoted and accepted a few days after delivery. To estimate accurately the net duration of postpartum infecundability, the overlap between postpartum amenorrhoea and abstinence as well as the use of other contraceptives needs to be estimated. However, in a survey of four districts of Gujarat, the overlap between postpartum amenorrhoea and use of contraception varied only between 1.7 and 2.6 months [Visaria et al 1995: 156].

(d) *Abortion*: The extent to which women resort to abortion has a direct effect on

TABLE 3: TOTAL FERTILITY RATE, MARITAL FERTILITY RATE AND INDEX OF MARRIAGE FOR MAJOR STATES OF INDIA, 1992-93

State	Total Fertility Rate	Marital Fertility Rate	Index Marriage C(m)
All-India	3.39	4.77	0.711
Andhra Pradesh	2.59	3.50	0.740
Assam	3.53	5.81	0.608
Bihar	4.00	4.89	0.818
Gujarat	2.99	5.08	0.589
Haryana	3.99	5.23	0.763
Karnataka	2.85	4.48	0.636
Kerala	2.00	4.12	0.485
Madhya Pradesh	3.90	4.72	0.826
Maharashtra	2.86	4.51	0.634
Orissa	2.92	4.58	0.638
Punjab	2.92	5.52	0.529
Rajasthan	3.63	4.73	0.767
Tamil Nadu	2.48	4.36	0.569
Uttar Pradesh	4.82	6.01	0.802
West Bengal	2.92	4.30	0.679

Note: Index of marriage (Cm) = Total fertility rate/total marital fertility rate.

TABLE 2: SINGULATE MEAN AGE AT MARRIAGE FOR WOMEN IN MAJOR STATES OF INDIA

State	1981 Census			1991 Census			1992-93 NFHS		
	Rural	Urban	All	Rural	Urban	All	Rural	Urban	All
All-India	17.8	20.1	18.4	19.0	21.3	19.6	19.3	21.5	20.0
Andhra Pradesh	16.8	18.9	17.3	17.9	20.1	18.5	17.3	20.3	18.1
Assam	NA	NA	NA	21.3	23.2	21.5	21.4	23.0	21.6
Bihar	16.3	18.7	16.7	17.5	20.0	17.9	17.6	20.3	18.0
Gujarat	19.1	20.5	19.5	19.8	21.3	20.3	20.0	20.6	20.2
Haryana	NA	NA	17.9	18.5	20.7	19.1	17.9	19.9	18.4
Karnataka	18.7	20.5	19.3	19.9	21.9	20.5	19.0	20.8	19.6
Kerala	21.7	22.4	21.8	23.5	24.9	23.9	21.7	23.2	22.1
Madhya Pradesh	16.0	19.0	16.7	17.5	20.2	18.2	16.7	19.7	17.4
Maharashtra	18.7	20.3	18.8	19.0	21.4	20.0	17.9	21.3	19.3
Orissa	18.9	19.9	19.1	20.3	21.8	20.5	20.4	21.8	20.7
Punjab	NA	NA	21.1	21.1	21.4	21.2	20.9	21.7	21.1
Rajasthan	15.8	18.0	16.3	17.1	19.2	17.6	17.9	20.5	18.4
Tamil Nadu	19.9	20.9	20.3	20.8	22.1	21.3	20.0	21.3	20.5
Uttar Pradesh	16.2	19.4	16.8	17.7	20.6	18.4	17.9	20.9	18.6
West Bengal	18.5	21.4	19.3	19.2	22.8	20.2	18.1	21.8	19.2

Note: In 1981, Punjab and Haryana constituted one state and although state level estimates of mean age at marriage for these states have been made, those for rural and urban areas are not made.

Sources: Goyal (1988, 97-119); 1981 and 1991 Census; and NFHS 1992-93.

fertility levels, independent of other proximate determinants, because abortion ends a pregnancy. Abortion may be spontaneous or deliberately induced to end an unwanted pregnancy or malformed pregnancy, which may be life-threatening, or to end a pregnancy with a foetus of the wrong sex. The extent of spontaneous abortions in a population may depend on the nutritional status of women or maternal health. However, induced abortions depend upon the cultural, religious and societal norms and attitudes as well as on the legal status of abortion in the country. In India, induced abortion has been legal since 1972 and yet there are no firm estimates of the number of such abortions performed in the country. The lack of information stems from the fact that, besides the governmental facilities, many women use private facilities for abortions. Abortions in these facilities are often performed by unqualified health practitioners and are rarely recorded.

In the early 1990s, a study undertaken to understand the extent to which women resorted to abortion in the country, estimated that 11 million abortions occurred in India annually, of which 60 per cent were probably induced and the remaining were spontaneous [Chabra and Nuna 1993: 17-27]. While collecting information on pregnancy history of women, questions on both spontaneous and induced abortions are invariably asked in many surveys. However, it is widely held that the incidence of induced abortion is grossly under-reported in the surveys for a complex set of reasons. There is still a stigma attached to reporting induced abortion. Women or couples often do not inform their immediate relatives about having resorted to abortion and are unlikely to report it to the investigators. Sometimes induced abortions are reported as spontaneous abortions. Even if the reference period of the survey requires women to recollect the outcomes of all pregnancies since marriage until the time of the survey, some events, which do not result in livebirths, are omitted. In the four-district Gujarat study, while 9 to 15 per cent of all women who were interviewed, reported having experienced a spontaneous abortion, only about 1 to 2 per cent reported an induced abortion. The total abortion rate worked out from the reported occurrences ranged between 0.1 and 0.2 per woman, with large rural-urban differences within the districts [Visaria et al 1995: 153].

The NFHS collected information on outcomes of all lifetime pregnancies from all ever-married women in the survey and noted that women reported 4.5 and 1.3 per cent of all pregnancies as having ended in spontaneous and induced abortions, respectively. The NFHS report admits that the information collected on abortions is likely to be less accurate than on livebirths. In spite of the possibility that the incidence of induced abortion in India is on the increase, its estimates tend to be very low so that the effect of this factor on total fertility is also estimated to be very small.

III
Estimation of Proximate Determinants of Fertility

While Bongaarts's analytical framework lends itself well to measuring the impact of proximate determinants of regulated fertility, either over time or between sub-populations within a region, to understand their individual contribution, data on all these factors were not readily collected in one survey until recently. Pooling information from different surveys poses problems of comparison in terms of sampling design, reference period and geographical coverage of surveys. In India, for the first time, data on marriage, use of contraception, duration of breastfeeding and length of postpartum amenorrhoea and outcome of pregnancies are available from one source – the 1992-93 National Family Health Survey (NFHS). These data enable us to estimate the values of proximate determinants of fertility for all the major states. The state samples of the NFHS were based on the population size of the states and ranged between 2,766 respondent women in Jammu and Kashmir

TABLE 4: CONTRACEPTIVE USE RATE BY METHOD AND INDEX OF CONTRACEPTION FOR MAJOR STATES OF INDIA, 1992-93

State	Contraceptive Use by Method				Contraceptive Prevalence Rate	UE	Index of Contraception C(c)
	Sterilisation	IUD	Oral Pills	Other Methods			
All India	.309	.019	.012	.067	40.7	.385	0.584
Andhra Pradesh	.452	.006	.005	.012	47.4	.552	0.492
Assam	.146	.009	.028	.247	43.0	.330	0.643
Bihar	.187	.005	.011	.028	23.2	.227	0.755
Gujarat	.410	.030	.010	.035	49.3	.472	0.490
Haryana	.348	.032	.012	.105	49.7	.463	0.500
Karnataka	.427	.032	.004	.030	49.4	.463	0.500
Kerala	.483	.027	.005	.118	63.3	.597	0.355
Madhya Pradesh	.317	.011	.007	.032	36.7	.355	0.617
Maharashtra	.465	.025	.014	.037	54.1	.528	0.430
Orissa	.317	.015	.009	.023	36.3	.355	0.617
Punjab	.340	.063	.022	.163	58.7	.534	0.423
Rajasthan	.278	.012	.005	.024	31.9	.310	0.665
Tamil Nadu	.396	.036	.006	.062	49.8	.478	0.484
Uttar Pradesh	.131	.011	.010	.047	19.8	.183	0.802
West Bengal	.308	.013	.036	.220	57.7	.506	0.453

TABLE 5: TOTAL ABORTION RATE, INDEX OF ABORTION AND OF POSTPARTUM INFECUNDABILITY FOR THE MAJOR STATES OF INDIA, 1992-93

State	Total Abortion Rate	Index of Abortion C(a)	Median No of Months of PA	Postpartum Abstinence	Postpartum Non-susceptibility	Index of Postpartum Amenorrhea C(i)
All India	.048	0.991	9.0	3.4	10.2	0.698
Andhra Pradesh	.022	0.995	9.1	4.3	10.1	0.699
Assam	.110	0.982	10.2	2.9	10.9	0.680
Bihar	.013	0.998	9.9	2.9	10.6	0.687
Gujarat	.026	0.995	8.9	2.9	9.4	0.717
Haryana	.067	0.990	8.9	2.0	8.9	0.730
Karnataka	.034	0.993	8.6	5.3	10.0	0.702
Kerala	.034	0.989	5.4	4.8	7.3	0.775
Madhya Pradesh	.025	0.996	8.3	2.5	9.4	0.717
Maharashtra	.031	0.993	8.5	4.5	9.8	0.707
Orissa	.028	0.995	8.5	4.7	10.2	0.699
Punjab	.054	0.988	4.1	2.4	4.4	0.873
Rajasthan	.043	0.994	8.0	2.0	8.6	0.738
Tamil Nadu	.124	0.971	5.6	5.6	9.3	0.719
Uttar Pradesh	.047	0.995	8.9	2.9	9.5	0.714
West Bengal	.028	0.994	9.5	2.3	10.0	0.702

Notes: Data are collected from mothers of children born during the three years preceding the survey.
Medians are based on current status.
Non-susceptible is defined as amenorrhoeic or abstaining or both.

and 11, 438 in Uttar Pradesh.[9] With such a sample size, it was possible to derive reasonably stable state level estimates of the contribution of proximate determinants which would help understand the transition from natural to controlled fertility in the 15 major states of the country. (Jammu and Kashmir is not included in this analysis because NFHS was conducted only in the Jammu region and the 1991 Census was not conducted in Jammu and Kashmir.)

(a) *Index of marriage*: The index of marriage C(m) is estimated from the information on total fertility rates (TFR) and total marital fertility rates (TMFR) as reported by the NFHS. These rates are based on the births during the three-year period of 1990-92 before the year of the survey. The index of marriage is estimated as TFR/TMFR. The values for the major states of India are shown in Table 3. The value of C(m) measures the effect of age at marriage on fertility and increases with an increase in the age at marriage. In other words, C(m) expresses the effect of non-marriage in terms of a reduction in fertility per woman. As is evident, the interstate variations in TFR ranged between a low of 2.0 for Kerala to more than twice that level of 4.8 for Uttar Pradesh. The total marital fertility ranged between a low value of 3.5 for Andhra Pradesh to 6.0 for Uttar Pradesh.[10]

(b) *Index of contraception*: The index of contraception C(c) is estimated from the information on method-specific contraceptive prevalence rates and use-effectiveness of various methods. These data are converted into an equation: C(c) = 1 –1.08 ue, where u is the contraceptive prevalence and e is the average effectiveness. The value of e is a weighted average, with method-specific prevalence rates as weights. The average effectiveness is assumed to be 1.0 for sterilisation, 0.95 for IUD, 0.90 for oral pills and 0.7 for all other methods, including condoms. The method-specific contraceptive use rates, the average effectiveness and the estimated index of contraception are given in Table 4. The value of C(c) measures the fertility-inhibiting effect of contraceptive use. A high value of C(c) is associated with low use of contraception. If contraceptive practice were absent or completely inefficient, C(c) would be 1.0. Among the states, as one would expect, the estimated C(c) ranges between a high of 0.80 in Uttar Pradesh and a low of 0.36 in Kerala.

(c) *Index of postpartum infecundability*: The index of postpartum infecundability C(i) is derived from the estimates of postpartum amenorrhoea (i) and by using a relationship, where C(i) = 20/(18.5 + i). Duration of postpartum infecundability is estimated on the basis of responses to a set of questions asked of women who gave birth(s) during the three-year period preceding the survey. The questions related to current postpartum amenorrhoea, if any, and the number of months without menstruation after each childbirth that occurred in the last three years. Women were also asked about the duration of abstinence from sexual intercourse after childbirth and about the length of breastfeeding of each child born in the past three years. These data have been used to estimate the gross duration of postpartum infecundability, the overlap between postpartum

TABLE 6: VALUES OF SELECTED FERTILITY INDICES FOR MAJOR STATES OF INDIA, 1992-93

State	TFR	C(m)	C(c)	C(a)	C(i)	TF
All India	3.39	0.711	0.584	0.991	0.697	11.8
Andhra Pradesh	2.59	0.740	0.492	0.995	0.699	10.2
Assam	3.53	0.608	0.643	0.982	0.680	13.5
Bihar	4.00	0.818	0.755	0.998	0.687	9.5
Gujarat	2.99	0.589	0.490	0.995	0.717	14.5
Haryana	3.99	0.763	0.500	0.990	0.730	14.5
Karnataka	2.85	0.636	0.500	0.993	0.702	12.8
Kerala	2.00	0.485	0.355	0.989	0.775	15.2
Madhya Pradesh	3.90	0.826	0.617	0.996	0.717	10.7
Maharashtra	2.86	0.634	0.430	0.993	0.707	15.0
Orissa	2.92	0.638	0.617	0.995	0.699	10.7
Punjab	2.92	0.529	0.423	0.988	0.873	15.1
Rajasthan	3.63	0.767	0.665	0.994	0.738	9.7
Tamil Nadu	2.48	0.569	0.484	0.971	0.719	12.9
Uttar Pradesh	4.82	0.802	0.802	0.995	0.714	10.5
West Bengal	2.92	0.679	0.453	0.994	0.702	13.6

Notes: (Cm) – Index of marriage
(Cc) – Index of contraception
(Ca) – Index of abortion
(Ci) – Index of postpartum infecundability
(TF) – Total fecundity rate
C(m) = TFR/TM
C(c) * C(a) = TM/TN
C(i) = TN/TF,
where TFR is total fertility rate, TM is total marital fertility rate, TN is total natural marital fertility rate and TF is total fecundity rate.
These can be rearranged as :
TFR = C(m) * TM
TM = C(c) * C(a) * TN
TN = C(i) * TF
Further simplified, they can be expressed as : TFR = C(m) * C(c) * C(a) * C(i) * TF
TM = C(c) * C(a) * C(i) * TF
TN = C(i) * TF

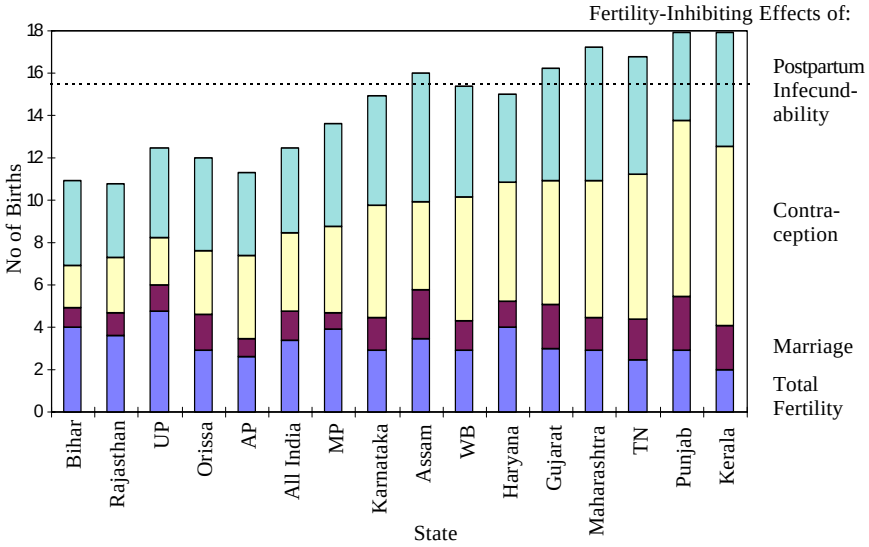
Source: Estimation procedures are based on Bongaarts and Potter (1983: 78-87).

TABLE 7: MEASURES OF FERTILITY INDICES AND THEIR CUMULATIVE VALUES IN TERMS OF NUMBER OF BIRTHS FOR MAJOR STATES OF INDIA, 1992-93

State	Values of Fertility Indices				Actual Values of Fertility Indices			
	TFR	TM-TFR	TN-TM	TF-TN	TFR	TM	TN	TF
All India	3.4	1.4	3.4	3.6	3.4	4.8	8.2	11.8
Bihar	4.0	0.9	1.6	3.0	4.0.	4.9	6.5	9.5
Rajasthan	3.6	1.1	2.5	2.5	3.6	4.7	7.2	9.7
Uttar Pradesh	4.8	1.2	1.5	3.0	4.8	6.0	7.5	10.5
Orissa	2.9	1.7	2.9	3.2	2.9	4.6	7.5	10.7
Andhra Pradesh	2.6	0.9	3.6	3.1	2.6	3.5	7.1	10.2
Madhya Pradesh	3.9	0.8	3.0	3.0	3.9	4.7	7.7	10.7
Karnataka	2.9	1.6	4.5	3.8	2.9	4.5	9.0	12.8
Assam	3.5	2.3	3.3	4.4	3.5	5.8	9.1	13.5
West Bengal	2.9	1.4	5.2	4.1	2.9	4.3	9.5	13.6
Haryana	4.0	1.2	5.4	3.9	4.0	5.2	10.6	14.5
Gujarat	3.0	2.1	4.9	4.5	3.0	5.1	10.0	14.5
Maharashtra	2.9	1.6	6.1	5.7	2.9	4.5	10.6	15.0
Tamil Nadu	2.5	1.9	4.9	3.6	2.5	4.4	9.3	12.9
Punjab	2.9	2.6	7.7	1.9	2.9	5.5	13.2	15.1
Kerala	2.0	2.1	7.7	3.4	2.0	4.1	11.8	15.2

Notes: TFR : Total fertility rate
TM : Total marital fertility rate
TN : Total natural marital fertility rate
TF : Total fecundity rate

FIGURE: ESTIMATED AVERAGE TOTAL FECUNDITY RATES (TF), TOTAL NATURAL MARITAL FERTILITY RATE (TN), TOTAL MARITAL FERTILITY RATES (TM), AND TOTAL FERTILITY RATES (TFR) FOR MAJOR STATES OF INDIA, 1992-93



infecundability and abstinence, and the net duration of postpartum infecundability. The estimates of these measures and the index of postpartum infecundability are shown in Table 5.

The effect of postpartum infecundability operates on fertility through changes in birth interval. Bongaarts has estimated that if no breastfeeding and postpartum abstinence are practised, the birth interval averages about 20 months. This is the sum of 1.5 months of minimum postpartum anovulation, 7.5 months of waiting time to conception, 2 months of time added by spontaneous intrauterine mortality, and 9 months for a full-term pregnancy. The index C(i) is thus estimated as 20/18.5 + i. Among the states, the estimate of C(i) ranged from a high of 0.87 in Punjab to a low of 0.68 in Assam.

(d) *Index of abortion*: The index of abortion C(a) is estimated from the reported lifetime experience of induced abortions, contraceptive use (u) and total fertility rate (TFR) using the equation:

$$C(a) = TFR/\ TFR + 0.4\ (1 + u)\ TA.$$

Data to estimate the total abortion rate (TA), which is equal to the average number of induced abortions per woman at the end of the reproductive period if induced abortion rates remain at prevailing levels throughout the reproductive period, are not available in the NFHS. Therefore, information on the outcome of all lifetime pregnancies is used to derive approximate estimates of total abortion rate. TA is calculated by multiplying the total fertility rate by the proportion of induced abortions among all live births. The estimates of the index of abortion for all the states are also given in Table 5. As is evident in the table the values of C(a) in all the states with the sole exception of Tamil Nadu are greater than 0.98. We have therefore not considered the insignificant fertility inhibiting effect of abortion in the model discussed here.

Table 6 gives the values of the indices of the four proximate determinants and the estimates of the total fecundity rates implied by these determinants. The data are graphically depicted in the Figure in terms of fertility inhibiting effects of the proximate determinants for each of the major states of India. The structure of the Figure suggests that if the effect of delayed marriage is removed without any other change in fertility behaviour, fertility level will increase to total marital fertility rate (TM). If the practice of contraception and induced abortion are also eliminated, the fertility will rise to a level of the total natural marital fertility rate (TN). In addition, if women do not breastfeed their children and do not practise postpartum abstinence, the fertility will increase to the total fecundity rate (TF). Fertility is below its maximum value because of delayed marriage, use of contraception, induced abortion and postpartum infecundability induced by breastfeeding and abstinence.

IV
Findings and Discussion

Bongaarts has empirically shown that the TF values range between 13 and 17 births per woman with an average near 15 and has suggested that values outside this range are very likely due to some errors in data or estimation procedures.[11] For India as a whole, the total fecundity rate was estimated to be 11.8 births, which is lower than the average of 15.3 by a little over three births. According to the district level Gujarat study cited earlier, the estimated TF values for all the four districts were also lower than 15.3 and ranged between 10.9 and 13.4 births [Visaria et al 1995:146]. While the estimates for nine of the 15 states (Gujarat, Haryana, Kerala, Maharashtra, Punjab, Assam, Tamil Nadu, West Bengal and Karnataka) fall within the range of 13 and 15, the TF values of the remaining 6 states are lower than 12.5 (Table 6). The estimated total fecundity rate in all the four large north Indian states and Orissa and Andhra Pradesh is less than 11 births. The quality of data used to derive the various estimates of proximate determinants needs to be closely scrutinised to understand the extent of errors in the survey in the reporting of age at marriage, duration of breastfeeding, onset of menstruation, etc.

However, the possibility that the natural fecundability of Indian women is lower also needs to be explored. It is sometimes alleged that lower nutrition and higher secondary sterility along with cultural and religious practices leading to a lowering of coital frequency may result in lower fecundability of women in cultures like that of India. In an analysis using various sources, including the ORG and the NFHS data, Jain estimated a value of TF around 13 births for the early 1970s and surmised that a lower value of TF for India is quite plausible because of terminal abstinence, low frequency of intercourse, malnutrition and seasonal migration of men in search of work [Jain 1996]. Some qualitative inquiries do support the view that frequency of intercourse among Indian couples is significantly reduced or even permanently terminated once a son is married and a daughter-in-law is present in the house, even if the woman is still in her early forties. The issue needs more data based exploration. Similarly, separation of spouses on account of migration of men for work would lower the risk of pregnancy and increase the inter-birth intervals even in the absence of use of contraception. More research is needed to fully explore the effect of short-term migration on fertility.

The figure provides some insights into how the proximate determinant model operates. (The values are shown in Table 7.) The major states are arranged according to the estimated value of TF or total fecundity rate. It is evident that the transition from natural to controlled fertility in states such as Kerala, Punjab and Tamil Nadu is accompanied by a large increase in the use of contraception. The contri-

bution of use of contraception to depressing the total fecundity was between 1.5 and 2.5 births in Bihar, Rajasthan, Uttar Pradesh; it was above 7 births in the case of Kerala and Punjab and 6 in the case of Maharashtra. In spite of the fact that the TF estimates for Bihar and Uttar Pradesh are lower than those of Punjab and Kerala, contraception depressed TF by less than 20 per cent in Bihar and Uttar Pradesh but by more than 50 per cent in Punjab and Kerala. (The contraceptive prevalence rate ranged between 20 in Uttar Pradesh and 23 in Bihar and 63 and 59 in Kerala and Punjab, respectively.)

The effect of a decline in the proportions married on the total fecundity or the fertility inhibiting influence of delayed marriage on total fecundity is much less than that of contraception. It ranged between 0.8 births in Madhya Pradesh and 2.6 births in Punjab and did not show a uniform pattern. The estimated value of C(m) or the index of marriage in the states of Madhya Pradesh, Bihar and Uttar Pradesh was above 0.8. At the other end of the spectrum, in the states of Tamil Nadu, Punjab and Kerala, C(m) ranged between 0.57 and 0.48, suggesting that the fertility inhibiting influence of late marriage on TF was relatively high. The states of Gujarat and Assam, with a relatively higher mean age at marriage were also in the latter category of states. However, even in the states with low values of the index of marriage, marriage continues to be universal.[12] The low value of C(m) in states like Kerala, Punjab and Tamil Nadu is largely due to a relatively high mean age at marriage. In the four large north Indian states and in Andhra Pradesh, the age at marriage is lower than the national average. With an increase in urbanisation, spread of education and some of the other urban values through mass media, we can expect the age at marriage of women in these states to go up in the near future. In the more industrialised and urbanised states, some women may also choose a career over marriage and thus decrease the proportion of the married. However, such changes tend to be slow.

Transition from natural to controlled fertility is typically accompanied by a shortening of postpartum infecundability. Women tend to breastfeed infants for shorter duration and resort to using contraception to control fertility. The estimated duration of postpartum infecundability ranged between the high values of 10.6 and 10.9 months in Assam and Bihar and the low value of 4.4 months in Punjab. This factor depressed total fecundity by just about 2 births in Punjab but close to 6 births in Maharashtra. In Punjab, the limited effect of postpartum infecundability on total fecundity is compensated by greater use of contraception. The relatively large role of this factor in depressing total fecundity implies that there is considerable scope or potential for fertility to increase in states such as Maharashtra, Gujarat and West Bengal if the infant feeding practices change. There is some evidence that the duration of breastfeeding in urban areas is somewhat shorter than in the rural areas. It is possible that the urban influence may spread to rural areas and rural women may also shorten the duration of breastfeeding their babies. If such a decline in the breastfeeding is not accompanied by an increase in the use of contraception, fertility can go up. Also, with a reduction in postpartum infecundability, inter-birth intervals can become shorter, unless there are compensating increases in the use of reversible methods of contraception.

Further, there are indications that the desired fertility is close to or below the replacement level in many parts of the country, including in the areas where the actual fertility is still relatively high. This implies that for attaining or realising that desired goal, couples will have to practise reversible methods of contraception or lower the age at sterilisation. The NFHS data indicate that the median age of women at the time of sterilisation was 27 years. Among those who were sterilised during the two years preceding the survey, the median age was 26.3 years. In states like Tamil Nadu, Maharashtra, Karnataka, Andhra Pradesh, the median age of women, who were sterilised two years prior to the survey, was less than 25 at the time of sterilisation. The implications of such a process or trend need to be fully explored.

Another factor not fully explored in demographic literature relates to the pathways through which India can attain the demographic goal of attaining the net reproduction rate of unity as early as possible. It is argued that significant changes will be required in socio-economic conditions to achieve this goal. However, these changes have to operate through fertility inhibiting processes such as increase in the mean age at marriage or in the proportion of women choosing permanent spinsterhood and in the control of marital fertility through the use of contraception or induced abortion. A countervailing fertility-enhancing factor would be a reduction in the duration of breastfeeding and the consequent shortening of the length of postpartum amenorrhoea. Admittedly, not all these processes are easily amenable to direct or indirect policy interventions. If, in spite of some increase in the mean age of marriage, marriage continues to remain universal in India, what would be the contraceptive prevalence level required to attain the net reproduction rate of one? If the urban and modern influences contribute to enhancing fertility to a certain extent by reducing the mean duration of breastfeeding, what would be the contraceptive use required to reach the replacement level of fertility?

According to some rough estimates, if we assume no change in the value of all the proximate determinants except for the use of contraception, the TFR of 2.1 or the replacement level can be achieved with rate of contraceptive use rate of 65 to 70 per cent at all India level. It would be very difficult to achieve this level of contraceptive use with major emphasis on sterilisation as a method. However, according to the NFHS data, sterilisation is the most used method of contraception throughout India, accounting for 76 per cent of the current contraceptive prevalence. Modern reversible methods, which accounted for less than 14 per cent of the current use of contraception, would have to be promoted in a big way to hasten the pace of fertility decline.

In order to promote the use of family planning, we have to address the issue of strong son preference with its roots in social mores and which contributes to raising wanted fertility and leads to some unwanted fertility. Measures to weaken the preference for sons include improving the status of women through education and employment.[13] There are very few direct policy interventions to enhance women's autonomy, and improve their bargaining or negotiating capacity within the household, except education which is sensitive to women's needs and which is provided to both boys and girls from early ages. Equally important is lowering of infant and child mortality. Strong policy intervention on this front would not only enhance the credibility of the health personnel and the government among the people, but would also raise the acceptance of the family planning programme among those who are hesitant to do so. A lower infant and child mortality will help reduce the wanted fertility insofar as the couples try to replace the deceased children and also seek to 'insure' against the loss of children, which often occurs when couples can no longer replace the lost children.

The policy options to raise the age at marriage are limited to influencing the enrolment and continuation of girls in

schools until the age of 14 or so, and an educational campaign to convey the advantages of late age at marriage (and avoiding teenage pregnancies). However, in spite of the rhetoric about universalisation of schooling up to the age of 14, the issue of schooling of girls is closely linked to the availability of schools within the small villages. Parents are often reluctant to send their young daughters to schools in the nearby villages because they fear for their safety. This is a larger social issue resulting from the socio-political climate prevailing in many parts of the country, which cannot be easily tackled by campaigning for education for girl children. Viable, acceptable and high quality alternatives to formal schooling need to be thought about and promoted.

Overall, in the wake of indications from the data available from the Sample Registration System and the NFHS of a faster than expected decline in fertility and the removal of quantitative method-specific family planning targets, the Indian policy-makers must now show flexibility in addressing the needs of the population. The state-specific trends, constraints, and socio-economic-political situation require region-specific policies and programmes especially in states (and districts), which have lagged behind and need to be helped to catch up with the rest of the country.

Notes

[This is an extensively revised version of the paper presented at the seminar on Comparative Perspectives on Fertility Transition in South Asia, organised by the IUSSP Committee on Fertility and Family Planning and held at Islamabad, Pakistan, during December 1996.]

1 In some regions of India, the SRS took a little longer to fully establish itself so that estimates of vital rates are either not available for or are underestimated in the initial years. In such cases, an unusual upward swing in vital rates is noted over time implying lower than the true level of decline. Notwithstanding some of these problems, the overall quality of the SRS data is considered quite robust to infer regional patterns and time trends.

2 The total fertility rate or the TFR shows the average number of children expected to be born to a cohort of women if at successive ages during their reproductive period, they bear children at the same rate as was observed during a specified period. While calculating the TFR, no allowance is made for any mortality and equal weights are assigned to successive five-year age groups. A crude birth rate, on the other hand, is a weighted average of the age specific fertility rates, with weights based on the age distribution of the population. As a result, the TFR shows a faster decline in fertility than the crude birth rate of the population.

3 The 1994 revision of the UN population projections places the medium and low variants of TFR during 1990-95 at 3.75 and 3.66, respectively. According to the medium variant of the projection, which is recommended for general use, a TFR of 2.10 is expected to be reached during 2015-20. The low variant projects a TFR of 2.01 during 2010-15 and 1.60 during 2015-20. The latter appears an unlikely scenario.

4 Rural fertility continues to be higher than urban fertility in all the states. Uttar Pradesh reported the highest rural TFR of 5.5 and the other three large north Indian states reported TFR between 4.9 -5.0 during 1990-92. At the other extreme were the two southern states of Kerala and Tamil Nadu, with a rural TFR of 1.9 and 2.5, respectively.

5 These are census-based estimates of mean age at marriage, known as singulate mean at marriage. The estimates refer to an average number of years a person remains single under the assumption that age specific marriage patterns remain unchanged in the 10 year period prior to the decennial census [Agrwala nd and Goyal 1988].

6 Although the basis of estimating couple protection rates in the official service statistics, for oral pills and condoms is their distribution, for IUD is the reported insertions, and for sterilisation it is the number of procedures performed, these rates are quite different from contraceptive prevalence rates, which are derived on the basis of the responses obtained from the users directly. The two estimates are generally treated as similar.

7 The findings of these three surveys are available in: Operations Research Group, *Family Planning Practices in India: The first All India Survey Report* (not dated); *The Second All India Survey Report* (1983); and *The Third All India Survey Report* (1990) Baroda.

8 The nature of discrepancies is discussed at some length, on the basis of empirical data, in Visaria et al (1994:293-303).

9 The targeted sample for each of the six small north-eastern states was smaller (around 1000 women) than for the other large states. The results of these were pooled to represent the entire north-eastern region.

10 The figure of low total marital fertility in Andhra Pradesh is somewhat puzzling. The incidence of childlessness as well as the percentage of menopausal women in thirties in Andhra Pradesh is the highest in the country: in the age group 30-34, the proportion of menopausal women was 8 per cent in Andhra Pradesh as opposed to 3 per cent for the country as a whole and in the age group of 35-39, it was 15 per cent as opposed to 7 per cent for India. More exploration of NFHS data as well as more studies is needed to understand the factors explaining these reported phenomena.

11 The total fecundity rate does not vary much because the other proximate determinants of fertility – natural infecundity, spontaneous intrauterine mortality and permanent sterility – which also influence fecundity cause only modest changes in fertility and differ very little between populations.

12 The institution of arranged marriages facilitates universal marriage. The proportion of population remaining single (never-married) beyond age 50 tends to be extremely small (less than 1 per cent among women and just about 1 per cent among men).

13 These and other policy issues are discussed in Visaria and Visaria (1996).

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