

Anrudh Jain*

Consistency Between Contraceptive Use and Fertility in India**

Introduction

THE total fertility rate (TFR) in India, according to the Sample Registration System (SRS), has declined from 5.7 births per woman in 1970-72 to 4.5 in 1980-82 and to 3.7 in 1990-92. The National Family Health Survey (NFHS) conducted in 1992-93 has confirmed that fertility in India has declined: TFR for 1990-92, according to NFHS, is estimated to be 3.4 births per woman'. While the two estimates of TFR are quite close, a further investigation is warranted because the contraceptive prevalence rate (CPR), 40.6, estimated from NFHS is also lower than 44.9, estimated

* The Population Council.

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' The National Family Health Survey (NFHS), carried out between April 1992 and September 1993, included a nationally representative sample of 89,777 ever-married women in the age group 13-49 years from 24 states and Delhi. It collected information on fertility, family planning, mortality, and maternal and child health. The Sample Registration System (SRS) was initiated in 1964-65 on a pilot basis and on a full-scale in 1969-70 to provide dependable estimates of vital rates at the national and state levels. The fertility estimates from NFHS are based on the retrospective data on birth dates of children born during the five years preceding the survey. These estimates are affected by displacement of births which may be associated with literacy of the respondents. The SRS estimates of fertility are based on births occurring during a particular time period. These rates are not affected by recall lapse or the literacy of respondents. Initially, the SRS underestimated the "true" level of birth and death rates. The accuracy of SRS estimates is believed to have improved over time. Data from SRS are taken from Visaria and Visaria (1994).

from an earlier national survey conducted in 1988/89 by the Operations Research Group (ORG)². Once again the difference between the two estimates of CPR is not large and could be in part due to sampling errors. It is, nevertheless, of some interest to assess the degree of internal consistency between the values of CPR and TFR by incorporating information on other proximate determinants of fertility from NFHS and other data available for an earlier time period.

Method

The degree of consistency between TFR and CPR is assessed by comparing the observed and estimated values of TFR, for the entire country and each of the 16 major states. The TFR values are estimated by using the cross-country relationship between contraceptive use and fertility observed by Mauldin and Ross (1991) and the model of proximate determinants of fertility (Bongaarts, 1982).

Mauldin and Ross (1991) observed the following relationship between TFR and CPR on the basis of data from a large number of countries:

$$TFR = 7.03 - (0.0662) CPR \quad (1)$$

According to this relationship, TFR in the absence of contraceptive use is likely to be around seven births; an increase of about 15 percent in CPR is likely to reduce TFR by one birth; and CPR alone explains 85 to 87 percent of the variance among countries in TFR.

According to Bongaarts' model of proximate determinants:

$$TFR = C_m \times C_c \times C_a \times C_i \times TF \quad (2)$$

Where C_m is an index of proportions married, C_c is an index of contraception, C_a is an index of induced abortions, C_i is an index of lactational infecundability, and TF is the total fecundity rate. The four proximate factors explained about 96 percent of variance in TFR among societies (Bongaarts, 1982).

The relationship shown in equation (2) also can be used to express the ratio of TFRs at two time periods as the product of ratios of various indices:

² The Operations Research Group, a private market research firm, has carried out three national surveys in 1970, 1980, and 1988 on behalf of the Department of Family Welfare. The third survey conducted in 1988/89 included 44,918 respondents (half of them males and half currently married women in 15-44 years age group) from 205 towns and 1271 villages spread over the entire country.

$$\frac{TFR(2)}{TFR(1)} = \frac{C_m(2)}{C_m(1)} * \frac{C_c(2)}{C_c(1)} * \frac{C_i(2)}{C_i(1)} * \frac{C_a(2)}{C_a(1)} * \frac{TF(2)}{TF(1)} \quad (3)$$

If we assume that there has been no change in total fecundity between the two time periods then equation (3) can be rewritten as:

$$\frac{TFR(2)}{TFR(1)} = \frac{C_m(2)}{C_m(1)} * \frac{C_c(2)}{C_c(1)} * \frac{C_i(2)}{C_i(1)} * \frac{C_a(2)}{C_a(1)} \quad (4)$$

Equation (4) can also be used to estimate the value of TFR at time (2) given the value of TFR at time (1) and value of other indices for both time periods³.

Estimating the Four Indexes

There is a good agreement between different estimates of TFR for the early 1970s: TFR according to the report of the National Academy of Sciences (NAS) panel on India (Bhat *et al.*, 1984) was 5.6, and it was 5.70 according to SRS and 5.75 according to an analysis carried out by Jain and Adlakha (1982). The estimates of contraceptive prevalence and the median duration of postpartum amenorrhoea periods and the indices of proximate determinants for the early 1970s are, therefore, taken from the information gathered by Jain and Adlakha (1982).

The data on fertility and its proximate determinants for the early 1990s are taken from NFHS. These data are used to estimate the values of C_m , C_c and C_i for all India and for each State. The index of marriage, C_m , is estimated by using information on age-specific fertility rates and proportion of women married in each age group⁴. The index of contraception C_c , is estimated from the information on method-specific contraceptive prevalence rates reported in NFHS and the ORG survey. CPR in this relationship also includes the reported use of traditional methods such as rhythm, abstinence, and withdrawal. The effectiveness of sterilization, IUD, and pills is assumed to be 100, 95, and 90 percent respectively. The effectiveness of condoms and

³ The model is not expected to predict accurately the value of TFR for any society for one time period because the TF is not directly observed. However, these relationships can be used to generate plausible estimates of TFRs based on reasonable assumptions about unobserved parameters. In this fashion, it is possible to detect gross inconsistencies among observed parameters.

⁴ In estimating the total marital fertility rate, the marital fertility rate for 15-19 year age group is multiplied by 0.75 to adjust for the period of exposure.

traditional methods is assumed to be 70 percent. The index, C , of lactational infecundability is estimated by using median duration of postpartum nonsusceptible period reported by women in NFHS, which includes both the periods of postpartum amenorrhoea as well as abstinence.

There is very little information on the incidence of abortions and the value of TF cannot be observed directly. In order to use the proximate determinants model, we have to make certain assumptions about these parameters. The index, C_a of abortion is estimated by assuming a total abortion rate of 0.3 abortions per woman. In the absence of reliable data on abortions from NFHS, we believe that the assumption about the abortion rate of 0.3 abortion per woman is quite reasonable. Bongaarts and Potter (1983: 72) reported a total abortion rate of 0.06 for India. The Medical Termination Pregnancy Act, under which abortions are performed in India, was adopted in 1971. According to the official estimates, the number of legal abortions has increased from about 24,000 in 1972/73 to about 600,000 in the early 1990s. It is, however, unlikely to reflect areal increase in the incidence of abortion, because of the unknown quantity of abortions that take place outside the legal system. Moreover, abortions reported under the legal system now probably also substitute for those that were taking place outside the legal system earlier. An estimate of 0.3 abortions per woman during her entire reproductive period of 30 years would imply that about 1.5 million abortions are performed annually in the early 1990s. This number is two and one-half times the official estimate. Since for 1970s the number of abortions was assumed to be zero, these abortions represent the increase in total number of abortions (legal and illegal) between the two time periods.

Estimating TF

Total fecundity rate is the average number of live births expected among women who, during their entire reproductive period, remain married, do not use contraception, do not have any induced abortion, and do not breastfeed their children. The value of TF is found to vary between 13 and 17, but in testing the validity of the model, Bongaarts (1982) used an average value of 15.3. Total fecundity rate in a population is a function of mostly biological proximate determinants—frequency of intercourse, natural sterility, and spontaneous intrauterine mortality. The value of TF in a population can also be suppressed due to the practice of terminal abstinence or long separations between spouses due to migration. Terminal abstinence is reported to have been practiced in India once any of a couples children gets married and has a child. This suggests that the value of TF in India is probably lower than 15.3. This assumption is supported by the analysis presented below.

The value of TFR for India estimated from the proximate determinants model by assuming TF to be 15.3 and using NFHS estimate of proximate determinants comes out to be 4.61 births, which is much higher than the NFHS estimate of 3.39. The values of TFRs for 16 major states similarly estimated from the proximate determinants model are also higher than the NFHS estimates. This is shown in Fig. 1 by the fact that almost all points lie above the diagonal.

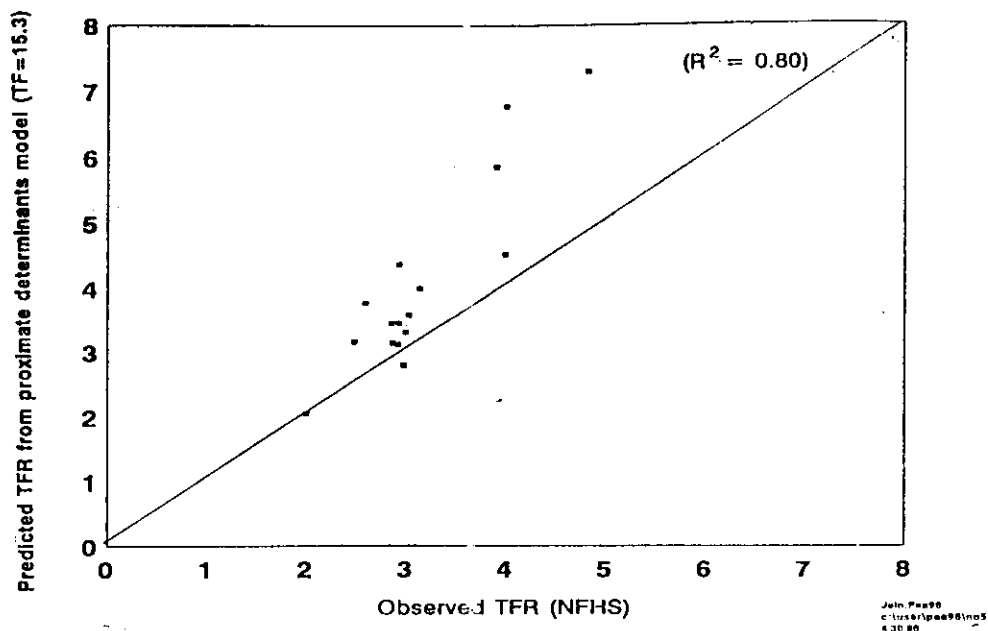


Fig. 1. Predicted and Observed Values of TFR for 16 Major States in India, 1990/92

The value of TFR for India estimated from the cross-country relationship observed by Mauldin and Ross (1991) by using NFHS estimate of CPR is 4.34 births, which is also higher than the NFHS estimate of 3.39. The relationship between NFHS-based values of TFR and CPR for 16 major states, shown in Fig. 2, is depicted by the regression equation shown below.

$$TFR = 5.25 - (0.0454)CPR \tag{5}$$

The coefficient of determination R^2 equals 0.63, i.e., CPR explains about 63 percent of the variance among states in TFR, which is considerably lower than the

corresponding value of R^2 observed by Mauldin and Ross (1991) for a large number of countries. A comparison of the relationship observed in India (equation 5) with the relationship observed internationally (equation 1) suggests that both the constant term and the regression coefficient in India are significantly lower than those observed internationally⁵. The lower constant term for India implies lower fecundity in India in comparison to the international average, which corroborates our assumption that the value of TF in India may be lower than 15.3 assumed by Bongaarts. The lower value of the regression coefficient may be an artifact of the lower constant term or it may imply that the effect of contraceptive use in India may be lower than the average effect observed internationally.

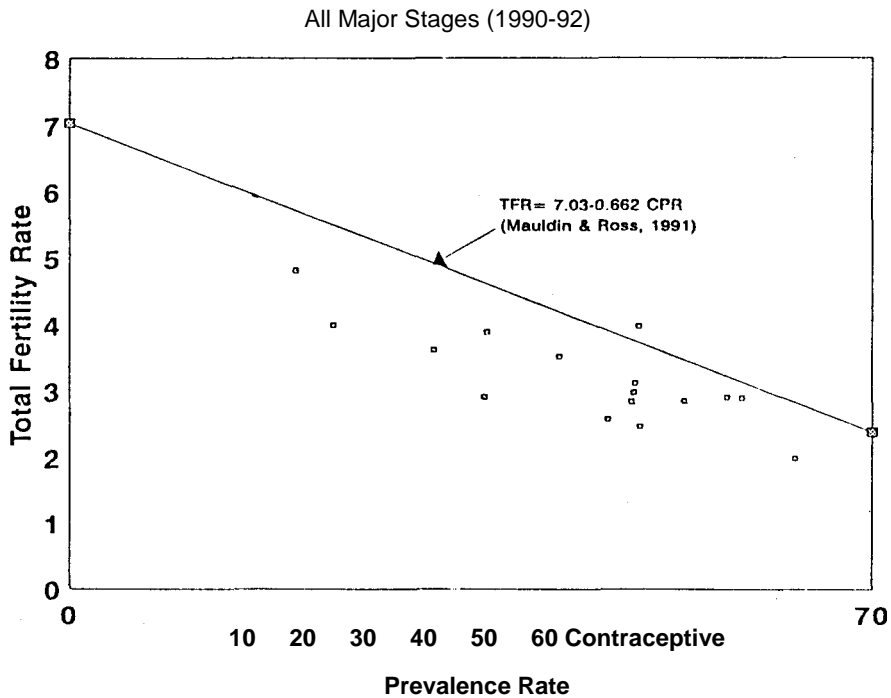


Fig. 2. The Relationship between Total Fertility and Contraceptive Prevalence Rates

⁵The standard error for the regression coefficient observed in India is estimated to be 0.0093 which implies that the difference between the two regression coefficients (.0454 and .0662) is statistically significant. The slope of the relationship between contraceptive prevalence and fertility observed in India thus appears to be different than that observed internationally. The standard error for the constant term observed in India is 0.43, which implies that the difference between the two constant terms (7.03 and 5.25) is also statistically significant.

The data presented so far suggests that the value of TF in India is lower than the average value of 15.3 assumed by Bongaarts in testing his model. While we cannot be certain how much lower it is, a better idea can be obtained by comparing data for early 1970s and early 1990s (see Table 1).

TABLE 1: CHANGES IN TOTAL FERTILITY RATE AND INDICES OF PROXIMATE DETERMINANTS BETWEEN 1972 AND 1990/92

<i>Indices</i>		1972	1990/92	<i>Ratio</i>
Total Fertility Rate	<i>TFR*</i>	5.75 5.60	3.39	0.590 0.605
Marriage	C_m	0.843	0.773	0.917
Contraception	C_c	0.864	0.587	0.679
Abortion	C_a	1.000	0.953	0.953
Lactational infecundability	C_i	0.592	0.697	1.177
Median duration of postpartum non-susceptible period (months)**	<i>i</i>	15.3	10.2	0.667
Contraceptive Prevalence Rate	<i>u</i>	14.6	40.6	2.781
Abortion Rate	<i>TA</i>	0	0.3	—
Average effectiveness of contraception	<i>e</i>	0.863	0.927	1.074
Implied total fecundity rate	<i>TF*</i>	13.3 13.0	11.3	0.872 0.869
$C_m \times C_c \times C_a \times C_i$	<i>C</i>	0.431	0.301	0.698

*The lower estimate of TFR refer to the NAS estimate of fertility. The lower estimate of TF correspond to the lower value of TFR.

**Data for 1972 refer to postpartum amenorrhoea but data for 1990/92 also include the period of postpartum abstinence.

Sources: Jain and Adlakha (1982) for 1972 and NFHS (1992/93) for 1990/92.

The lower value of TFR for 1972 is taken from Bhat *et al.* (1984).

$$C_m = TFR/TMFR, C_c = 1 - 1.08 ue$$

$$C_a = TFR/TFR + 0.4 (1 + u) TA$$

$$C_i = 20/18.5 + i$$

$$TF = TFR/C$$

The values of TF for 1990/92 is estimated to be about 11.3 births based on the values of TFR and indices of proximate determinants estimated from NFHS data. This means that the NFHS estimates are internally consistent with a value of 11.3 for TF, which is substantially lower than its value for the early 1970s. The value of TF, however, is unlikely to decrease over time unless the values of the proximate

determinants have changed faster (or slower in the case of postpartum non susceptible period) than implied by the available estimates. The value of TF can also decrease due to a substantial increase in labour migration both within India and to the Middle East and other foreign destinations. On the other hand, the value of TF would increase overtime with improvements in nutrition or changes in such factors as terminal abstinence. The effects of these factors could compensate each other and the value of TF could remain constant. Thus, it would be quite reasonable to assume that TF in 1990/92 is unlikely to be less than around 13.0 to 13.3 estimated for 1972. These estimates of TF correspond to the NAS estimate of TFR (5.6) and Jain and Adiakha's estimate of TFR (5.75) for 1972. In the following analysis a value of 13.0 for TF in the early 1990s is selected in order to be conservative⁶.

Consistency between NFHS Estimates of TFR and Proximate Determinants

The ratio of TFRs (0.605) for 1990/92 and 1972 imply a decline of 40 percent, whereas the product (0.698) of the ratios of all proximate determinants (see equation 4) implies a decline of 30 percent in fertility (see Table 1). The difference between the two estimates of fertility decline suggests that the NFHS estimates of TFR and proximate determinants are not internally consistent with the assumption of no decline in the value of TF. The NFHS estimate will not be consistent also with the assumption of an increase in the value of TF between the two time periods.

The estimated values of TFR in 1990/92 under various assumptions⁷ by using cross-country relationship (equation 1) and proximate determinants model (equations 2 and 4) are shown in Table 2. Two estimates of CPR are used—40.6 from NFHS and 44.9 from ORG. The NFHS estimate of TFR; 3.39 births per woman, is lower than all estimates. There are two exceptions.

First exception is based on the assumptions of no change in TF, postpartum non susceptible period, and abortions (panel III.B in Table 2). This means that the estimated decrease in TFR from 5.60 in 1972 to the NFHS estimate of 3.39 in 1990/ 92 could be consistent with an increase in CPR from 15 percent in 1972 to 41-45 percent in 1990/92 and with the estimated increase in age at marriage only if we assume that there is no change in the duration of postpartum non susceptible period, the incidence of abortion, and TF. The assumption about no change in TF is

⁶ Since TF is not observed directly, its implied value would be affected by errors involved in estimating "true" values of the four determinants. Underestimation (overestimation) of the four indices would overestimate (underestimate) the implied value of TF.

⁷ These assumptions do not exhaust various combinations of the unmeasured parameters but do provide a range of various scenarios.

reasonable. This means that any decline in postpartum non-susceptible period has to be compensated by an increase in the abortion rate.

TABLE2: ESTIMATED VALUES OF TFR IN 1990/92 UNDER VARIOUS ASSUMPTIONS

<i>Source/Assumption</i>	<i>TFR</i>
I. Observed	
NFHS	3.39
SRS	3.67
II. Estimated from cross-country relationship between TFR and CPR observed by Mauldin and Ross (1991)	
CPR = 40.6 (NFHS)	4.34
CPR = 44.9 (ORG)	4.06
.II. Estimated from proximate determinants	
A. TF = 15.3 and TA = 0.3	
CPR = 40.6 (NFHS)	4.61
CPR = 44.9	4.33
B. TF = 13.0.TA = 0, no decline in postpartum non-susceptible period	
CPR = 40.6 (NFHS)	3.49
CPR = 44.9 (ORG)	3.28
C. TF = 13.0 and TA = 1.0	
CPR = 40.6 (NFHS)	3.53
CPR = 44.9 (ORG)	3.30
D. TF = 13.0 and TA = 0.3	
CPR = 40.6 (NFHS)	3.91
PR = 44.9 (ORG)	3.68

While data on postpartum amenorrhoea (PPA) for the early 1970s at the all-India level are not available, breastfeeding has been thought to be universal and prolonged. The average duration of PPA for that period has been estimated to be around 15 months (Jain and Adiakha, 1982). For the early 1990s, the median duration of non-susceptible period estimated from NFHS was 10.2 months. The two estimates suggest a decline of about 5 months in the postpartum non-susceptible period during

twenty years—not an unreasonable estimate⁸. Even if this estimate of a decline is inaccurate, any real decline in the postpartum non-susceptible period during this period would have to be compensated by a decline in the value of TF or an increase in the incidence of abortion in order for the observed decline in TFR to be consistent with the observed increase in CPR. As mentioned earlier, a decline in TF is unlikely. A decline in postpartum non-susceptible period, therefore, has to be compensated by an increase in the abortion rate. How much increase in abortion rate is required is tested next.

The second exception is based on the assumptions of no change in TF between 1972 and 1990/92 and the total abortion rate of one abortion per woman (see Panel III C, Table 2). In this case, NFHS estimates of TFR (3.39) marriage and postpartum non-susceptible period could be consistent with a CPR estimate of between 40.6 and 44.9. However, an increase in the value of TA from no abortion to one abortion per woman is very unlikely. It should be noted that the total abortion rate of one was reported for Yugoslavia in 1970 (Bongaarts and Potter, 1983:88). The total abortion rate in India is likely to be much lower than one.

At a reasonable assumption of an abortion rate of 0.3 abortions per woman, the SRS estimate of TFR (3.7) appears to be consistent with the ORG estimate of CPR (44.9), and NFHS estimates of marriage, and postpartum non-susceptible period. In other words, the NFHS estimates of TFR and CPR are unlikely to be internally consistent. This conclusion is further corroborated by the observation that NFHS estimates for six major states are unlikely to be consistent internally.

Comparison between Observed and Estimated Fertility for Major States

Table 3 shows four values of TFRs for each state: two observed values are based on NFHS, and SRS; and two estimated values are based on the proximate determinants model—one uses the NFHS estimate of CPR and the other the ORG estimate of CPR. The relationships between the two observed and two estimated values of TFRs are shown graphically in four panels of Figure 3 and summarized by regression equations in Table 4. All the points in these figures would lie on the diagonal passing through the origin if the observed value of TFR for each state were equal to those

⁸ The two estimate are not strictly comparable. The median is usually lower than mean. However, the estimate of non-susceptible period from NFHS also includes the period of postpartum abstinence, which was not done in the 1972 estimate of postpartum amenorrhoea. The mean duration of postpartum amenorrhoea, according to NFHS, was 9.5 months based on reported months since birth and 10.3 months based on current status method. The estimated mean duration of postpartum amenorrhoea based on current status method is the same as the median duration of non-susceptible period.

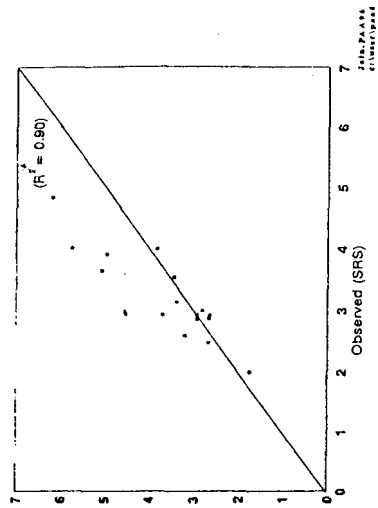
Consistency Between Contraceptive Use and Fertility in India

Fig. 3 B



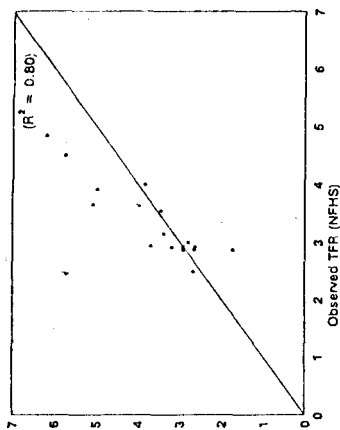
Predicted TFR (TF = 13.0 CPR From ORG)

Fig. 3 D



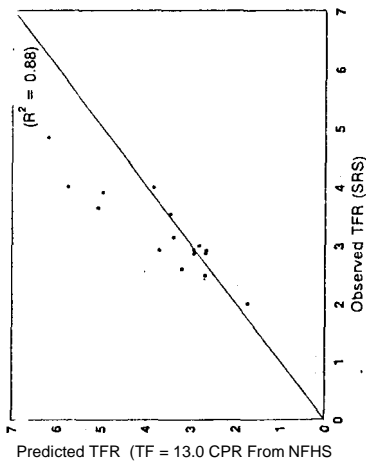
Predicted TFR (TF = 13.0 CPR From ORG)

Fig. 3 A



Predicted TFR (TF = 13.0 CPR From NFHS)

Fig. 3 C



Predicted TFR (TF = 13.0 CPR From NFHS)

estimated. Moreover, the value of the constant term in the regression equation would be equal to zero and that of regression coefficient would be equal to one. In this case we could conclude that the model accurately predicts the values of TFR and the data from NFHS on various parameters are internally consistent. This, however, is not the case. In all cases, the value of the constant term is statistically different than zero and the regression coefficient is statistically different than one. Moreover, it is difficult to pick any one series for all states.

TABLE 3- OBSERVED AND ESTIMATED VALUES OF TFR BY STATES, 1990/92

<i>State</i>	<i>TFRs estimated from proximate determinants model</i>			
	<i>SRS</i>	<i>NFHS</i>	<i>CPR from NFHS</i>	<i>CPR from ORG</i>
Andhra Pradesh	3.0	2.59	3.19	3.30
Assam	3.4	3.53	3.45	3.42
Bihar	4.6	4.0	5.74	5.41
Gujarat	3.2	2.99	2.80	2.65
Haryana	3.9	3.99	3.82	3.59
Jammu	3.3	3.13	3.38	3.89
Karnataka	3.1	2.85	2.92	3.09
Kerala	1.8	2.00	1.74	1.02
Madhya Pradesh	4.6	3.90	4.96	4.80
Maharashtra	3.0	2.86	2.66	2.67
Orissa	3.3	2.92	3.70	3.30
Punjab	3.1	2.91	2.64	2.17
Rajasthan	4.5	3.63	5.07	5.31
Tamil Nadu	2.2	2.48	2.67	2.41
Uttar Pradesh	5.2	4.82	6.19	5.65
West Bengal	3.2	2.92	2.92	3.13
India	3.7	3.39	3.91	3.68

Source: Visaria and Visaria (1994) for SRS-based TFRs.

Table 5 shows the percent difference between the observed and estimated values of TFRs. A cut-off point of 10 percent difference between the observed and predicted values of TFRs is used in classifying a state to have a consistent set of parameters. With this definition, the NFHS estimates are consistent for Assam, Gujarat, Haryana,

Jammu, Kamataka, Maharashtra, Punjab, Tamil Nadu and West Bengal. The difference between the observed and predicted values of TFRs is between 10 to 20 percent for Kerala; and it is more than 20 percent for Andhra Pradesh, Bihar, Madhya Pradesh, Orissa, Rajasthan, and Uttar Pradesh. For these seven states, the NFHS estimates do not appear to be internally consistent with the assumptions of 0.3 abortions per woman and a TF value of 13.0. Since the predicted value of TFR for Kerala is lower than the observed value of TFR, the discrepancy between the two can be explained by a slightly higher than the average value of TF for the state. For the remaining six states, the predicted values are higher than the observed values of TFRs. Adjusting values of TF upward will not improve the situation and there is no basis to assume a higher than average abortion rate in these states.

TABLE 4: RELATIONSHIP BETWEEN ESTIMATED AND OBSERVED TOTAL FERTILITY RATES IN INDIA, 1990/92

<i>Regression equations used TFR as independent factor from</i>	<i>Dependent variables: TFR estimated by using proximate determinants model and*</i>			
	<i>CPR from NFHS</i>		<i>CPR from ORG</i>	
	<i>Coefficient</i>	<i>S.E.</i>	<i>Coefficient</i>	<i>S.E.</i>
I. TFR from NFHS				
<i>a</i>	-1.501	(.667)	-1.538	(.783)
<i>b</i>	1.589	(.203)	1.561	(.238)
<i>R</i> ²	0.801		0.737	
II. TFR from SRS				
<i>a</i>	-1.140	(.446)	-0.961	(.401)
<i>b</i>	1.336	(.125)	1.322	(.112)
<i>R</i> ²	0.883		0.902	

* Proximate determinants model used TF as 13.0, TA as 0.3; the values of C_m and C_i from NFHS; and CPR from NFHS or ORG survey.

The situation improves for Andhra Pradesh and Kerala, once the SRS-based estimates are compared with the model predicted values. The difference between the two reduces to less than 10 percent. For these states, the SRS-based estimates of TFRs appear to be consistent with NFHS-based estimates of CPRs and other proximate determinants. Similarly, the SRS estimate of TFR is consistent with ORG estimate of CPR for Madhya Pradesh, Orissa, and Uttar Pradesh. None of the four comparisons provide a close fit for two states, Bihar and Rajasthan.

TABLE 5: PERCENT DIFFERENCE BETWEEN THE OBSERVED AND ESTIMATED VALUES OF TFRs BY STATES, 1990/92

<i>State</i>	<i>(Estimated TFR - Observed TFR)* 100/Observed TFR</i>			
	<i>Observed TFR from NFHS</i>		<i>Observed TFR from SRS</i>	
	<i>Estimated*</i>	<i>TFR</i>	<i>Estimated*</i>	<i>TFR</i>
	<i>CPR from NFHS</i>	<i>CPR from NFHS</i>	<i>CPR from NFHS</i>	<i>CPR from ORG</i>
<i>(1)</i>	<i>(2)</i>	<i>(3)</i>	<i>(4)</i>	<i>(5)</i>
Andhra Pradesh	23.23	27.39	6.39	9.98
Assam	-2.26	-3.00	1.48	.71
Bihar	43.57	35.22	24.85	17.58
Gujarat	-6.33	-11.48	-12.48	-17.29
Haryana	^t.20	-10.14	-1.98	-8.07
Jammu	8.00	24.37	2.44	17.96
Karnataka	2.49	8.48	-5.77	-.27
Kerala	-13.16	^19.01	-3.51	^3.34
Madhya Pradesh	27.25	23.01	7.88	4.29
Maharashtra	-7.02	6.54	-11.36	-10.90
Orissa	26.56	13.08	11.99	.06
Punjab	-9.23	-25.59	-14.79	-30.15
Rajasthan	39.72	46.23	12.70	17.96
Tamil Nadu	7.75	-2.87	21.46	9.49
Uttar Pradesh	28.48	17.19	19.09	8.62
West Bengal	.04	7.33	-8.71	-2.06
India	15.44	8.42	5.77	-.66

* Estimated by using proximate determinants model and CPR as specified.

The predicted values of TFR for Bihar and Rajasthan could be higher than the observed value under four conditions: higher CPR than estimated by NFHS or ORG, higher than average use of abortions, lower than average total fecundity, and an underestimation of postpartum nonsusceptible periods by NFHS. There is no evidence in favour of a higher than average use of abortion. The value of TF implied by the observed values of TFR and other proximate determinants observed in NFHS is about

9 births for both states. The practice of terminal abstinence may be more prevalent in these states, but the extent to which this practice can account for such a low estimate of TF can not be ascertained.

The NFHS estimates for four Northern states are compared with the available data for an earlier period (circa 1984) in Table 6. Two values of the index of contraception for the early 1990s are estimated, which corresponds to CPR estimates from NFHS and ORG. The values of TF for the two time periods are estimated first. As can be seen, TF for 1984 range from 12.4 to 13.6. The TF value for Bihar in 1984 was slightly lower than that for Rajasthan it was slightly higher than the average assumed for all states in the model for 1991/92. The TF values in these states are unlikely to have decreased from 12.6 in 1984 to 9.0 in the early 1990s. The values of TFR for the early 1990s are estimated next by assuming no decline in the state-specific values of TF. Two estimates of TFR correspond to two estimates of contraceptive

TABLE 6: CHANGES IN TOTAL FERTILITY RATES AND PROXIMATE DETERMINANTS BETWEEN 1984 AND 1990/92 IN FOUR NORTHEASTERN STATES

<i>Index</i>	<i>Year</i>	<i>Source</i>	<i>Bihar</i>	<i>Madhya Pradesh</i>	<i>Rajasthan</i>	<i>Uttar Pradesh</i>
C_m	84	(1)	.82	.86	.90	.88
	90/92	NFHS	.87	.90	.83	.85
C_c	84	(1)	.83	.70	.80	.83
	90/92	NFHS	.76	.62	.67	.80
	88	ORG	.72	.60	.70	.73
C_a	84		1.00	1.00	1.00	1.00
	90/92		.96	.96	.96	.97
C_i	80	(1)	.69	.65	.58	.65
	90/92	NFHS	.69	.72	.74	.71
TFR	84	(1)	5.9	5.1	5.7	5.9
	90/92	NFHS	4.0	3.9	3.6	4.8
	90/92	SRS	4.6	4.6	4.5	5.2
Implied TF	84	(1)	12.6	13.0	13.6	12.4
	90/92	NFHS	9.1	10.2	9.3	10.1
Estimated TFR	90/92	NFHS	5.5	5.0	5.4	5.8
		ORG	5.2	4.9	5.6	5.3

1. Data for early 1980s are taken from Srinivasan (1991: 43 and 73).

2. Implied $TF = TFRIC_m \times C_c \times C_a \times C_i$ Two estimates correspond to two estimates of TFR.

3. Estimated TFRs are based on the assumption of no change in TF between 1984 and 1990/92 (see equation 4 in the text). Two estimates correspond to two estimates of CPR from NFHS and ORG.

prevalence. The SRS-based estimates of TFR come close to estimated values corresponding to ORG-based estimate of CPR for Madhya Pradesh and Uttar Pradesh, but not for Bihar and Rajasthan. These results corroborate the observation made above. The discrepancy for Rajasthan is artificially created by an unusually high value of TF implied for 1984 and an unusually large increase in the index of lactational infecundability. Changes in the proximate determinants in Bihar, however, appear to be reasonable. It is quite possible, therefore, that the values of TFRs in Bihar and Rajasthan are underestimated by NFHS and also continue to be underestimated by SRS.

TABLE 7: VALUES OF INDEXES OF PROXIMATE DETERMINANTS BY STATES, 1990/92

<i>State</i>	C_m	C_c (NFHS)	C_a	C_i	C_c (ORG)	<i>PPNS</i>	<i>CPR(NFHS)</i>	<i>CPR(ORG)</i>
Andhra Pradesh	.82	.46	.94	.70	.47	10.1	47.0	50.3
Assam	.66	.62	.95	.68	.62	10.9	42.8	43.1
Bihar	.87	.76	.96	.69	.72	10.6	23.1	30.7
Gujarat	.66	.48	.94	.72	.46	9.4	49.3	56.2
Haryana	.84	.50	.96	.73	.47	8.9	49.7	53.1
Jammu	.66	.52	.95	.81	.60	6.3	49.4	40.6
Karnataka	.71	.48	.94	.70	.51	10.0	49.1	47.5
Kerala	.53	.36	.91	.78	.21	7.3	63.3	80.1
Madhya Pradesh	.90	.62	.96	.72	.60	9.4	36.5	39.4
Maharashtra	.71	.43	.94	.71	.44	9.8	53.7	54.7
Orissa	.70	.62	.95	.70	.55	10.2	36.3	45.3
Punjab	.59	.42	.94	.87	.35	4.4	58.7	69.3
Rajasthan	.83	.67	.96	.74	.70	8.6	31.8	30.0
Tamil Nadu	.63	.48	.93	.72	.44	9.3	49.8	59.3
Uttar Pradesh	.85	.80	.97	.71	.73	9.5	19.8	28.3
West Bengal	.75	.46	.94	.70	.49	10.0	57.4	54.8
India	.77	.59	.95	.70	.55	10.2	40.6	44.9

PPNS: Post Partum NonSusceptible.

Conclusion

The analysis presented in this paper has applied the cross-country relationship between TFR and CPR and the proximate determinants model to assess the degree of

consistency between contraceptive use and fertility in India. The data from NFHS are used to obtain estimates for states and the country as a whole for the early 1990s.

The analysis presented here suggests that the value of TF in India is likely to be lower than the average of 15.3 births assumed by Bongaarts in testing his model. This is shown by three observations. First, the estimated values of TFR from the cross-country relationship and the proximate determinants model using TF value of 15.3 are substantially higher than the observed values for all India. Second, the TFR values estimated from the proximate determinants model are also higher than the NFHS estimates for almost all states. Third, the constant term in regression equation of TFR on CPR for cross-state comparison in India is substantially lower than the constant term in cross-country regression equation. A lower value of TF in India is quite plausible because of terminal abstinence, low frequency of intercourse associated with religious practices, malnutrition, and labour migration. The implied value of TF in the early 1970s was between 13.0 and 13.3 births. While we can not be certain about changes in TF since 1970s, we have assumed that TF had remained constant. Moreover, in order to be conservative, we have used a lower TF value of 13.0 births in the early 1990s. In fact, TF may have decreased due to an increase in labour migration and may have increased since 1970s due to improvements in nutrition and decline in cultural practices such as abstinence. However, an assumption about an increase in TF would increase the magnitude of discrepancies: the estimated value of TFR from the proximate determinants model would be even higher than that estimated on the assumption of no increase in TF.

The values of TFR, CPR, marriage, and postpartum nonsusceptible periods estimated from NFHS do not appear to be internally consistent for the country and for at least six states: Andhra Pradesh, Bihar, Madhya Pradesh, Orissa, Rajasthan, and Uttar Pradesh. TFRs in Andhra Pradesh, Madhya Pradesh, Orissa, and Uttar Pradesh could be closer to the SRS-based estimate. CPRs in Madhya Pradesh, Orissa and Uttar Pradesh could be closer to those estimated by ORG. TFR in Bihar and Rajasthan could be even higher than the SRS-based estimates.

At the all India level, the estimated decrease in TFR from 5.60 births in 1972 to 3.39 in 1991 could be consistent with an increase in CPR from 15 percent in 1972 to 41 percent in 1992 under three scenarios: (1) a substantial decline in TF; (2) no change in postpartum nonsusceptible period, incidence of abortion, and TF; and (3) no change in TF but an increase in the abortion rate from 0 to 1 abortion per woman. All these conditions are rejected. TF is unlikely to have declined from 13.0 in the early 1970s to 11.3 births in the early 1990s. The duration of postpartum nonsusceptible period is unlikely to have remained constant during the past 20 years. While the decline implied by NFHS estimate (from 15 to 10 months) may overestimate the actual decline, any

decline in postpartum nonsusceptible period nevertheless has to be compensated by an increase in the abortion rate. An assumption about the accuracy of nonsusceptible period estimated from NFHS implies an abortion rate of at least one abortion per woman. While abortion rate in India is likely to have increased, it is unlikely to have increased by one abortion per woman.

At an arbitrary but reasonable assumption of an abortion rate of 0.3 abortion per woman, the estimated value of TFR corresponding to NFHS-based estimate of CPR is likely to be 3.91 births per woman and TFR corresponding to the ORG-based estimate of CPR is likely to be 3.68 births per woman. Based on the analysis presented in this paper, we conclude that TFR is likely to be closer to or slightly higher than the SRS-based estimate of 3.7 births per woman, and CPR is likely to be closer to the ORG-based estimate of 44.9 percent. The primary reason for this discrepancy at the all-India level estimates appears to be the discrepancies among these parameters in six states.

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