Transition in Age Pattern of Marital Fertility in India: 1985-2007

Aalok Ranjan
'Shyam' Institute
aranjan@shyaminstitute.in

Abstract

This paper analyses the transition in the age pattern of marital fertility in India and in its constituent states during the period 1985 through 2007 on the basis of the age-specific marital fertility rates available through the sample registration system and application of the relational model proposed by Brass. The paper concludes that transition in marital fertility in India continues to be oriented towards fertility control, an important component of which is eliminating unwanted fertility. However, transition in the age pattern of marital fertility has not been conducive to minimising the impact of population momentum on future population growth. In recent years, there has been an emphasis on the spacing methods of family planning yet, it appears that this policy shift has not been very effective in modifying the age patterns of marital fertility.

1 Introduction

The evidence available through the sample registration system as well as the National Family Health Survey indicates that fertility is declining in India, albeit at a pace slower than expected. According to the National Family Health Survey, the total fertility rate in India decreased from around 3.4 births per woman of reproductive age in 1990-92 to around 2.7 births per woman of reproductive age in 2003-05. On the other hand, information available through the sample registration system suggests that total fertility rate in India decreased from 4.3 births per woman of reproductive age in 1985 to 2.7 birth per woman of reproductive age in 2007 while the total marital fertility rate decreased from 5.6 births per currently married woman of reproductive age in 1985 to 4.4 births per currently married woman of reproductive age in 2007. Information available through the sample registration system also suggests that there has been a considerable slowdown in the decrease in marital fertility in the country after 1995. Between 1985 and 1995, the total marital fertility rate in India decreased from 5.6 to 4.7 in 1995 but between 1995 and 2007, it decreased from 4.7 to 4.4 births per currently married woman of reproductive age. In fact, marital fertility in India remained virtually stagnant during the period 1995 through 2003. Between 2003 and 2004 the total marital fertility rate decreased abruptly from 2.7 to 2.4 births per currently married woman of reproductive age but the decrease stagnated again during the period 2004 through 2007.

It is obvious to conjecture that the decrease in fertility and marital fertility in India since 1985 has been associated with changes in age patterns of fertility as well as age patterns of marital fertility. There has however been no attempt to analyse how the age pattern of fertility or marital fertility has changed under the declining fertility regime. Kumar (1977) has compared fertility in India during 1951-60 with fertility in Sweden and Finland between 1871-80 and observed that the rate of reproduction in fertility within marriage in India during 1951-60 was lower than that in Sweden and Finland in the late nineteenth century because of high level of abstinence because of taboos and customs, long duration of breast feeding, etc. However, in recent years, there has been no attempt to analyse the changes in the age patterns of fertility in India and its implications.

The age pattern of fertility of currently married women is influenced by a host of factors including: 1) marriage patterns; 2) patterns of widowhood; 3) patterns of divorce and separation; 4) distribution of females in the child bearing ages; and 5) age specific marital fertility rate. The total marital fertility rate, on the other hand, is determined only by the age pattern of reproduction within the institution of marriage which is largely shaped by the orientation of fertility regulation efforts. When the prevailing wisdom is to limit the number of births not to properly space successive births, child bearing is primarily concentrated in younger ages of the reproductive period. In such a regime, when a couple achieves the desired family size, there is a deliberate attempt to stop child bearing so that marital fertility declines sharply in the older ages of the reproductive period.

Henry (1961) has discovered that in populations where there is little or no voluntary or deliberate control of fertility, the age pattern of fertility within marriage is approximately constant. Voluntary or deliberate control of fertility, according to Henry, is any behaviour affecting fertility that is modified as parity increases. He termed fertility in the absence of voluntary or deliberate control as the 'natural fertility' and observed that, although, natural fertility varied across populations, yet its age pattern remained the same. Henry did not include, in his analysis, the situation in which couples deliberately attempt to space births but are not concerned with the number of children that are ultimately born. Laridon (1975) extended the definition of natural fertility in situations where couples do not consciously attempt to regulate or space the number of children. It has been observed in Indonesia and Nigeria that couples deliberately space births in the context of survival of children and health of women and children but not in the context of regulation of fertility (Calwell and Caldwell, 1977). In India also, the official family planning programme, introduced way back in 1952, had its rooting in improving the health of women and children and not the reduction in fertility.

Following the work of Henry, Coale and Trussell (1974) proposed a model that, by generalising the pattern of natural fertility, was able to represent the fertility experience of populations where voluntary control of fertility was exercised. The model was based on the assumption that marital fertility either follows the natural fertility (if deliberate fertility regulation is not practised) or it departs from the natural fertility in a way that increases with age according to a typical pattern (United Nations, 1983). Coale and Trussell used this model in developing model fertility schedules that depicted variations in the age pattern of child bearing in human populations at different levels of fertility. The parameter 'm' of the Coale and Trussell fertility model has widely been used as an indicator of the extent of fertility control (Knodel, 1977; Lavely, 1986). This indicator measures the rapidity of decline in fertility, or the extent of concavity of the age specific marital fertility curve, above ages 20-24 (Anderson and Silver, 1992).

Brass, on the other hand, suggested a relational scheme between a 'standard' fertility schedule and any other fertility scheduled to model age pattern of fertility (Brass, 1980). In essence, Brass approach to linearise the age specific fertility curve by using a Gompertz transformation. Brass also derived an appropriate standard fertility schedule on the basis of Coale and Trussell model fertility schedules as the basis of the application of the scheme proposed by him. Booth (1984) has developed another 'standard' fertility schedule that has specifically been designed for high fertility populations.

In this paper, we apply the relational scheme proposed by Brass to analyse the transition in the age pattern of marital fertility in India and in its constituent states during the period 1985 through 2007. The paper also discusses implications of the observed transition in the age pattern of marital fertility in India in the context of fertility reduction and population stabilisation. The paper is organised as follows. The next section discusses the methodology which is essentially the same as proposed by Brass with the only difference that we use the age specific

marital fertility rates prevailing in India around 1985 as the standard. Essentially, we are interested in analysing how the age pattern of marital fertility has changed from the pattern that prevailed in 1985. The third section of the paper describes the data source while the fourth section presents an overview of marital fertility in India and states. The analysis is based on the annual estimates of age specific marital fertility rates available through the sample registration system. This is the only source of information on marital fertility in India and states as the National Family Health Survey does not provide estimates of marital fertility. The fifth section of the paper analyses the age patterns of marital fertility while the sixth and the last section discusses policy implications.

Methodology

The methodology employed in the present paper, essentially comprises of fitting the following equation (United Nations, 1983):

$$Y_t(x) = \alpha_t + \beta_t\, Y_s(x) \qquad (1)$$

where

$$Y(x) = -ln(-ln(F(x)/TF)), \qquad (2)$$

and $F(x)$ is the cumulative fertility up to age x and TF is the total fertility rate. Here the subscript t stands for time and s stands for 'standard' fertility schedule.

The parameters α and β of the model has the following interpretation: α can be taken as the age location of fertility schedule or, more specifically, the age by which half of the total child bearing has occurred. On the other hand, β may be interpreted as determining the spread or degree of concentration of the fertility schedule (United Nations, 1983). When α=0 and β=1, the age patterns of $Y(x)$ and $Y_s(x)$ are the same. When α<0, half of the total childbearing occurs at an older age than the standard and vice versa. Similarly, when β>1, the observed age pattern of fertility is steeper than the standard age pattern and vice versa. This implies that an analysis of the trend in parameters α and β facilitates the analysis of transition in the age pattern of marital fertility.

An important consideration in the application of the above approach is the selection of the standard marital fertility schedule. One approach, obviously, is to use the natural fertility schedule developed by Coale and Trussell as the standard for the present analysis. The second approach may be to treat the age specific marital fertility rate in India and in its constituent states around 1985 as the standard. In fact, if $Y_n(x)$ is the transformation of natural fertility schedule and $Y_s(x)$ stands for the transformation of marital fertility schedule that prevailed in India around 1985, then

$$Y_t(x) = \alpha_t + \beta_t\, Y_s(x)$$

and

$$Y_s(x) = \eta + \theta\, Y_n(x)$$

so that

$$Y_t(x) = \alpha_t + \beta_t\, (\eta + \theta\, Y_n(x))$$

$$(\alpha_t + \beta_t\eta) + \beta_t\theta\, Y_n(x) \qquad (3)$$

In view of the above, we have opted for taking the age specific marital fertility rate that prevailed in India around 1985 for analysing relative changes in the age pattern of marital fertility between 1985 and 2007.

2 Data Source

The analysis is built upon annual estimates of age specific marital fertility rates available through the Sample Registration System. Estimates available through the Sample Registration System are generally believed to be quite accurate, although there is some under reporting of vital events which varies from state to state. An investigation carried out in 1980-81 an omission rate of 3.1 per cent for births at the all India level under the system (Government of India, 1983). Another enquiry conducted in 1985 suggested that omission rate had decreased to 1.8 per cent for births, although omission rates varied from state to state (Government of India, 1988). Recently, Mari Bhat has estimated that the Sample Registration System has missed about 7 per cent of the births and concluded that there has been no substantial change in the completeness, although some improvements in the accuracy of data appears to have taken place in some states (Mari Bhat, 2002). These improvements might have resulted in a slight underestimation of the pace of fertility decline at the national level.

Estimates available through the system are known to be associated with year-to-year fluctuations. As such, the normal practice to minimise these fluctuations is to use three-year moving average, centred at the middle year of the three-year period, instead of annual estimates. The same practice has been adopted here too. The estimate of birth rate for the year 1986 is actually the un-weighted average of birth rates for the years 1985, 1986 and 1987.

Estimates of marital fertility may also be derived from children ever born data collected during the decennial population census using indirect techniques. However, these estimates are not available on an annual basis.

3 Marital Fertility in India

Estimates of total marital fertility rate for India and its constituent states available through the sample registration system are given in table 1. The total marital fertility rate, in India, decreased from around 5.4 births per currently married woman of reproductive age during 1985-87 to around 4.3 births during 2005-07. The decrease has however not been uniform during the 20 years period under reference (Figure 1). The decrease in total marital fertility stagnated during the period 1995-97 through 2001-03 and again in the recent years.

Among different states, total marital fertility rate varies widely currently as well as in the past. During the period 1985-87, total marital fertility rate was the highest in Assam (almost 7 births per currently married woman of reproductive age) and the lowest in Kerala (around 4.7 births per currently married woman of reproductive age). Twenty years later, Uttar Pradesh had the highest total marital fertility rate of around 5.6 birth per currently married woman of reproductive age while Andhra Pradesh had the lowest the total marital fertility rate of around 3.4 births per currently married woman of reproductive age. The decrease in the total marital fertility rate, during the 20 years period between 1985-87 and 2005-07 has been the slowest in Uttar Pradesh but the fastest in Andhra Pradesh.

It is also clear from figure 1 that path of transition in marital fertility has been different in different states. However, in most of the states of the country, the total martial fertility rate either increased or stagnated during the period 1995-97 through 2001-03 according to the estimates available through the sample registration system.

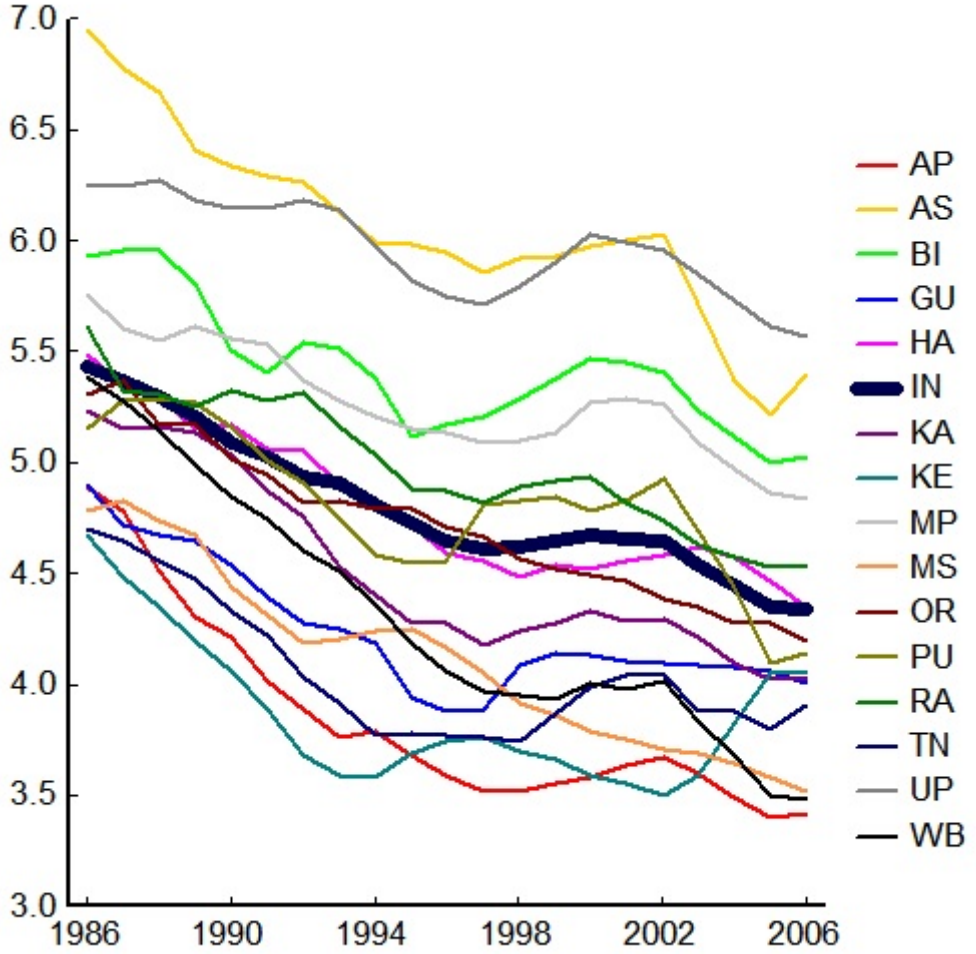
Despite the decrease in the total marital fertility rate, a currently married woman was expected to produce, on average, more than 4 children during her reproductive period according to fertility levels that prevailed in India 2005-07. There was only one state, Andhra Pradesh, where this number was less than 3.5. Obviously fertility control efforts in India and in most of the states have not been very effective in regulating fertility within the institution of marriage. There has been a decrease in the total marital fertility rate but this decrease has been substantially slower than what was expected or what was conceived. By international standards, marital fertility in India still remains high with the result that the goal of replacement fertility still remains elusive for the country.

Table 2 gives estimates of age specific marital fertility rates in India during the period 1985-87 through 2005-07. These rates contain an outline of the history of marital fertility transition in the country during the 20 years between 1985-87 and 2005-07. The trend in the age specific marital fertility rates in India is shown in figure 2 which indicates that marital fertility in women aged 25 years and above has decreased in the country during the period under reference but there appears little decrease in the fertility of young married women - married women less than 25 years of age. This observation is also supported by the trend analysis which suggests that the trend rate of decrease in India has been statistically significant in case of currently married women aged 25 years and above only.

A similar situation prevailed in most of the constituent states of the country (Table 3). There are only three states - Maharashtra, Orissa and Tamil Nadu - where there has been a significant decrease in the fertility of very young married women - married women in the age group 15-19 years. On the other hand, in the states of Bihar, Haryana, Madhya Pradesh, Rajasthan and Uttar Pradesh, the age specific marital fertility rate in the age group 20-24 years actually increased during the period under reference. By contrast, fertility of the currently married women in the age group 25-49 years decreased in all states of the country. Moreover, the trend rate of decrease in the age specific marital fertility rate has been found to be statistically significant in all states with the only exception of the age group 45-49 years in Assam.

The change in the age specific marital fertility rates in India and states suggests two different transition regimes that prevailed in the country during the period under reference. The estimates of age specific marital fertility rates available through the sample registration system suggests that the decrease in the total marital fertility rate in India has been the result of the decrease in the fertility of married women with at least 25 years of age. By contrast, fertility of young married women - women aged less than 25 years of age - has remained largely unchanged in the country and in its states.

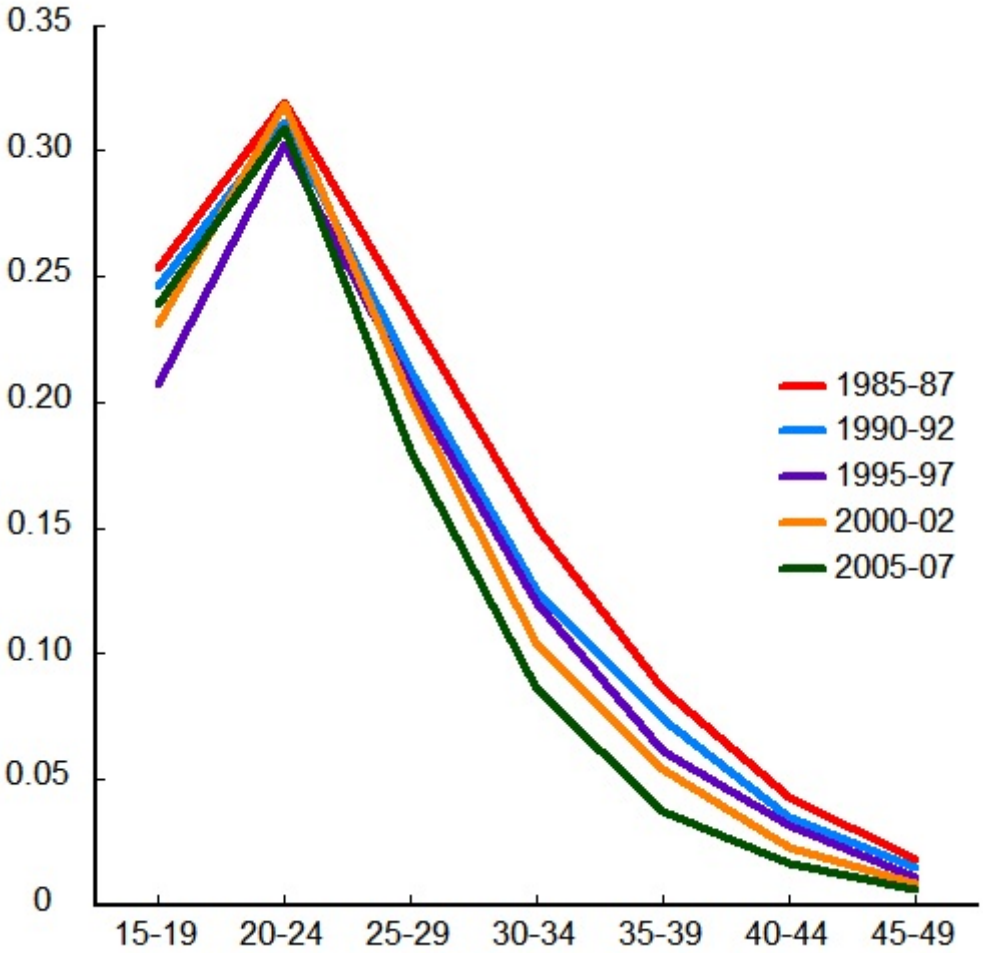
Figure 1
Trends in total marital fertility rates
India and States
1985-2007



Source: Annual Reports of the Sample Registration System for different years.

Remarks:
1. The total marital fertility rates shown in the figure are the unweighted average of three-year period. For example, the year 1986 shown in the figure actually refers to the period 1985-87. Similarly, the year 2006 refers to the period 2005-07.
2. Bihar (BI), Madhya Pradesh (MP) and Uttar Pradesh (UP) were divided in the year 2000. Rates for the year 2004 onwards are related to the divided states whereas rate prior to the year 2004 are for undivided states.

Figure 2
Age specific marital fertility rates
India: 1985-2007



Source: Annual Reports of the Sample Registration System for different years.

Remarks:
1. Fertility rates shown in the figure are the unweighted average of three-year period. For example, the year 1986 shown in the figure actually refers to the period 1985-87. Similarly, the year 2006 refers to the period 2005-07.
2. Bihar (BI), Madhya Pradesh (MP) and Uttar Pradesh (UP) were divided in the year 2000. Rates for the year 2004 onwards are related to the divided states whereas rate prior to the year 2004 are for undivided states.

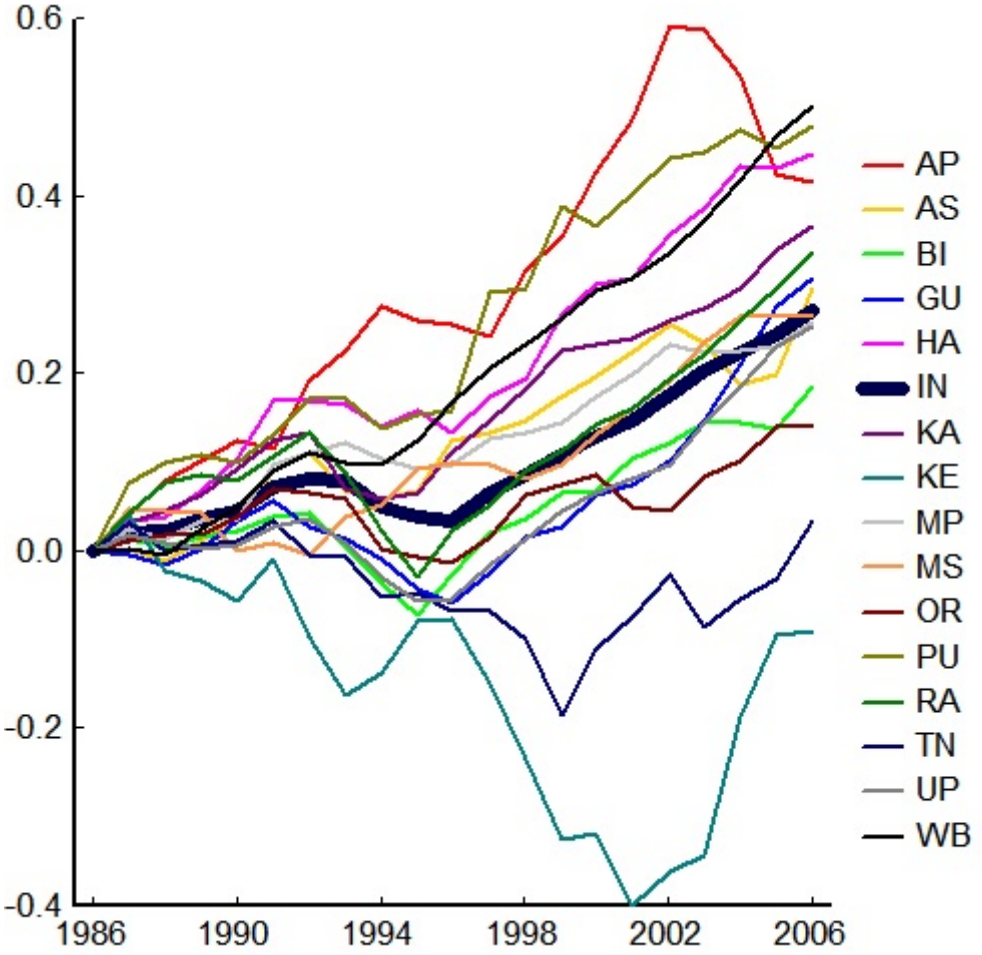
4 Age Pattern of Marital Fertility

The estimates of parameters α and β of model (1) for India and its constituent states are given in tables 4 and 5 and the trend in the parameters is depicted in figures 3 and 4. Table 6 presents estimates of the mean age of child bearing of currently married women and the trend is shown in figure 5. The parameter α has increased over time in the country and in states which means that the age by which half of the marital fertility occurs has decreased over time. This observation is supported by the trend in the mean age at child bearing of currently married women. In India, the mean age at child bearing of currently married women decreased by almost 2 years from around 26.1 years during 1985-87 to around 24.3 years during 2005-07. Marital fertility in India is increasingly getting concentrated in the younger ages of the reproductive period as the result of some sharp decrease in fertility of older married women.

The parameter β, on the other hand, is increasing which means that fertility of the currently married women is increasingly getting concentrated around its age location and the age curve of marital fertility curve is getting more and more laptokurtic. These observations are in line with the trend in the age specific marital fertility rates which suggests that nearly all the decrease in marital fertility in India and in its most of the states has been confined to married women with at least 25 years of age. There has been little change in fertility of currently married women aged less than 25 years of age and in many states, fertility of young currently married women below 25 years of age has increased over time.

The trend in parameters α and β of the model (1) and the trend in the age specific marital fertility rates in India and states reflect the typical pattern of fertility control regime that prevails in India. This regime focusses on birth limitation rather than birth spacing. The underlying wisdom of fertility control in India continues to be production of the desired number of children quickly after marriage and then stopping reproduction. The evolution of this regime is the result of the official efforts towards fertility control which, right since their inception in 1952, have been focussed on fertility limitation rather than fertility planning. The focus on fertility limitation rather than fertility planning has also been instrumental in promoting and pushing the use of terminal methods of family planning like female and male sterilisation and the near total neglect of temporary or spacing methods like oral pill, condom, intra-uterine device, etc. Latest estimates of contraceptives prevalence rate available through the District Level Household Survey 2007-08 suggest that around 54 per cent of the married couples in India were using some form of contraception of which nearly two third were sterilised. Among around 19 per cent married couples who were using some spacing method, almost 13 per cent were using highly inefficient condom or traditional methods of family planning. Use of highly efficient spacing methods of family planning - intrauterine devices and oral pill - was limited to just around 6 per cent currently married couples which suggests that use of family planning in the country has, at best, very limited impact as far as proper spacing between successive births is concerned.

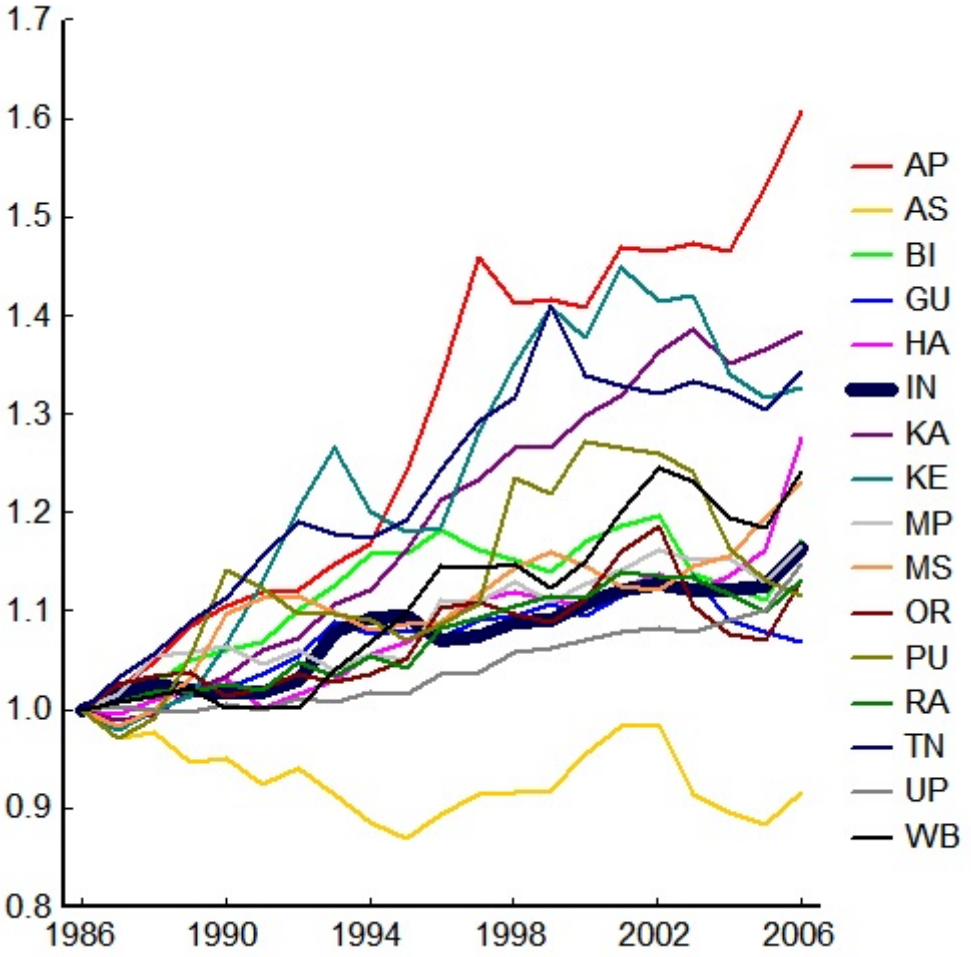
Figure 3
Trends in parameter α



Source: Author's calculations based on Annual Reports of the Sample Registration System for different years.

Remarks:
1. Fertility rates used for estimation are the unweighted average of three-year period. For example, the year 1986 shown in the figure actually refers to the period 1985-87. Similarly, the year 2006 refers to the period 2005-07.
2. Bihar (BI), Madhya Pradesh (MP) and Uttar Pradesh (UP) were divided in the year 2000. Rates for the year 2004 onwards are related to the divided states whereas rate prior to the year 2004 are for undivided states.

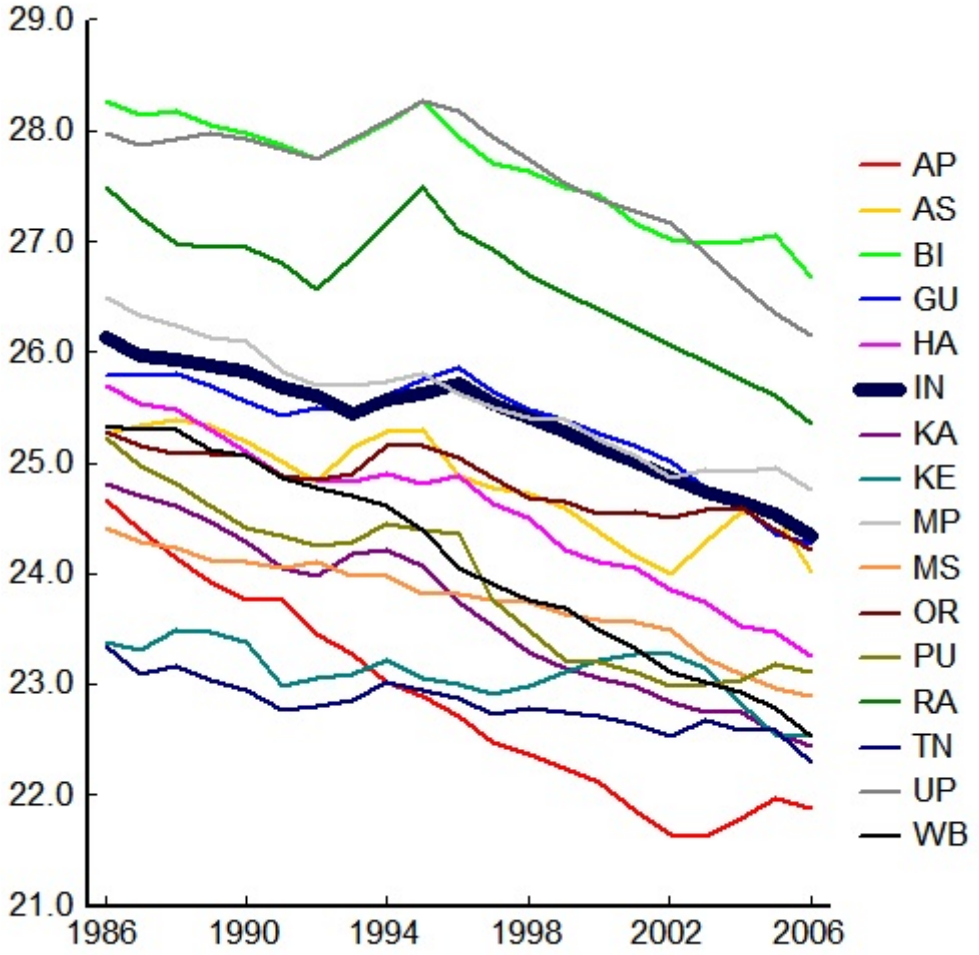
Figure 4
Trend in parameter β



Source: Author's calculations based on Annual Reports of the Sample Registration System for different years.

Remarks:
1. Fertility rates used for estimation are unweighted average of three-year period. For example, the year 1986 shown in the figure actually refers to the period 1985-87. Similarly, the year 2006 refers to the period 2005-07.
2. Bihar (BI), Madhya Pradesh (MP) and Uttar Pradesh (UP) were divided in the year 2000. Rates for the year 2004 onwards are related to the divided states whereas rate prior to the year 2004 are for undivided states.

Figure 5
Trend in mean age at child bearing



Source: Author's calculations based on Annual Reports of the Sample Registration System for different years.

Remarks:
1. Fertility rates used for estimation are unweighted average of three-year period. For example, the year 1986 shown in the figure actually refers to the period 1985-87. Similarly, the year 2006 refers to the period 2005-07.
2. Bihar (BI), Madhya Pradesh (MP) and Uttar Pradesh (UP) were divided in the year 2000. Rates for the year 2004 onwards are related to the divided states whereas rate prior to the year 2004 are for undivided states.

The dominance of the permanent methods of family planning - female or male sterilisation - is very much evident at the state level also. In six states of the country - Andhra Pradesh, Chhattisgarh, Karnataka, Madhya Pradesh, Maharashtra and Tamil Nadu, more than 80 per cent of the currently married couples who were using a family planning method at the time of the survey were found to be sterilised. In Andhra Pradesh, sterilised couples accounted for more than 98 per cent of the currently married couple who were using a family planning method. In these states, obviously, there is just fertility limitation, little fertility planning. In other states where the prevalence of spacing methods of family planning in relatively satisfactory, most of the use is limited to condom and traditional methods which have very low efficiency in regulating fertility.

Policy Implications

From the perspective of fertility reduction and population stabilisation, the foregoing analysis has two important policy implications. The first policy imperative is that there is a need to focus on young married women - married women below 25 years of age - for further reduction in marital fertility and hence in fertility. This is possible only when the focus of the official family planning programme, the mainstay of fertility reduction efforts in India, is shifted from fertility limitation to fertility planning. Substantial reduction in marital fertility and hence in fertility in India is now possible only when there is a decrease in the fertility of young married women. Any appreciable decrease in the fertility of young married women could be recorded in only six states - Assam, Kerala, Maharashtra, Orissa, Tamil nadu and West Bengal - whereas in five states - Haryana, madhya Pradesh, Punjab, Rajasthan and Uttar Pradesh - fertility of young married women actually increased during the period under reference.

Reduction in fertility of young married women requires a radical change in the orientation of the official family planning efforts. The official efforts must promote 'practising' family planning rather than 'treating' high fertility as is the case at present. 'Practising' family planning requires a different service delivery system than 'treating' high fertility. High fertility can be 'treated' through a camp approach and banking upon the permanent methods of family planning. In order to ensure that married women, especially young married women, 'practice' family planning regular contact with then and an uninterrupted supply system needs to be put in place. Such a system is missing at present. Attempts to promote 'practice' of family planning are based on a service delivery system that is designed to 'treat' high fertility. As a result, these efforts are not effective.

The observed transition in the age-pattern of marital fertility in India has implications for population stabilisation also. It is well known that even when fertility is brought down to the replacement level with constant mortality and zero migration, population growth will continue because of the young population structure which keeps the birth rate high (Bongaarts and Bulatao 1999). This age structure effect is termed as population momentum (Keyfitz 1971, 1985). Because of the population momentum, there is a time lag between achieving replacement

fertility and levelling off the rate of natural increase or achieving population stabilisation. Once the replacement fertility is achieved, it takes about the average life expectancy for the age structure of the population to stabilise. The significance of population momentum may be judged from the observation that nearly half of the projected population growth in the world in the current century will be the result of population momentum (Bongaarts 1994; Bongaarts and Bulatao 1999).

Population momentum is now a major component of the future population growth in India. Chaurasia and Gulati (2008) have observed that the constituent states of India can be grouped into three categories on the basis of prevailing levels of the total fertility rate - states where replacement fertility has already been achieved; states which are on the verge of achieving replacement fertility; and states where fertility still remains well above the replacement level. It is estimated that population momentum alone will account for 50-60 per cent of the increase in India's population in the first quarter of the current century.

One option to minimise the effect of population momentum on population growth is to raise the mean age of child bearing (Bongaarts 1994). It has been observed that fertility in a given year is significantly affected by shifts in the timing of births. When childbearing starts at an early age and spacing between successive births is small, fertility temporarily rises. Ryder (1980) has concluded that much of the temporary rise in fertility in the United States of America during the 1950s was caused by changes in the timing of fertility rather than by variation in the desired family size. Conversely a delay in the start of childbearing and wider spacing between successive births leads to a temporary decline in fertility and hence in the population growth rate. The transition in the starting, spacing and stopping behaviour of couples is reflected in the transition in the age structure of fertility. Viewed in this perspective, the observed transition in the age pattern of marital fertility is going to have a negative impact on stabilisation in India. There is a need to correct this negative impact by postponing the first birth and through proper spacing between successive births.

Conclusions

India needs a second fertility transition. Fertility regulation efforts in India over the last 55 years or so have largely been confined to control high fertility through fertility limitation strategies and approaches which revolved round the permanent methods of family planning. This approach appears to be nearing saturation. There is a need to reorient fertility regulation efforts in India from fertility limitation to fertility planning focussed on young married women and not on women who have achieved their desired fertility. This is possible only when the attention is shifted to 'practising' family planning rather than 'treating' high fertility.

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Table 1: Total marital fertility rates in India and states: 1985-2007.

Period	India	Andhra Pradesh	Assam	Bihar	Gujarat	Haryana	Karnataka	Kerala	Madhya Pradesh	Maharashtra	Orissa	Punjab	Rajasthan	Tamil Nadu	Uttar Pradesh	West Bengal
1985-87	5.521	4.949	6.963	6.164	4.943	5.542	5.279	4.685	5.856	4.807	5.358	5.180	5.757	4.718	6.427	5.463
1986-88	5.453	4.827	6.798	6.173	4.753	5.412	5.207	4.499	5.687	4.860	5.413	5.312	5.452	4.660	6.413	5.344
1987-89	5.373	4.546	6.693	6.167	4.706	5.351	5.215	4.364	5.621	4.760	5.211	5.312	5.429	4.565	6.443	5.211
1988-90	5.278	4.331	6.431	5.981	4.681	5.206	5.176	4.205	5.687	4.692	5.205	5.282	5.368	4.484	6.356	5.050
1989-91	5.162	4.238	6.361	5.664	4.566	5.212	5.072	4.067	5.634	4.453	5.058	5.173	5.437	4.340	6.310	4.914
1990-92	5.094	4.036	6.326	5.548	4.425	5.111	4.910	3.891	5.604	4.324	4.986	5.019	5.397	4.232	6.309	4.809
1991-93	5.007	3.910	6.292	5.674	4.297	5.096	4.786	3.684	5.434	4.198	4.858	4.922	5.414	4.039	6.334	4.660
1992-94	4.960	3.777	6.168	5.639	4.276	4.945	4.551	3.592	5.347	4.220	4.868	4.758	5.278	3.918	6.300	4.561
1993-95	4.854	3.807	6.034	5.491	4.214	4.845	4.428	3.581	5.269	4.256	4.826	4.589	5.137	3.777	6.132	4.401
1994-96	4.776	3.693	6.029	5.233	3.961	4.752	4.293	3.692	5.223	4.261	4.820	4.558	4.995	3.789	5.988	4.217
1995-97	4.697	3.595	5.991	5.274	3.899	4.622	4.283	3.750	5.183	4.177	4.737	4.566	4.957	3.771	5.895	4.085
1996-98	4.664	3.523	5.895	5.313	3.909	4.579	4.184	3.763	5.134	4.060	4.689	4.821	4.900	3.760	5.848	3.993
1997-99	4.664	3.520	5.957	5.396	4.108	4.508	4.246	3.702	5.137	3.921	4.592	4.825	4.968	3.743	5.919	3.970
1998-2000	4.691	3.557	5.961	5.496	4.156	4.558	4.281	3.665	5.189	3.870	4.549	4.853	4.989	3.866	6.023	3.959
1999-01	4.721	3.581	6.002	5.572	4.154	4.550	4.340	3.588	5.314	3.796	4.518	4.782	5.009	3.986	6.152	4.032
2000-02	4.699	3.632	6.024	5.546	4.120	4.582	4.291	3.554	5.332	3.762	4.484	4.832	4.881	4.045	6.109	3.999
2001-03	4.684	3.672	6.052	5.495	4.112	4.608	4.302	3.496	5.300	3.711	4.401	4.932	4.799	4.044	6.065	4.027
2002-04	4.579	3.597	5.751	5.348	4.106	4.644	4.218	3.584	5.130	3.697	4.374	4.698	4.690	3.884	5.955	3.846
2003-05	4.484	3.491	5.412	5.237	4.093	4.598	4.103	3.822	5.017	3.652	4.301	4.447	4.634	3.879	5.829	3.692
2004-06	4.385	3.396	5.268	5.129	4.078	4.484	4.033	4.050	4.913	3.586	4.307	4.102	4.592	3.796	5.709	3.517
2005-07	4.371	3.421	5.435	5.119	4.029	4.361	4.034	4.058	4.876	3.520	4.213	4.147	4.585	3.908	5.641	3.498

Source: Samples Registration System

Table 2: Age-specific marital fertility rates in India: 1985-2007

Period	15-19	20-24	25-29	30-34	35-39	40-44	45-49
1985-87	0.253	0.319	0.235	0.150	0.086	0.043	0.018
1986-88	0.256	0.319	0.231	0.144	0.084	0.041	0.016
1987-89	0.251	0.319	0.229	0.140	0.082	0.039	0.015
1988-90	0.248	0.315	0.224	0.135	0.080	0.038	0.015
1989-91	0.243	0.312	0.219	0.131	0.077	0.036	0.015
1990-92	0.246	0.312	0.213	0.125	0.074	0.035	0.015
1991-93	0.242	0.311	0.209	0.122	0.070	0.034	0.013
1992-94	0.242	0.312	0.207	0.123	0.066	0.032	0.010
1993-95	0.226	0.309	0.207	0.124	0.063	0.032	0.010
1994-96	0.217	0.306	0.206	0.124	0.062	0.031	0.010
1995-97	0.207	0.303	0.206	0.120	0.061	0.032	0.011
1996-98	0.214	0.301	0.203	0.115	0.059	0.029	0.011
1997-99	0.221	0.302	0.202	0.112	0.059	0.028	0.010
1998-2000	0.227	0.306	0.202	0.109	0.058	0.026	0.010
1999-01	0.231	0.313	0.202	0.108	0.057	0.025	0.009
2000-02	0.231	0.319	0.201	0.104	0.054	0.023	0.008
2001-03	0.236	0.322	0.198	0.100	0.051	0.022	0.008
2002-04	0.236	0.314	0.194	0.096	0.047	0.020	0.008
2003-05	0.234	0.312	0.187	0.094	0.042	0.019	0.008
2004-06	0.235	0.303	0.184	0.090	0.039	0.018	0.008
2005-07	0.239	0.309	0.181	0.086	0.037	0.016	0.006

Source: Sample Registration System

Table 3: Average annual rate of change in the age specific marital fertility rates in India and states: 1985-2007

Country/ State	15-19	20-24	25-29	30-34	35-39	40-44	45-59
India	-0.004	-0.001	-0.011	-0.024	-0.038	-0.044	-0.043
Andhra Pradesh	-0.001	-0.002	-0.032	-0.072	-0.104	-0.123	-0.158
Assam	-0.000	-0.008	-0.013	-0.019	-0.032	-0.046	0.025
Bihar	-0.006	0.004	-0.004	-0.012	-0.027	-0.028	-0.036
Gujarat	0.009	-0.008	-0.010	-0.022	-0.032	-0.041	-0.038
Haryana	0.002	0.003	-0.018	-0.041	-0.056	-0.065	-0.066
Karnataka	-0.002	-0.003	-0.019	-0.046	-0.078	-0.102	-0.115
Kerala	-0.004	-0.008	-0.008	-0.008	-0.034	-0.088	-0.121
Madhya Pradesh	-0.002	0.004	-0.007	-0.022	-0.036	-0.042	-0.040
Maharashtra	-0.012	-0.005	-0.023	-0.042	-0.056	-0.069	-0.061
Orissa	-0.010	-0.005	-0.011	-0.021	-0.032	-0.041	-0.038
Punjab	0.012	-0.004	-0.017	-0.042	-0.071	-0.081	-0.064
Rajasthan	-0.009	0.005	-0.008	-0.025	-0.036	-0.036	-0.044
Tamil Nadu	-0.010	-0.001	-0.008	-0.026	-0.047	-0.069	-0.095
Uttar Pradesh	-0.001	0.007	-0.002	-0.015	-0.024	-0.029	-0.035
West Bengal	-0.003	-0.011	-0.030	-0.051	-0.077	-0.083	-0.087

Source: Author's calculations

Table 4: Estimates of parameter α for India and states: 1985-2007.

Period	India	Andhra Pradesh	Assam	Bihar	Gujarat	Haryana	Karnataka	Kerala	Madhya Pradesh	Maharashtra	Orissa	Punjab	Rajasthan	Tamil Nadu	Uttar Pradesh	West Bengal
1985-87	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1986-88	0.021	0.040	0.003	0.014	-0.004	0.034	0.032	0.041	0.025	0.047	0.011	0.077	0.043	0.032	0.019	0.001
1987-89	0.022	0.081	-0.011	0.005	-0.017	0.038	0.046	-0.022	0.014	0.045	0.018	0.098	0.076	-0.000	0.010	-0.005
1988-90	0.036	0.101	0.013	0.015	0.003	0.069	0.064	-0.033	0.034	0.043	0.019	0.107	0.085	0.006	0.003	0.026
1989-91	0.046	0.124	0.038	0.024	0.034	0.104	0.091	-0.057	0.036	0.001	0.038	0.100	0.079	0.012	0.007	0.051
1990-92	0.074	0.115	0.091	0.038	0.056	0.169	0.125	-0.008	0.097	0.010	0.069	0.131	0.106	0.033	0.028	0.091
1991-93	0.081	0.192	0.111	0.043	0.027	0.169	0.134	-0.098	0.110	-0.004	0.066	0.172	0.134	-0.005	0.037	0.110
1992-94	0.080	0.225	0.069	0.004	0.014	0.164	0.071	-0.163	0.123	0.038	0.058	0.171	0.088	-0.006	0.008	0.098
1993-95	0.049	0.277	0.059	-0.037	-0.009	0.140	0.059	-0.138	0.105	0.053	0.003	0.138	0.023	-0.052	-0.028	0.098
1994-96	0.037	0.260	0.068	-0.071	-0.043	0.159	0.066	-0.078	0.094	0.094	-0.006	0.154	-0.030	-0.047	-0.057	0.125
1995-97	0.034	0.257	0.125	-0.027	-0.058	0.133	0.110	-0.076	0.098	0.100	-0.015	0.158	0.024	-0.067	-0.055	0.168
1996-98	0.065	0.242	0.134	0.020	-0.026	0.174	0.147	-0.148	0.127	0.096	0.017	0.293	0.053	-0.067	-0.017	0.204
1997-99	0.086	0.317	0.147	0.037	0.017	0.195	0.184	-0.236	0.134	0.083	0.063	0.296	0.090	-0.100	0.013	0.232
1998-2000	0.109	0.355	0.175	0.066	0.028	0.267	0.227	-0.325	0.145	0.097	0.075	0.388	0.114	-0.186	0.045	0.263
1999-01	0.128	0.427	0.197	0.068	0.064	0.300	0.233	-0.318	0.175	0.132	0.085	0.367	0.142	-0.111	0.066	0.293
2000-02	0.146	0.486	0.224	0.103	0.075	0.308	0.240	-0.399	0.200	0.161	0.050	0.402	0.160	-0.075	0.082	0.308
2001-03	0.176	0.592	0.256	0.121	0.101	0.357	0.259	-0.361	0.232	0.191	0.046	0.443	0.194	-0.026	0.097	0.337
2002-04	0.204	0.587	0.235	0.145	0.147	0.387	0.274	-0.343	0.224	0.236	0.085	0.450	0.222	-0.086	0.145	0.373
2003-05	0.223	0.537	0.187	0.145	0.210	0.433	0.296	-0.187	0.225	0.264	0.101	0.475	0.259	-0.054	0.187	0.418
2004-06	0.245	0.424	0.200	0.139	0.276	0.431	0.339	-0.094	0.231	0.265	0.142	0.455	0.297	-0.032	0.231	0.468
2005-07	0.271	0.417	0.297	0.187	0.308	0.447	0.367	-0.090	0.257	0.265	0.143	0.480	0.337	0.033	0.254	0.501

Source: Author's calculations

Table 5: Estimates of parameter β for India and states: 1985-2007.

Period	India	Andhra Pradesh	Assam	Bihar	Gujarat	Haryana	Karnataka	Kerala	Madhya Pradesh	Maharashtra	Orissa	Punjab	Rajasthan	Tamil Nadu	Uttar Pradesh	West Bengal
1985-87	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1986-88	1.015	1.021	0.971	1.015	1.008	0.996	0.988	0.978	1.015	0.983	1.027	0.972	1.007	1.031	1.004	1.007
1987-89	1.026	1.047	0.976	1.025	1.022	1.009	0.995	1.000	1.055	0.998	1.035	0.991	1.018	1.056	0.999	1.013
1988-90	1.021	1.084	0.947	1.050	1.023	1.019	1.017	1.014	1.059	1.033	1.039	1.055	1.018	1.089	0.997	1.021
1989-91	1.019	1.105	0.950	1.060	1.022	1.031	1.034	1.066	1.065	1.097	1.013	1.141	1.025	1.114	1.006	1.001
1990-92	1.017	1.119	0.925	1.068	1.035	1.000	1.061	1.131	1.045	1.113	1.021	1.123	1.020	1.156	0.999	1.002
1991-93	1.030	1.121	0.939	1.100	1.055	1.016	1.072	1.204	1.061	1.116	1.036	1.096	1.047	1.190	1.011	1.001
1992-94	1.080	1.148	0.915	1.127	1.088	1.030	1.107	1.266	1.040	1.099	1.029	1.096	1.034	1.178	1.007	1.040
1993-95	1.094	1.169	0.886	1.157	1.077	1.056	1.121	1.201	1.056	1.081	1.036	1.090	1.055	1.175	1.017	1.068
1994-96	1.095	1.242	0.870	1.158	1.081	1.068	1.161	1.180	1.050	1.086	1.053	1.070	1.043	1.192	1.016	1.100
1995-97	1.071	1.336	0.893	1.183	1.073	1.088	1.214	1.184	1.111	1.089	1.103	1.087	1.083	1.244	1.036	1.145
1996-98	1.075	1.459	0.913	1.162	1.091	1.111	1.233	1.282	1.109	1.118	1.110	1.107	1.092	1.292	1.039	1.145
1997-99	1.088	1.412	0.915	1.151	1.095	1.119	1.266	1.350	1.131	1.144	1.098	1.235	1.104	1.316	1.058	1.148
1998-2000	1.090	1.416	0.918	1.140	1.107	1.111	1.265	1.408	1.109	1.161	1.088	1.218	1.116	1.409	1.062	1.124
1999-01	1.106	1.408	0.955	1.171	1.094	1.105	1.297	1.377	1.127	1.145	1.111	1.272	1.113	1.339	1.072	1.150
2000-02	1.122	1.468	0.982	1.187	1.115	1.123	1.319	1.448	1.141	1.125	1.159	1.266	1.139	1.328	1.080	1.200
2001-03	1.128	1.466	0.984	1.196	1.131	1.137	1.364	1.414	1.162	1.121	1.186	1.259	1.135	1.321	1.084	1.245
2002-04	1.121	1.473	0.914	1.138	1.136	1.120	1.386	1.419	1.152	1.146	1.104	1.242	1.134	1.333	1.079	1.231
2003-05	1.121	1.464	0.896	1.126	1.091	1.136	1.351	1.341	1.154	1.155	1.077	1.163	1.118	1.323	1.092	1.195
2004-06	1.125	1.530	0.882	1.111	1.079	1.161	1.366	1.317	1.130	1.195	1.072	1.131	1.099	1.305	1.101	1.185
2005-07	1.164	1.606	0.916	1.172	1.069	1.275	1.383	1.327	1.166	1.231	1.131	1.115	1.131	1.342	1.147	1.241

Source: Author's calculations

Table 6: Mean age at child bearing of currently married women in India and states: 1985-2007.

Period	India	Andhra Pradesh	Assam	Bihar	Gujarat	Haryana	Karnataka	Kerala	Madhya Pradesh	Maharashtra	Orissa	Punjab	Rajasthan	Tamil Nadu	Uttar Pradesh	West Bengal
1985-87	26.13	24.66	25.27	28.27	25.79	25.70	24.80	23.38	26.50	24.42	25.29	25.23	27.50	23.35	27.99	25.33
1986-88	25.97	24.39	25.34	28.14	25.79	25.54	24.71	23.30	26.32	24.28	25.15	24.97	27.22	23.10	27.86	25.31
1987-89	25.93	24.15	25.38	28.18	25.81	25.48	24.62	23.49	26.24	24.24	25.09	24.82	26.99	23.16	27.92	25.31
1988-90	25.87	23.93	25.34	28.05	25.70	25.30	24.46	23.48	26.13	24.13	25.07	24.61	26.94	23.03	27.98	25.12
1989-91	25.82	23.76	25.19	27.99	25.56	25.11	24.28	23.38	26.09	24.11	25.06	24.41	26.96	22.95	27.93	25.06
1990-92	25.69	23.76	25.00	27.87	25.43	24.89	24.06	22.99	25.82	24.04	24.88	24.34	26.80	22.76	27.82	24.87
1991-93	25.60	23.46	24.84	27.75	25.50	24.85	23.98	23.05	25.70	24.10	24.84	24.26	26.57	22.80	27.74	24.77
1992-94	25.45	23.27	25.14	27.91	25.47	24.84	24.17	23.09	25.69	23.98	24.91	24.29	26.86	22.85	27.92	24.71
1993-95	25.56	23.02	25.28	28.06	25.62	24.90	24.21	23.22	25.74	23.98	25.15	24.44	27.17	23.03	28.09	24.61
1994-96	25.62	22.90	25.30	28.26	25.76	24.81	24.07	23.06	25.82	23.81	25.15	24.40	27.49	22.96	28.26	24.39
1995-97	25.72	22.70	24.89	27.94	25.86	24.88	23.75	23.01	25.64	23.81	25.04	24.35	27.10	22.87	28.18	24.06
1996-98	25.54	22.48	24.78	27.70	25.65	24.63	23.53	22.91	25.49	23.76	24.86	23.76	26.92	22.73	27.95	23.91
1997-99	25.40	22.36	24.71	27.63	25.47	24.51	23.30	22.98	25.40	23.75	24.69	23.49	26.69	22.79	27.73	23.77
1998-2000	25.28	22.24	24.60	27.49	25.39	24.21	23.14	23.11	25.40	23.64	24.65	23.21	26.53	22.75	27.54	23.70
1999-01	25.14	22.11	24.38	27.41	25.27	24.10	23.05	23.22	25.21	23.58	24.54	23.20	26.38	22.72	27.39	23.50
2000-02	25.02	21.87	24.16	27.16	25.16	24.05	22.99	23.27	25.06	23.56	24.57	23.11	26.23	22.63	27.26	23.33
2001-03	24.86	21.64	24.00	27.03	25.01	23.85	22.84	23.27	24.87	23.50	24.51	22.98	26.06	22.53	27.16	23.11
2002-04	24.74	21.63	24.29	26.98	24.78	23.74	22.75	23.14	24.94	23.23	24.58	23.00	25.92	22.68	26.89	23.02
2003-05	24.65	21.79	24.56	26.99	24.60	23.53	22.75	22.83	24.92	23.09	24.59	23.05	25.76	22.59	26.61	22.93
2004-06	24.54	21.96	24.55	27.06	24.35	23.48	22.58	22.55	24.95	22.96	24.40	23.18	25.61	22.59	26.34	22.78
2005-07	24.34	21.89	24.01	26.67	24.27	23.25	22.45	22.52	24.75	22.89	24.22	23.11	25.36	22.29	26.14	22.53

Source: Author's calculations

Table 7: Proportion (per cent) of currently married women using a family planning method.

Country/State	Any method	Any Modern Method	Female Sterilisation	Male Sterilisation	Pill	IUD	Condom	Traditional methods	Permanent methods	Modern spacing methods	Traditional spacing methods	Permanent methods as proportion to all methods	Spacing methods as proportion to all methods
Andman & Nikobar	72.7	66.2	46.3	1.1	7.6	4.0	7.2	6.3	47.4	18.8	6.3	65.4	34.6
Andhra Pradesh	65.3	65.1	60.3	3.9	0.3	0.4	0.4	0.2	64.2	1.1	0.2	98.0	2.0
Arunachal Pradesh	52.0	49.0	30.6	0.5	10.9	3.7	3.1	2.9	31.1	17.7	2.9	60.2	39.8
Assam	49.7	31.2	10.7	0.2	16.5	1.5	2.3	18.3	10.9	20.3	18.3	22.0	78.0
Bihar	32.4	28.4	25.0	0.3	1.1	0.4	1.4	3.6	25.3	2.9	3.6	79.6	20.4
Chandigarh	76.9	71.4	29.7	0.9	2.9	6.3	31.6	5.5	30.6	40.8	5.5	39.8	60.2
Chhattisgarh	49.7	47.1	41.3	1.8	1.7	0.6	1.6	1.4	43.1	3.9	1.4	89.0	11.0
Daman & Dieu	62.4	51.9	41.3	0.2	2.4	1.4	6.7	10.4	41.5	10.5	10.4	66.5	33.5
Dadra & Nagar Haveli	51.6	48.7	36.6	4.8	1.5	1.3	4.4	2.9	41.4	7.2	2.9	80.4	19.6
Delhi	66.1	55.5	22.9	0.6	4.9	5.0	21.9	10.5	23.5	31.8	10.5	35.7	64.3
Goa	45.0	35.9	23.1	0.2	1.6	1.8	9.0	9.1	23.3	12.4	9.1	52.0	48.0
Gujarat	61.6	54.3	41.5	1.7	3.0	3.5	4.5	7.2	43.2	11.0	7.2	70.4	29.6
Haryana	62.0	54.5	36.3	1.0	2.8	3.8	10.4	7.4	37.3	17.0	7.4	60.5	39.5
Himachal Pradesh	70.2	68.1	45.1	7.1	3.4	1.3	11.0	2.1	52.2	15.7	2.1	74.6	25.4
Jammu & Kashmir	54.1	41.2	24.0	1.2	4.4	5.0	9.4	12.1	25.2	18.8	12.1	44.9	55.1
Jharkhand	34.9	30.8	24.6	0.4	3.3	0.5	2.0	2.7	25.0	5.8	2.7	74.6	25.4
Karnataka	61.8	60.8	56.7	0.2	0.9	1.8	1.3	1.0	56.9	4.0	1.0	91.9	8.1
Kerala	62.3	53.1	46.1	0.4	0.4	2.0	4.2	9.0	46.5	6.6	9.0	74.9	25.1
Madhya Pradesh	56.2	53.1	45.1	0.8	1.9	0.5	4.6	2.9	45.9	7.0	2.9	82.3	17.7
Maharashtra	63.8	62.6	51.5	2.5	2.3	1.6	4.7	1.1	54.0	8.6	1.1	84.8	15.2
Manipur	44.9	19.6	5.0	0.3	5.4	5.3	3.2	25.2	5.3	13.9	25.2	11.9	88.1

Country/State	Any method	Any Modern Method	Female Sterilisation	Male Sterilisation	Pill	IUD	Condom	Traditional methods	Permanent methods	Modern spacing methods	Traditional spacing methods	Permanent methods as proportion to all methods	Spacing methods as proportion to all methods
Meghalaya	22.9	16.8	8.2	0.2	5.1	0.9	2.2	5.8	8.4	8.2	5.8	37.5	62.5
Mizoram	53.9	53.1	35.9	0.2	11.6	4.3	1.2	0.4	36.1	17.1	0.4	67.4	32.6
Orissa	47.0	37.8	25.6	1.0	9.0	0.3	1.8	8.6	26.6	11.1	8.6	57.5	42.5
Puducherry	59.4	57.5	48.7	1.7	0.5	2.3	4.3	1.8	50.4	7.1	1.8	85.0	15.0
Punjab	69.3	62.9	32.6	0.6	4.1	6.2	19.4	6.3	33.2	29.7	6.3	48.0	52.0
Rajasthan	57.0	54.0	40.5	0.5	3.2	1.4	8.3	2.8	41.0	12.9	2.8	72.3	27.7
Sikkim	71.1	61.1	21.8	5.3	18.9	7.0	4.3	9.9	27.1	30.2	9.9	40.3	59.7
Tamil Nadu	59.9	57.8	53.8	0.2	0.2	2.0	1.6	2.0	54.0	3.8	2.0	90.3	9.7
Tripura	68.5	40.8	13.9	0.1	23.1	1.0	2.1	27.4	14.0	26.2	27.4	20.7	79.3
Uttar Pradesh	38.4	26.7	16.5	0.2	1.7	1.0	7.1	11.4	16.7	9.8	11.4	44.1	55.9
Uttarakhand	60.1	57.7	39.5	2.0	4.1	1.0	10.9	2.3	41.5	16.0	2.3	69.4	30.6
West Bengal	72.7	53.3	33.7	0.3	14.7	0.7	3.6	18.8	34.0	19.0	18.8	47.4	52.6
India	54.0	47.1	34.0	1.0	4.2	1.9	5.9	6.7	35.0	12.0	6.7	65.2	34.8

Source: District Level Household Survey, 2007-08