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Exploring tempo-quantum interplay in the period fertility trends in India

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Abstract: The postponement or advancement of births increases or decreases mean age at childbearing which in turn, distorts period TFR. This is true for any population undergoing fertility transition. However, despite the ubiquity of strong evidences of postponement of births across countries, research so far on tempo effects is disproportionately focused on developed nations with almost neglected focus in the developing countries. In attempt to fulfill this research gap, this study examines role of the tempo effects in period fertility trends in India. Using merged birth histories of three rounds of NFHS (19992-93, 1998-99, 2005-06), in this paper, we estimated fertility trends and the mean ages at child bearing by birth orders for the past 25 years (1981-2006) in India. Results indicate that cumulated fertility before age 40 in India declined from around 4.5 to 2.7 during 1981-2006 with urban fertility levels being lower than rural areas. Fertility trends by birth order show that fertility declined for all births orders with relatively higher decline for higher order births. The mean age at first birth increased by almost 0.82 years with urban areas showing an increase of 1.1 years during 1981-2006. Results reveal considerable tempo distortions in the period TFRs in India which are more pronounced since 1990s. The second order births have witnessed higher postponement than first order births.

Introduction:

Fertility estimates are among the most widely used demographic indicators among policy makers, family planning program managers and researchers across the world. Among numerous measures of period fertility, total fertility rate (TFR) is most widely used measure of fertility among the class of measures which are constructed on the basis of synthetic cohorts (Rallu and Toulemon, 1994). The dominance of TFR over other synthetic cohort measures is primarily driven by fact that calculation of TFR requires relatively less detailed data compared with other measures which require detailed data on the age and parity composition of women in their construction.

Despite its ubiquitous use in demographic analysis, literature on the fertility analysis points to several limitations of TFR. Previous research points out that TFR provides distorted picture of current fertility levels due to: changes in the timing of births (tempo effects); parity composition; duration of marriage or entry into sexual union (Ní Bhrolcháin, 1992; Rallu and Toulemon, 1994).

The distortions in TFR caused by changes in timing of births (the tempo effects) are most pertinent. The 'tempo effects' refers to an inflation or deflation of the period incidence of a demographic event (e.g., births, marriages, deaths) resulting from a rise or fall in the mean age at which the event occurs. The tempo effects in TFR have been acknowledged in demographic literature for long (Whelpton, 1945 1954; Ryder, 1964 1980), but no formal attempt had been made to correct TFR for tempo effects until Bongaarts and Feeny (1998). Bongaarts and Feeny (1998) derived an adjusted TFR which adjusts for annual in the mean age at child bearing under the assumption that variance of fertility schedule does not change. This adjusted TFR provides a measure of quantum of fertility. However, Bongaarts and Feeny's formulations have been criticized by the researchers because of its restrictive assumptions (Kim and Schoen, 2000; Imhoff and Keilman, 2000). Kim and Schoen (2000) concluded that Bongaarts-Feeney measure performs as claimed only under the assumption of a constant linear shift affecting every cohort of reproductive age otherwise this is very unstable and if the assumption is violated B-F measure mischaracterizes that levels and trends of fertility. Bongaarts and Feeny (2000) replied to the reservations expressed by Kim and Schoen (2000) about adjusted TFR by arguing that adjusted TFR does not attempt to estimate completed fertility of actual cohorts as comprehended by Kim and Schoen (2000); they further counter-argued the questions raised by Imhoff and Keilman (2000) about non consideration of changing variance of fertility schedule at different birth order by demonstrating that change in the variance of United States fertility schedule for different birth orders during 1917-1991 has been negligible.

Zeng and Land (2001) supported Bongaarts and Feeny's argument by conducting a sensitivity analysis of the assumptions on which Bongaarts and Feeny (1998) based their derivation of tempo adjusted TFR. In their analysis, Zeng and Land (2001) used extension of Brass Relational Gompertz Fertility Model and concluded that tempo adjusted TFR by Bongaarts and Feeny (1998) generally gives robust estimates except in some abnormal conditions. Kohler and Philipov (2001) attempted to improve the Bongaarts and Feeny's measure by relaxing the assumption of invariant fertility schedule. Further, On the basis of adjusted child bearing intensities Kohler and Ortega (2002) derived the *index of period fertility* which gives completed fertility of women who experience current tempo adjusted child bearing intensities. However, despite limitations, the B-F approach for tempo adjustment can be considered to be the first approximation to the tempo effects and is being used because of its simplicity of calculations.

Despite the theoretical feasibility of the tempo effects in the fertility trends in any population passing through fertility transition, most studies on fertility postponement and its effects on period TFR in terms of tempo distortions have so far focused on the developed world (Bongaarts and feeny, 1998; Philipov and Kohler 2001, Kohler and Ortega, 2002; Zeng and Land, 2001; Sobotka, 2004). Almost all the studies have used analysis of tempo effects in attempts to explain the prolonged below replacement level fertility observed in the European countries (Sobotka, 2008, Bongaarts and Sobotka, 2012; Kohler and Ortega, 2002a). There is virtually no study in the developing country which has explored tempo effects in the developing countries except Bongaarts (1999). Using data from WFS and DHS surveys, Bongaarts (1999) demonstrated that the fertility trends observed in many of the developing countries are likely to be distorted by the tempo effects.

The assessment of tempo distortions in the period fertility in the developing countries which are undergoing fertility transition assume considerable significance as there is a need to examine realistic progress in fertility transition. Further, in conjunction with the family planning programmes, the governments in the developing countries could promote the tempo affecting policies like increasing legal age at marriage to achieve the goal of replacement level fertility.

India's fertility regime has evolved from the one with fertility levels among the highest in the world to near replacement level over the last 50 years. During first half of 20^{th} century, fertility levels in India were hovering around six births per women while the onset of fertility decline took place in mid 1960s, but no major decline in fertility was registered until early 1980s. Rele (1987) estimated that the total fertility rate in India declined from 5.8 in 1951-56 to 4.8 in 1976-81 but TFR was in the range of 5 births per woman until 1908s. Following this, the estimates from the sample registration system, 2010 show that TFR at the national level declined from 5 births per woman in 1971-75 to 2.5 in 2010.

The past estimates used to assess fertility trends suffer from the tempo distortions by the changes in the mean age of mothers at child birth. To date, there was no major study that has attempted to assess the true progress in fertility decline in India by adjusting for the tempo effects. In this background, the main objective of this study was to examine trends in the mean ages of mothers at child birth or different order and assess the tempo distortions in the period fertility trends due these factors. This is a fresh attempt to estimate period TFRs and TFRs by birth orders using pooled birth histories from the three rounds of NFHS, the Indian version of DHS.

Methods:

Data Sources

Pooled birth histories of the three rounds of nationally representative national family health survey (NFHS) conducted in 1992-93, 1998-99 and 2005-06 successively have been used to construct trends in period fertility measures. The NFHS along with the household information provides information on the birth histories of women in the reproductive ages. The birth history data was collected for ever married women of age 13-49 in NFHS-1; for ever-married women of age 15-49 in NFHS-2 and; for all women of age 15-49 in NFHS-3.

Fertility estimation from the NFHS

The first part of the analysis of this paper consists of estimation of period fertility trends using the pooled data from the three rounds of NFHS. Each of the three successive rounds of NFHS contains an extended (full) birth history data for women in the reproductive ages. The availability of full birth histories from three successive NFHS rounds with substantial overlaps among them offers a unique opportunity to estimate fertility trends for a longer time period of time; over 25 years of 1981-2006 during which time most of fertility decline occurred in India. We seize the opportunity to merge the data from retrospective birth histories of the three rounds of NFHS. Thus, for some years there was data from only one of survey and for others data was available from all three surveys. The combined birth histories have been aggregated into a single event-exposure file with multiple periods of exposure and each period of exposure being each calendar year (From January 1st to December 31st). In the process, we have retained the normalized weights.

Since we do not have a common date of interview for all the women enumerated in a survey, the creation of event-exposure format data becomes difficult. Therefore, to overcome such computational difficulties, the data was censored to the 1st January before the beginning of the survey to obtain a single date of reference for all the women interviewed in a survey. The date of reference is taken to be 1st January, 1992 for women interviewed in NFHS-I, 1st January, 1999 for women interviewed in NFHS-II and 1st January 2006 for the women from NFHS-III. Further, using the person-period file, person years of exposures were calculated by single years of ages and calendar years and births were tabulated by the calendar years and ages of mothers. The age specific fertility rates can be obtained for each calendar year by dividing the births tabulated by age of mothers and calendar years by the person years of exposure for respective years.

It is notable here that due to limiting the age of respondents to be 49 years at the time of survey, the fertility rates cannot be calculated for all the ages in prior years of survey. Also, this sample is biased because the sample is representative of the women in the reproductive ages at the time of survey and it ignores the women who were in the reproductive ages in the past but not at the time of survey. This bias can be controlled to some extent by calculating the fertility up to ages for which the data is available. However, the bias is not removed completely because the calculation excludes the women of reproductive ages who died during the period.

The birth histories of women in the reproductive ages provide a full account of fertility rates up to age 40 for the 10 years prior to the survey, and since most of births (usually more than 90 percent) occur before age 40, the cumulated fertility up to age 40 can be effectively used as an approximation to the TFR. Therefore, the period of observation for estimating fertility measures is effective from 1st January, 1981 to 1st January 2006 representing a total duration of 25 years.

The computation of age specific fertility rates for each calendar year from birth histories is not advised. Therefore, for calculation of fertility trends, we followed a five year period of exposure as suggested in DHS guide. From the exposures computed by single year age groups of women and calendar years, the five years of exposures can be computed in two ways. First is to split the whole observation period (1981-2006) into mutually exclusive quinquennial periods and obtain exposure for each mutually exclusive period by adding exposures of five successive calendar years in each period. The second approach would be to obtain exposures moving quinquennium of successive calendar years sum of exposures with one year shift. We follow, the later approach, as it provides opportunity to examine the annual changes in the fertility rates without compromising the condition of five years period of exposure. Births by ages of mothers are calculated using the same procedure.

Estimation of Tempo effects

The analysis of tempo effects in period fertility trends starts with the measurement of changes in the timing of childbearing. The timing of childbearing refers to the mothers' age at child birth (Pressat 1985, p.191). Usually, the timing of births is measured by mean age at childbearing (MAC). The mean age at child bearing was used by Ryder in his analysis of demographic translation. However, researchers who have explored tempo effects for period fertility measures have recommended that the tempo effects should be measured through the mean age at births of different orders rather than using overall mean age at childbearing as later is not considered suitable for measurement of tempo distortions (Bongaarts and Feeny, 1998; Bongaarts, 1999; Hobcraft, 1996).

So, in this paper we estimate the mean ages at childbearing for different birth orders. We restrict the analysis to birth orders one, two, three and four plus. The mean ages at child bearing is estimated from the age order specific birth rates. The age order specific birth rates are defined as follows.

Order specific total fertility rates (TFRi): the order specific TFR (TFRi) is calculated as follows:

$$\mathrm{TFR_i} = \sum_{x=15}^{49} \mathrm{ASFR_i}\,(x) = \sum_{x} \frac{\mathrm{B_i}(x)}{\mathrm{P_f}(x,t)}$$

Where, $\mathrm{B_i}(x)$ is the number of live births of ith order to women aged x in a period t, $\mathrm{P_f}(x,t)$ is mid-period population of women aged x (exposure in our case) in period t. The conventional TFR is the sum of order specific TFR (TFRi).

$\mathrm{TFR} = \sum_i \mathrm{TFR_i}$, Where ‘i’ denotes birth order.

Once the age order specific birth rates and mean ages at childbearing are estimated for each period, the next step is to estimate the tempo effects using the Bongaarts and Feeny’s (1998) method. They derived an equation for adjusting the order specific TFR for the tempo effects. The equation is specified as follows:

$$\mathrm{adjTFR_i} = \frac{\mathrm{TFR_i}(t)}{1 - \mathrm{r_i}(t)}$$

Where $r_i(t)$ is the annual change in the mean age of the age specific fertility schedule of birth order 'i' during a given period `t'.

For the estimation of tempo effects, accurate measurement of mean ages of child bearing are required in order to have reliable estimates of tempo distortions in the period fertility. However, the estimates of mean ages from the fertility surveys are subjected biases of errors related to sampling, reporting etc. Also, since fertility from the survey data is estimated for five year interval, the measurement of annual change in the mean ages becomes difficult. Because, estimation of the annual change during the five year interval requires mean ages exactly at the start and end of the periods. Subtracting these two and dividing by 5 provides annual change in mean ages. Since, this information is not available from the DHS birth histories, we have used the methods suggested by Bongaarts & Feeny (1998) which give the annual change in TFR as follows: $r_i(t) = \frac{1}{2}[MAB_i(t+1) - MAB_i(t-1)]$

Results:

Fertility decline in India

This section presents the results of first part of this analysis consisting of estimation of total fertility rates from the pooled birth histories from three successive rounds of NFHS. Figures1a presents the cumulated fertility up to age 39 (TFR(40)) calculated using first approach that is calcualting fertility during mutually exclusive quinquennial periods of 1981-86 , 1986-91,…,2001-06 for urban, rural and total populations of India. The results reveal that fertility in India has declined from around 4.5 births per women before age 40 in 1981-86 to 2.75 in 2001-06 registering a decline of 1.8 births per woman during a span of 25 years. In the rural areas, the total fertility before age 40 declined from 4.8 in 1981-1986 to 3.05 in 2001-06 while in the urban areas it declined from 3.8 to 2.14 during the same period. It's worth noting here that the speed of fertility decline in rural and urban areas has been almost similar during the period 1981 to 2006 maintaining a difference of around .9 births per woman throughout the 25 years of observation. Urban areas have been clearly ahead of rural areas in fertility transition.

Figure 1b presents the estimates of cumulated fertility before age 40 for total population and rural and urban India using second approach which involved calculation of age specific exposures and events for moving quinquennial periods of calendar years with one year shift. The second approach has been facilitated by the fact that we calculated the event exposure file from the combined birth histories of successive surveys by every calendar year. One advantage of this approach compared with the first approach of calculating fertility for mutually exclusive quinquinnial periods is that it provides fairly reliable estimates of the annual change in the levels. Comparison of the estimates from the two approaches show that the estimates from these two approaches are same, but, the second approach is more useful as it facilitates assessment of annual change in the fertility rates and other derived indices such as mean and variance of fertility schedules. In the following sections, therefore, we examine results based on the second approach.

Figure1a: Estimated trends in TFR(40) for the mutually exclusive quinquennium of calendar years, India, 1981-2006.

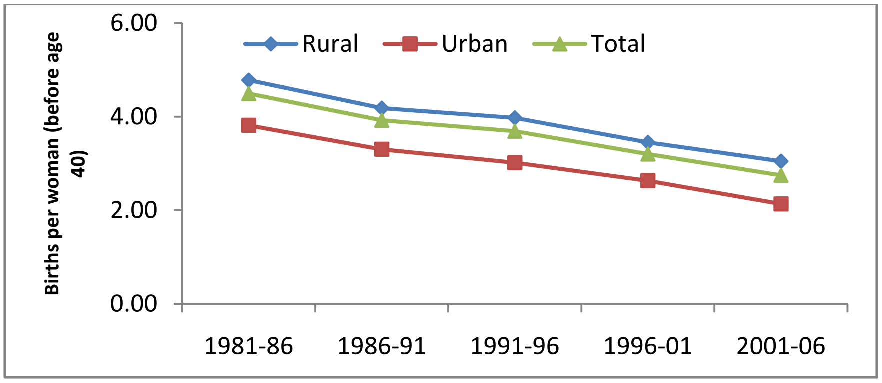
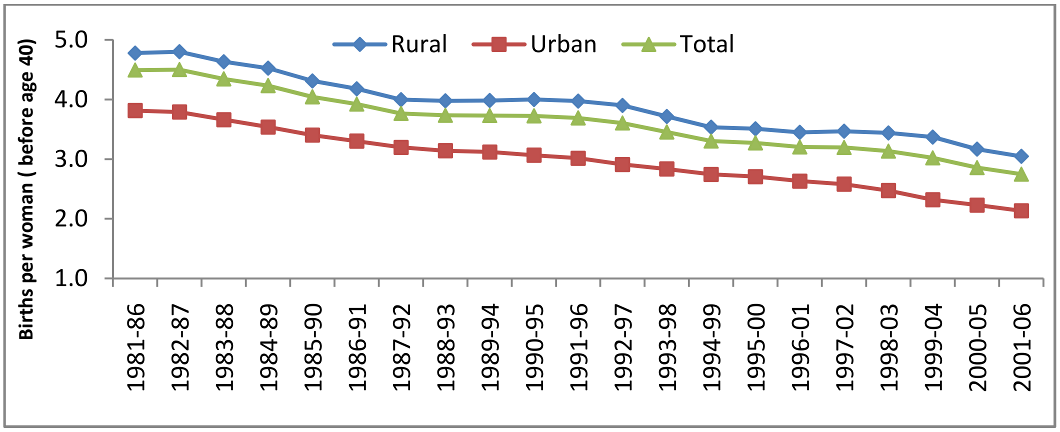


Figure1b: Estimated trends in TFR(40) for the moving quinquennium of calendar years with the shift of one calendar year, India, 1981-2006.



Birth order components of fertility in India

The figures 2a, 2b and 2c show the trends of cumulated fertility before age 40 ($TFR_i(40)$: i=1,2,3,4+) by birth orders 1, 2, 3 and 4+ for India, urban and rural India respectively. The estimates are provided for moving quinquenial periods. The total fertility rates for different birth orders are calculated from age specific fertility rates which include only the births of a given order in numerator while the denomination consists of total person years of exposure during a period. Results from the figures show that the $TFR_1(40)$ in India declined from 0.9 in 1981-86 to 0.77 in 2001-06 while during the same period $TFR_1(40)$ declined from .92 to 0.75 in the urban areas and in the rural areas it declined from 0.89 to 0.77. Such patterns suggest that the proportion of women in India remaining childless up to age 40 has increased from 10% in 1981-86 given the first child bearing propensity of 1981-86 to 23% percent provided that women follow the child bearing propensity of 2001-06. Over the course of fertility transition some increase in the proportion of women remaining childless is expected, but such a huge proportion of women remaining childless is very unlikely given the socio-cultural context of India and thus warrants some alternative explanations for these patterns. Scholars have shown that the tempo distortions in the period fertility due to increasing mean age at child bearing are most likely contributors to such patterns (Bongaarts and Feeny, 1998; Bongaarts, 1999).

Results show that the cumulated fertility before age 40 (TFR_2 (40)) of birth order 2 in India declined from 0.93 in 1981-86 to 0.73 in 2001-06 which implies that the proportion of women who will have second child before age 40 declined from 93% in 1981-86 to 73 % in 2001-06. In the urban areas, during same period, the TFR_2(40) declined from 0.90 to 0.67 while in the rural areas the decline was from 0.94 to 0.75; thus, urban areas in India have witnessed sharper decline in second order birth rates than rural areas. Such patterns of childbearing of second order are again very unlikely in the Indian context. The TFR_3(40) in India has declined 0.81 in 1981-86 to 0.45 in 2001-06 while in urban areas, during the same period, TFR_3(40) declined 0.71 to 0.31 and in the rural areas it declined from 0.85 to 0.52. A sharp decline in TFR(40) of order 4+ during 1981-2006 suggests a remarkable decline in the quantum of fertility as not much postponement of 4 or higher order births is expected. The TFR_{4+}(40) at the national level declined from 1.85 in 1981-96 to 0.80 in 2001-06. In the urban areas, during the same period, TFR_{4+}(40) declined from 1.29 to 0.40 and in the rural areas from 2.09 to 1.00.

A comparative assessment of TFRs by birth order leads to a very insightful inferences about the fertility transition in India. Results indicate that higher order births particularly birth or order 3 and 4+ have largest share in fertility decline during 1981-2006 with urban areas showing sharper decline. Such sharp decline could certainly be attributed to decline in the quantum of births. However, the decline in births rates for first and second order births which were relatively lower than those of higher order births ,though remarkable, envelop tempo distortions due to postponement of births along with the decline in actual decline in quantum of births. Another interesting feature of this decline is that during initial phase of our observation period, birth rates of first and second order were more or less similar, even higher rates for second order births in rural areas; however, the second order birth rates declined faster to be lower than the first order birth rates towards end of the observation period.

Figure2a: Estimated trends in the birth order components of period total fertility, India, 1981-2006

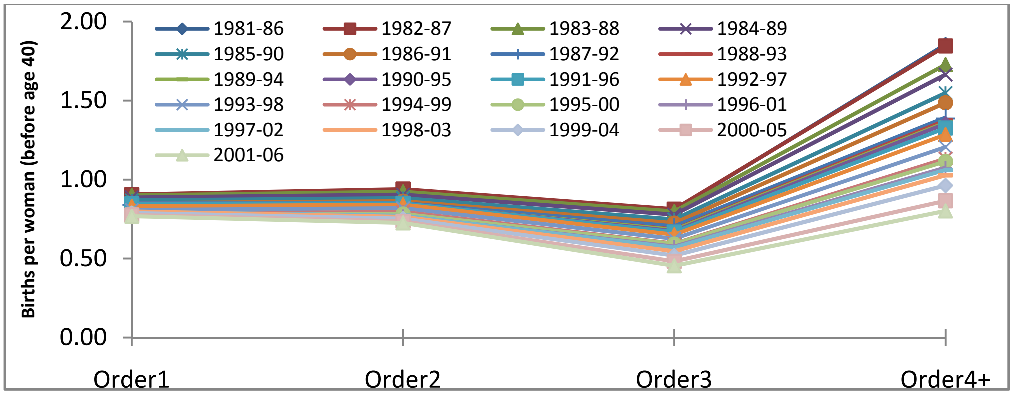


Figure2b: *Estimated trends in the birth order components of period total fertility, urban India, 1981-2006*

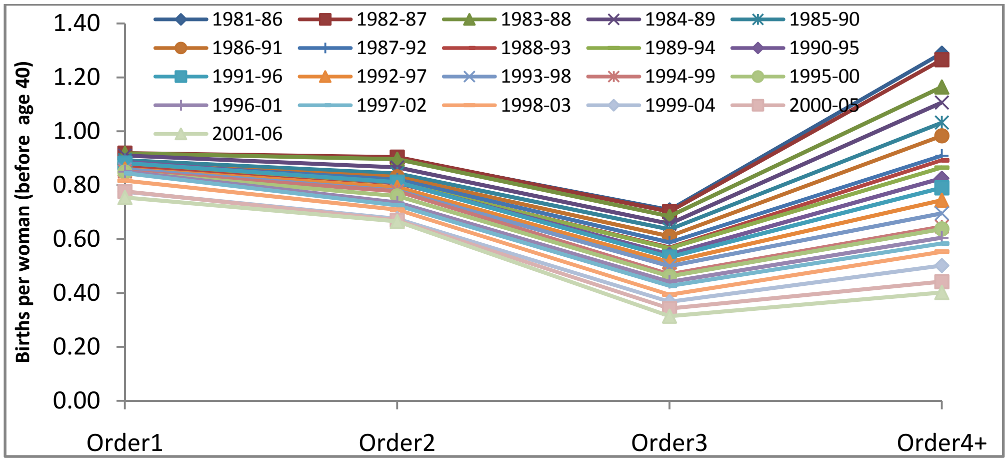
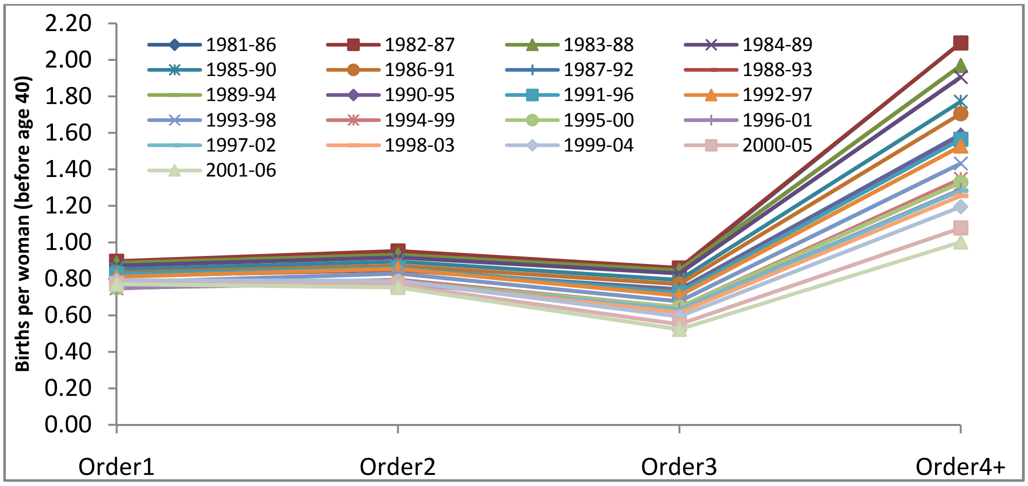


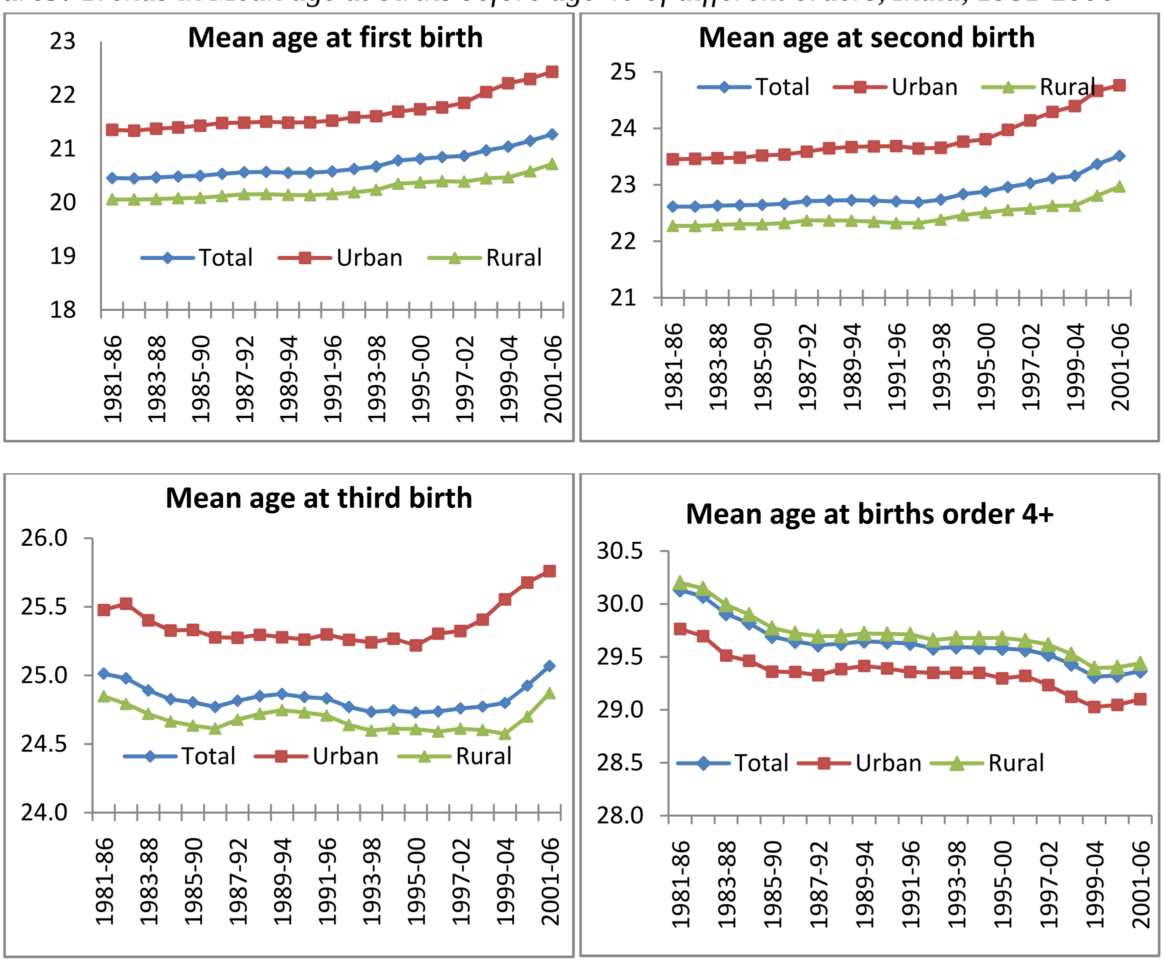
Figure2c: *Estimated trends in the birth order components of period total fertility, rural India,1981-2006*



Trends in the mean ages of childbearing in India

The tempo effects are first examined in terms of mean ages at child bearing for different birth orders. Figure3 presents the mean ages for different birth orders before age 40 calculated from age-order specific birth rates. The first panel of figure3 shows that the mean ages at the first childbearing rose steadily during the 1980s but increased rather sharply since 1990s in India and in the urban and rural areas. The mean age at the first birth before age 40 (MAFB40) in India increased from 20.45 in 1981-86 to 21.27 in 2001-05 showing an increase of 0.82 years during the period. In the urban areas, the MAFB40 increased from 21.35 years to 22.4 years, the increase of 1.05 years. This increase was however, slower in the rural areas as the MAFB40 increased from 20.06 in 1981-86 to 20.72 years in 2001-05. The mean age at childbearing for second birth depict patterns similar to those of first births, though, the increase had been a bit faster. For India as a whole, the increase in mean age at second birth was 0.9 years during the period. The urban areas experienced a much higher increase of 1.3 years compared to 0.7 years in rural areas during 1981-2006. The mean ages at child bearing for third order births followed fluctuating trends during 1981-2006. The mean ages at third birth show a decline during first half of 1980s; remained almost constant until late 1990s and shown modest increase afterwards. The mean age at child birth for 4+ orders declined for both rural and urban areas. In comparison to lower birth orders, the mean age at birth of order 4+ is higher in the rural areas than urban areas. Since the 4+ combines births or all 4 or higher order births, the declining trends in mean ages at birth of order 4+ is more likely due to decline in the higher order births. The downward pressure exerted on the mean ages due to decline in higher order birth is cannot be offset by the increases in the mean ages at birth of different birth orders which in turn result in the declining mean age at child birth. The lower mean age at child birth of order 4+ in the urban areas can also be explained by this analogy as urban areas are expected to have lower proportion of higher order births.

Figure3: Trends in Mean age at births before age 40 of different orders, India, 1981-2006



Tempo adjusted TFR (B-F Method)

Fertility of birth order 1

Figures 4a 4b and 4c show trends in the TFR and tempo adjusted TFR before age 40 of birth orders 1 for India, urban India and rural India respectively during 1981-86 to 2001-06. Results show evidences of tempo effects in the first order births in India and in both the urban and rural areas. However, tempo effect in the first order births are more pronounced only after 1990-95 and after 1997-02 the tempo effects are the highest registering the difference of around 0.15 births per woman before age 40 between observed and adjusted TFRs at the national level. The urban areas show slightly higher level of tempo effects in the fertility of birth order. The trends in the tempo adjusted TFR for order 1 in India and both in the rural and urban area are fluctuating mainly because of the fact the these estimates are based on the survey data and a very crude estimates of annual change in the mean ages at births. Despite these fluctuations, it's clear that fertility in India as measured by the TFRs is underestimated due to postponement of births.

Figure 4a: Trends in observed TFR and tempo adjusted TFR before age 40 for births of order1, India , 1981-2006

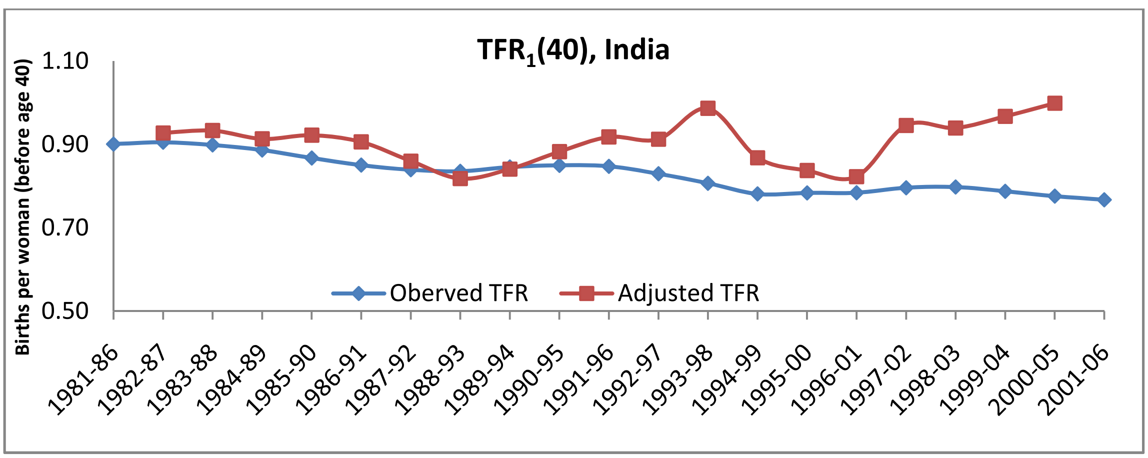


Figure 4b: Trends in observed TFR and Tempo adjusted TFR before age 40 for births of order1, India urban, 1981-2006

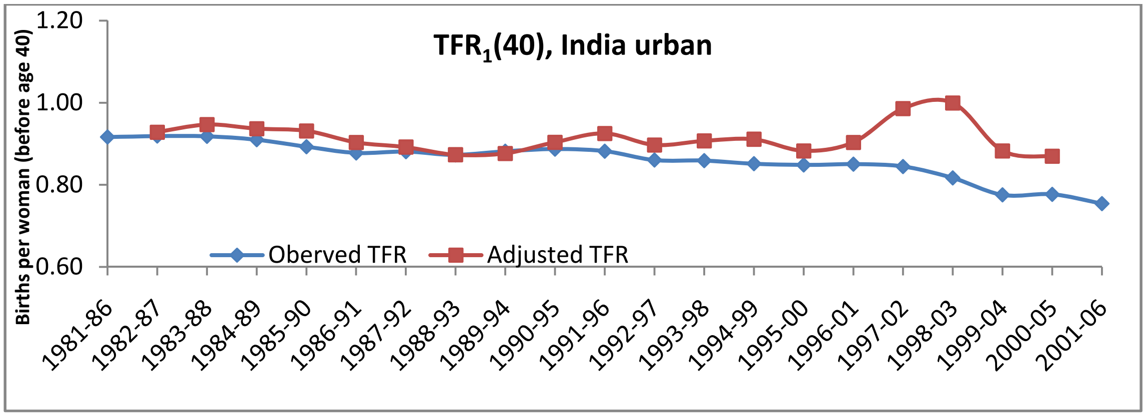
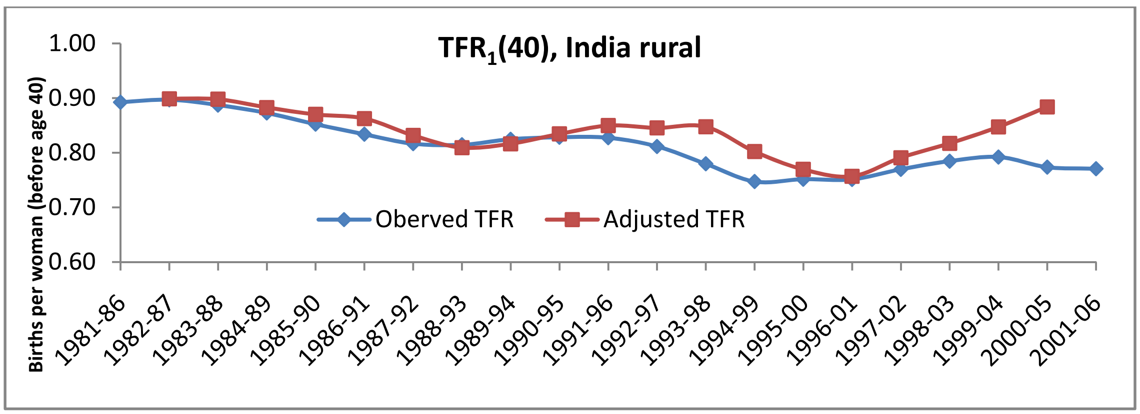


Figure 4c: Trends in observed TFR and Tempo adjusted TFR before age 40 for births of order1, India rural, 1981-2006



Fertility of birth order 2

Figures 5a, 5b and 5c summarize the TFR and tempo adjusted TFRs before age 40 of birth order 2 for India, urban and rural India during 1981-86 to 2001-06. Results suggest evidence of of tempo effects in the second order births. The trends in adjusted TFRs compared with conventional TFRs suggest modest tempo distortions during 1980s. Both in urban and rural areas, considerable tempo effects are evident in the second order TFRs after the period 1992-97. The tempo effects are higher in the urban areas suggesting higher postponement in the urban areas. Also advancement of births, though small, during mid of the observation period that is during later half of the 1980s are notable.

The trends in the adjusted TFRs of first and second order births implies that the postponement in the second order births started after the postponement in the first order births, but by the end of observation period overall postponement in second order births was higher than that in first order births.

Figure 5a: Trends in observed TFR and Tempo adjusted TFR before age 40 for births of order2, India , 1981-2006

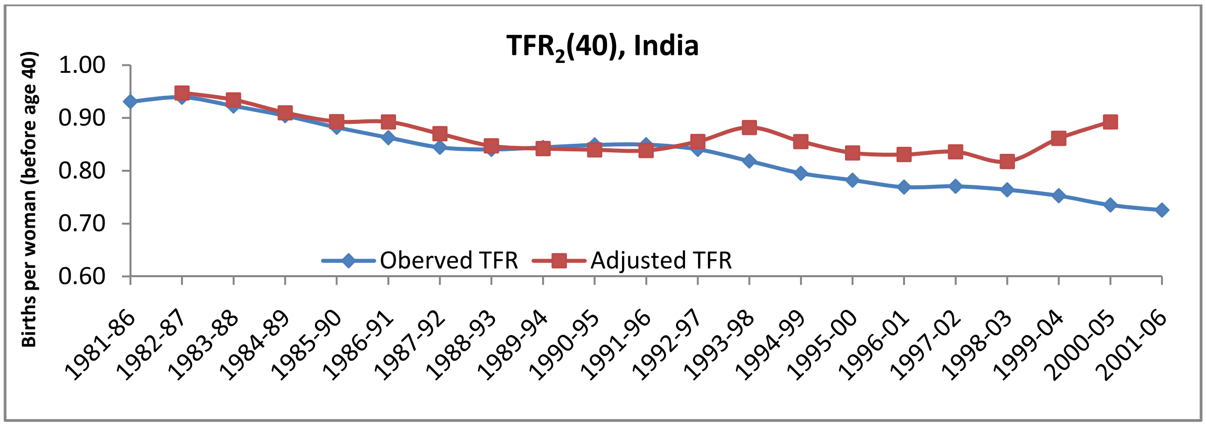


Figure 5b: Trends in observed TFR and Tempo adjusted TFR before age 40 for births of order2, India urban, 1981-2006

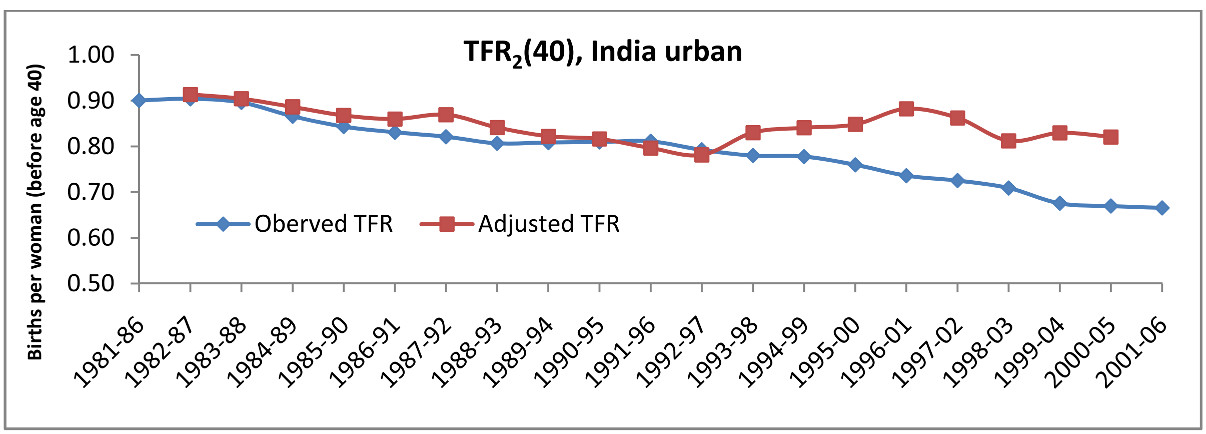
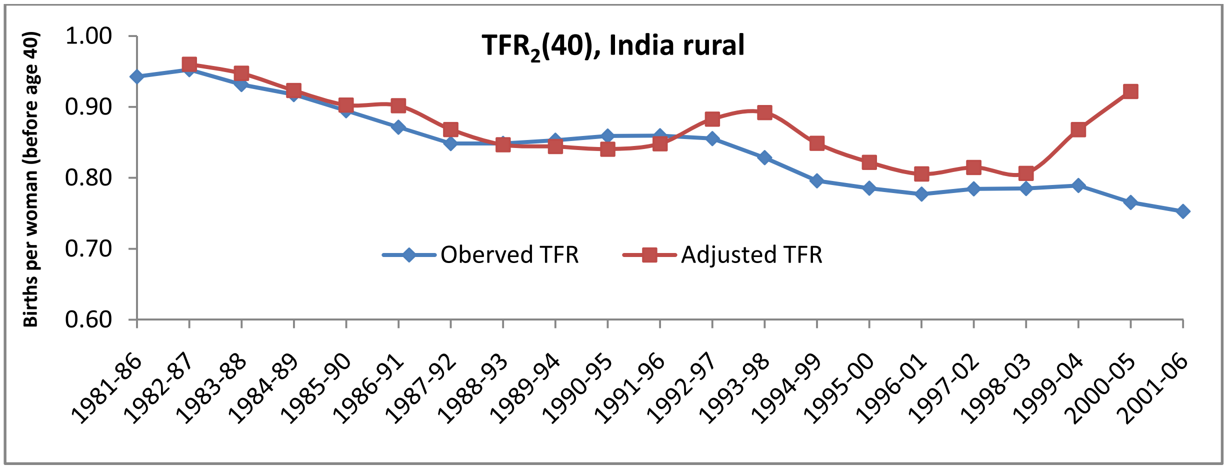


Figure 5c: Trends in observed TFR and Tempo adjusted TFR before age 40 for births of order2, India rural, 1981-2006



Fertility of birth order 3

Figures 6a, 6b and 6c present the trends in TFRs and tempo adjusted TFRs before age 40 of birth order3 for India, Urban and rural India respectively during, 1981-86 to 2001-06. Trends in tempo adjusted TFRs for order three were fluctuating around the measured TFRs for India and also for urban and rural areas. The figures depict less significant tempo effects in the TFR of order 3 during the observation period. However, the results suggest a modest advancement of births during early period and slight postponement of births towards end phase of period. Overall, the tempo effects in third order births seem to be negligible.

Figure 6a: Trends in observed TFR and Tempo adjusted TFR before age 40 for births of order3, India , 1981-2006

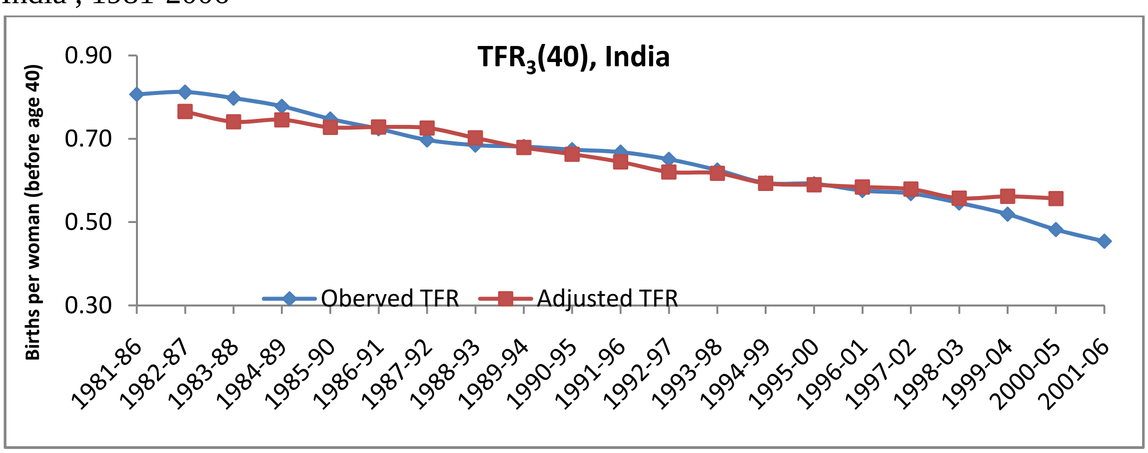


Figure 6b: Trends in observed TFR and Tempo adjusted TFR before age 40 for births of order3, India urban, 1981-2006

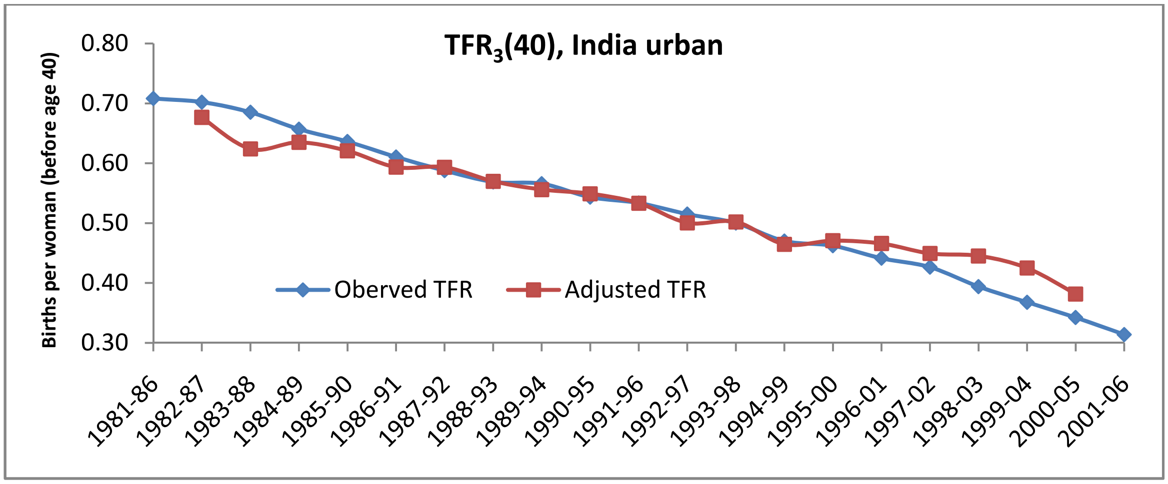
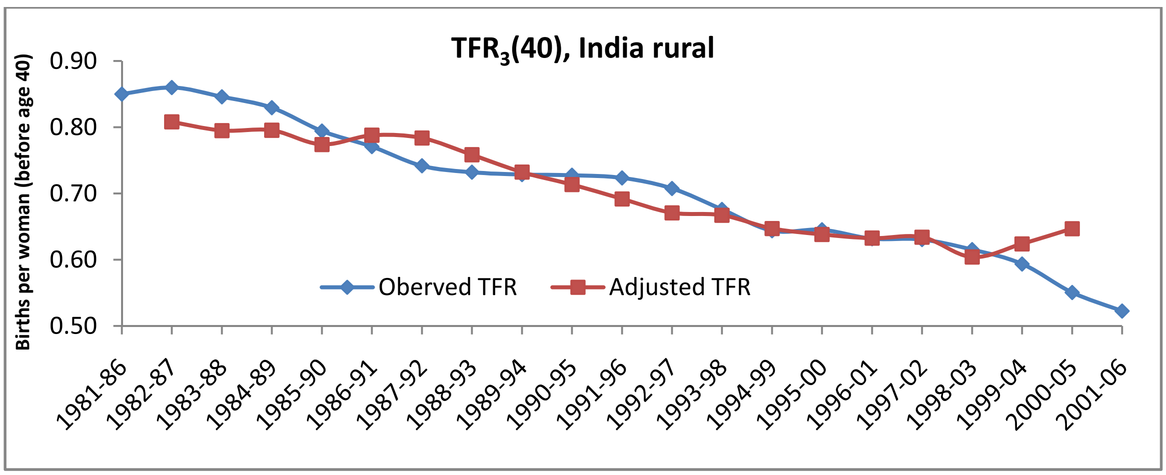


Figure 6c: Trends in observed TFR and Tempo adjusted TFR before age 40 for births of order3, India rural, 1981-2006



All birth orders combined: total fertility

The tempo effects in total fertility are summarized in the figures 7a, 7b, and 7c in terms of TFRs and tempo adjusted TFRs before age 40 for India, urban India and rural India respectively. The tempo adjusted TFR has been calculated by adding the tempo adjusted TFRs for births of order 1, 2 and 3 and unadjusted TFR for orders 4+. The adjusted TFRs for order 4+ are not estimated because we do not expect much postponement in the higher order births as this is evident from almost negligible tempo effects for third order births. Secondly, the sample was not sufficient to calculate TFRs for higher order births.

Figure 7a: Trends in observed TFR and Tempo adjusted TFR before age 40, India , 1981-2006

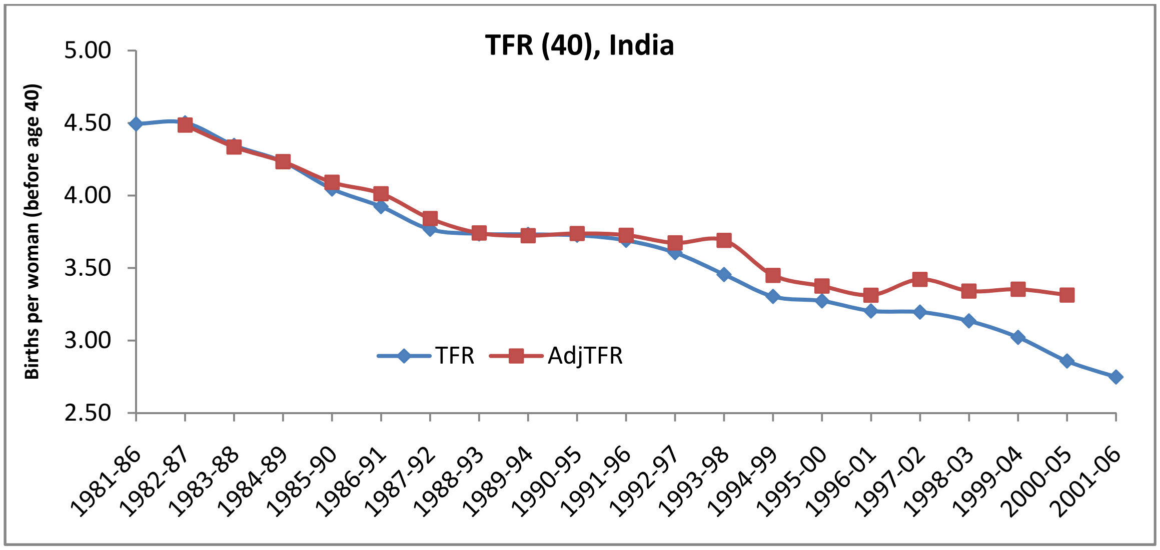


Figure 7b: Trends in observed TFR and Tempo adjusted TFR before age 40, India urban, 1981-2006

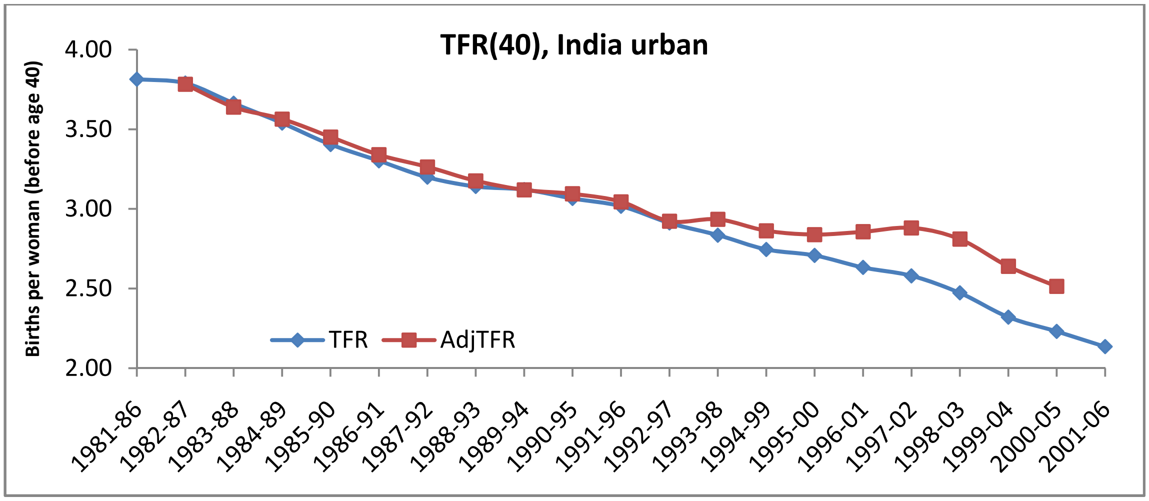
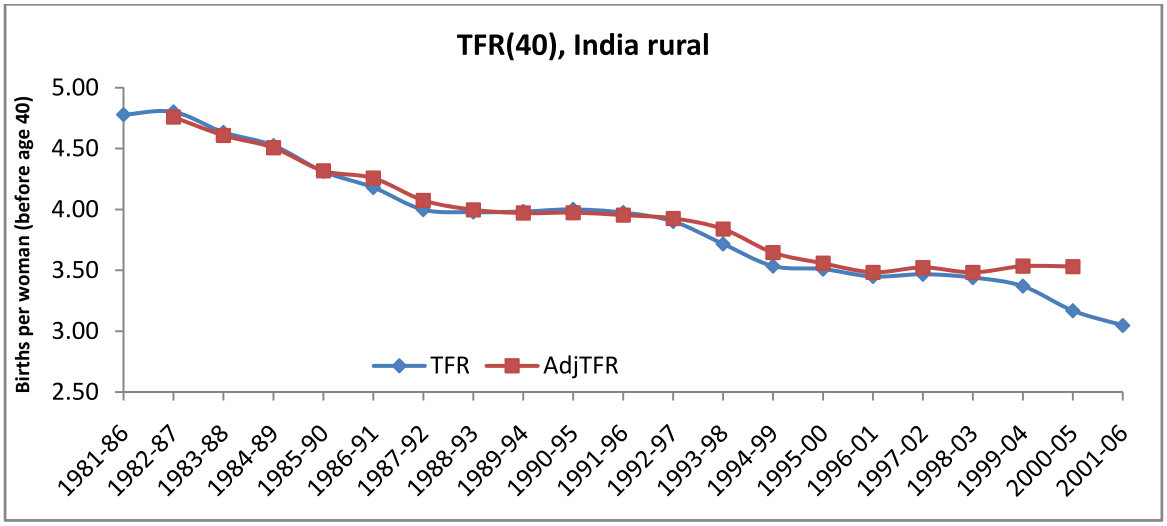


Figure 7c: Trends in observed TFR and Tempo adjusted TFR before age 40, India rural, 1981-2006



The results confirm the existence of tempo distortions in the period TFRs in India. However, the pronounced tempo effects are apparent after 1990s. During the period 1993-98, the difference between TFR and adjusted TFR was 0.24 which rose to 0.46 births per woman before age 40 in 2000-05 (figure 7a). Similarly, the tempo effect in the TFR before age 40 in the urban areas increased from 0.10 in 1993-98 to 0.28 births per woman in 2000-05. In the rural areas, the tempo effects are almost negligible except in the later periods of: 1999-2004 and 2000-2005. Overall, it may be concluded that the tempo effects in the national TFR trends are driven by the postponement of first and second order births which is more pronounced in the urban areas.

Conclusions:

The main objective of this paper was to examine the role of tempo effects in fertility trends in India by constructing fertility trends for India using the combined birth histories from the three rounds of NFHS. The analysis of this paper is subdivided into two parts: (i) reconstruction of the trends of fertility and its birth order components and (ii) assessment of the tempo effects in the fertility trends obtained from the first part of the analysis.

The results show that TFR before age 40 (TFR(40)) in India declined by almost 39% during 1981-2006. During the same period, urban areas registered a decline of 44% and rural areas a decline of 36% in TFR(40). Assessment of birth order components of fertility during this period sheds more insights about the fertility transition in India. The births of order 4-plus witnessed highest decline in India. It is evident that urban areas experienced much higher decline (68%) in TFR of order 4 than rural areas (52%). Overall results show that higher order births undergone more pronounced decline of fertility rates while the first order births showing least decline followed by second order births and third order births respectively.

Further, India has registered a decline of 15 and 21% respectively in the fertility of order 1 and 2 making TFR(40) of order 1 and 2 to decline 0.77 and 0.73 respectively in 2001-06. These figures show that almost 23% of women aged 15 in 2001-06 will remain childless and nearly 27% will have only one child given the propensity to reproduce of 2001-06. Such fertility patterns are very unlikely given the social and cultural background of India and require alternative explanations.

The increasing trends in the mean ages at births of different orders indicate a possible deflation in the TFR due to tempo effects. Trends also point to higher postponement of fertility in the urban areas compared with rural areas. The estimates of tempo effects in the period TFRs using B-F methods suggest the existence of a negative tempo effect; observed TFR is lower than what it would have been without postponement of births of different orders. One of the important features of tempo effects in the period fertility trends in India is that these effects affected TFRs significantly since the 1990s both in rural and urban areas for all the birth orders. The analysis also suggests much higher postponement of second order births compared with the first order births. The third order births depicted fluctuating but negligible trends in tempo effects during 1981-2006.

We conclude that fertility transition in India is characterized by both tempo effects and decline in the higher order births. The role of tempo effects in shaping fertility trends in India is substantial since the 1990s.

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