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Fertility and Family Planning in India, 1992-2021: Evidence from National Family Health Survey

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Abstract

We analyse the relationship between fertility and family planning in India based on the inter-state/Union Territory variation in total fertility rate and contraceptive prevalence using the data from different rounds of the National Family Health Survey. The paper observes that fertility family planning relationship in the country based on different rounds of the National Family Health Survey is essentially different and there is a regression discontinuity between the first three rounds and the last two rounds of the survey as regards the fertility reduction effect of family planning is concerned. Evidence from the first three rounds of the survey suggests that 10 per cent point increase in contraceptive prevalence accounted for a decrease of 0.43 points in *TFR* whereas evidence from the last two rounds of NFHS suggests that 10 per cent point increase in contraceptive prevalence was associated with a decrease of 0.13 points in *TFR*. The paper also discusses policy and programme implications of the weakening of fertility and family planning relationship in the country.

Introduction

Contraceptive use is one of the proximate determinants of fertility (Davis and Blake, 1956; Bongaarts, 1978; Bongaarts, 2015; Stover, 1998). The association between contraceptive use, measured in terms of contraceptive prevalence (CPR) and fertility, measured in terms of total fertility rate (TFR), has been found to be the strongest among different proximate determinants of fertility based on the cross-country data. This relationship suggests that every 15 per cent points increase in CPR is, on average, associated with a decrease of 1 point in TFR (Bongaarts, 1984; Mauldin and Segal, 1988; Ross and Frankenberg, 1993; Tsui, 2001; Westoff, 1990; United Nations, 2000). In recent years, however, this relationship appears to have weakened. The increase in CPR in many countries has been found to be associated with less than expected decrease in TFR (Westoff and Bankole, 2001; Bongaarts, 2015; 2017; Jain et al, 2014; Adamchack and Mbizvo, 1990; Thomas and Mercer, 1995; Jurczynska et al, 2016). In some countries, *TFR* decreased despite decrease in TFR (Bietsch et al, 2021). Many reasons have been put forward to explain the weakening of the relationship. These include unobserved heterogeneity (Bongaarts, 2015; 2017; Stover and Winfrey, 2017), shifts in method mix towards less effective methods (Bertrand et al, 2014; Toss et al, 2015; Zheng et al, 2012) and measurement mismatch (Choi et al, 2018).

India was the first country in the world to launch an official family planning programme way back in 1952 with the objective of limiting births and control population growth. The evidence available from the National Family Health Survey indicates that TFR in the country has decreased from 3.4 births per woman of reproductive age during 1992-1993 to around 2 births per woman of reproductive age during 2019-2021 while *CPR* has increased from 40.7 per cent to 66.7 per cent during this period (Government of India, 2022b). The TFR in the country is now below the replacement level, although it varies widely within the country, across states and Union Territories (Government of India, 2022a; 2022b). The latest round of the National Family Health Survey, 2019-2021, suggests that TFR in the country has varied from 3 live births per woman of reproductive age in Bihar to 1 live birth per woman of reproductive age in Sikkim during 0-3 years before the survey (Government of India, 2022b). There are 5 states in the country where TFR was above the replacement level. These states include Uttar Pradesh and Bihar, the two most populous state of the country. At the same time, the contraceptive prevalence (CPR), defined as the proportion of currently married women of reproductive age or their husband using a contraceptive method, has varied from more than 77 per cent in the Union Territory of Chandigarh to less than 27 per cent in Meghalaya. There are 8 states/Union Territories where CPR was less than 60 per cent during 2019-2021.

To the best of our knowledge, however, we have not come across any study which has attempted to analyse fertility and family planning relationship in India based on the variation in TFR and CPR across the states and Union Territories of the country. An understanding of the relationship between fertility and family planning in India is important as it helps to inform future investments in family planning, particularly, in official family planning efforts, when the country has achieved the replacement fertility. Family planning has always been an integral component of the social and economic development agenda of the country after the independence as is evident from different Five-year Development Plans that the country had since independence. Family planning is also an integral element of the reproductive and child health component of the National Health Mission (Government of India, 2013).

In this paper, we analyse the relationship between fertility, measured in terms of TFR and contraceptive use, measured in terms of CPR in India based on the state/Union Territory level data on fertility and family planning available through different rounds of the National Family Health Survey. The analysis reveals that the relationship between fertility and family planning based on within India, across- state/Union Territory data has not been as strong as revealed through the relationship based on the cross-country data. Another revealing observation of the present analysis is that the relationship appears to be different based on different rounds of the National Family Health Survey. We, therefore, first test whether the data available from different rounds of the National Family Health Survey can be pooled to analyse the fertility family planning relationship by examining whether there is regression discontinuity in fertility family planning relationship obtained from different rounds of the National Family Health Survey. If there is a regression discontinuity in the fertility family planning relationship based on different rounds of the National Family Health Survey, then data from different rounds of the survey cannot be pooled for analysing the fertility family planning relationship.

The paper is organised as follows. The next section of the paper discusses the trend in fertility and family planning use in India and across states/Union Territories during the period 1992-1993 through 2019-2021 based on the data available from different rounds of the National Family Health Survey. The third section examines regression discontinuity in fertility family planning relationship across different rounds of the National Family Health Survey using state/Union Territory level variation in TFR and CPR. The Chow test (Chow, 1960; Fisher, 1970; Toyoda, 1974; Schmidt and Sickles, 1977) has been used for the purpose. Application of the Chow test suggests that there is regression discontinuity in fertility family planning relationship based on the first three rounds of the National Family Health Survey and fertility family planning relationship based on the last two rounds of the National Family Health Survey. The fifth section examines fertility family planning relationship by pooling data from the first three rounds of the survey and by pooling data from the last two rounds of the survey and observes that fertility family planning relationship based on the first three rounds of the National Family Health Survey is essentially different from the last two rounds of the survey and observes that there has been a decrease in the fertility reducing effect of contraceptive use. The sixth section analyses the contribution of the decrease in the fertility reducing effect of contraceptive use on the decrease in fertility. The seventh section of the paper discusses possible reasons that may be responsible for the decrease in the fertility reducing effect of contraceptive use. The eighth and the last section of the paper summarises the main findings of the analysis and discusses their policy and programme implications.

Levels and Variation in TFR and CPR

Table 1 presents levels and trend in TFR in India and in states/Union Territories based on different rounds of the National Family Health Survey whereas table 2 presents levels and trend in CPR. The estimates of TFR refer to the period 0-3 years prior to the survey whereas estimates of CPR are for the year in which the survey was conducted. The TFR, in India, decreased from around 3.4 births per woman of reproductive age according to the first round of the survey to around 2 births per woman of reproductive age according to the fifth round of the survey. This means that TFR in the country decreased by more than 40 per cent during the 30 years period between the first and the fifth round of the survey. On the other hand, increase in CPR has relatively been faster as it increased by almost 64 per cent from around 40.7 per cent according to the first round of the survey to around 66.7 per cent according to the fifth round of the survey.

The state/Union Territory level variation from these national averages has been substantial and the variation was different in different rounds of the survey. During 1992-1993, TFR was the lowest in Goa but the highest in the undivided Uttar Pradesh (Uttar Pradesh and Uttarakhand). During 1998-1999, TFR was the lowest again in Goa but the highest in Meghalaya. During period 2005-2006, TFR was the lowest in the undivided Andhra Pradesh (Andhra Pradesh including Telangana) but the highest in undivided Bihar (Bihar including Jharkhand). During 2015-2016 and 2019-2021, TFR was the lowest in Sikkim but the highest in Bihar. On the other hand, CPR was the lowest in Nagaland but the highest in Kerala during 1992-1993. During 1998-1999 and 2005-2006, CPR was the lowest in

Meghalaya but the highest in Himachal Pradesh. During 2015-2016, CPR was the lowest in Manipur but the highest in Punjab whereas, during 2019-2021, CPR was the lowest again in Meghalaya but the highest in Chandigarh. During 1992-1993, TFR was less than or equal to the replacement fertility in only 2 of the 25 states – Goa and Kerala. During 2019-2021, TFR was less than or equal to the replacement fertility in 31 of the 36 states and Union Territories of the country. The CPR, on the other hand, was equal to or more than 60 per cent in only 2 of the 25 states during 1992-1993 – Goa and Kerala. During 1998-1999, 7 out of 26 states were having a CPR of at least 60 per cent while 12 out of 29 states were having a CPR of at least 60 per cent during 2005-2006. During 2015-2016, however, there were only 9 out of the 35 states/Union Territories where CPR was equal to or more than 60 per cent. This number, however, increased to 29 out of 35 states and Union Territories during the period 2019-2021.

We have measured the inter-state/Union Territory variation in TFR and CPR in terms of an index of variation which is a modification of the conventional coefficient of variation. The index of variation is defined as the ratio of the positive root mean squared deviation from the median to the median whereas the coefficient of variation is defined as the ratio of the positive root mean square deviation from the mean to the mean. The index of variation is more appropriate to measure the variation across spatial units such as variation across states/Union Territories than the conventional coefficient of variation, although both are spread-to-shift ratio. The coefficient of variation is based on the assumption that the variable of interest is distributed 'normally.' If the variable of interest is not distributed 'normally,' then it may be difficult to interpret the mean and the standard deviation and hence the coefficient of variation. Moreover, if there are outliers in the data then the coefficient of variation is adversely affected (Arachchige et al, 2022). In case of skewed distributions, the coefficient of variation does not take into account for the skewness in the distribution. When the variable of interest is distributed 'normally,' then the index of variation is the same as the coefficient of variation as the median is the same as the mean so that the positive root mean square deviation from the median is the same as the standard deviation.

There are other measures also that have been proposed for measuring the disparity or variation across spatial units. These include quartile-based measures (Ospina and Marmolejo-Ramos, 2019; Bonett, 2006), and the coefficient of dispersion (Gastwirth, 1988; Bonett and Seier, 2006; Ospina and Marmolejo-Ramos, 2019). We have used the index of variation in the present analysis as it is simple, straightforward, and analogous to the coefficient of variation. A comparison of the index of variation with the coefficient of variation shows how the skewness present in the data influences the coefficient of variation as the median is not influenced by the outliers present in the data.

It may be observed from tables 1 and 2 that both TFR and CPR are not distributed 'normally' across the states and Union Territories of the country and the inter-state/Union Territory distribution of both TFR, and CPR has changed over time. As such, the index of variation is more appropriate to measure the inter-state/Union Territory variation in TFR and CPR than the commonly used conventional coefficient of variation. The index of variation correctly accounts for the disparity across spatial units, especially when one or two spatial units have exceptionally high or low values of TFR or CPR.

Table 1: Trend in TFR in India, States, and Union Territories, 1992-93 through 2019-21.

Country/State/Union Territory	1992-93	1998-99	2005-06	2015-16	2019-21
India	3.4	2.8	2.7	2.2	2.0
Andaman and Nicobar Islands	na	na	na	1.4	1.3
Andhra Pradesh, including Telangana	2.6	2.2	1.8	1.8	1.7
Arunachal Pradesh	4.3	2.5	3.0	2.1	1.8
Assam	3.5	2.3	2.4	2.2	1.9
Bihar, including Jharkhand	4.0	3.5	3.8	3.2	2.8
Chandigarh	na	na	na	1.6	1.4
Chhattisgarh	na	na	2.6	2.2	1.8
Dadra and Nagar Haveli	na	na	na	2.3	na
Dadra and Nagar Haveli, Daman and Diu	na	na	na	na	1.8
Daman and Diu	na	na	na	1.7	na
Goa	1.9	1.8	1.8	1.7	1.3
Gujarat	3.0	2.7	2.4	2.0	1.9
Haryana	4.0	2.9	2.7	2.1	1.9
Himachal Pradesh	3.0	2.1	1.9	1.9	1.7
Jharkhand	na	na	3.3	2.5	2.3
Jammu, Kashmir & Ladakh	3.1	2.7	2.4	2.0	1.4
Karnataka	2.8	2.1	2.1	1.8	1.7
Kerala	2.0	2.0	1.9	1.6	1.8
Ladakh	na	na	na	na	1.3
Lakshadweep	na	na	na	1.8	1.4
Madhya Pradesh, including Chhattisgarh	3.9	3.3	3.0	2.3	1.9
Maharashtra	2.9	2.5	2.1	1.9	1.7
Manipur	2.8	3.0	2.8	2.6	2.2
Meghalaya	3.7	4.6	3.8	3.0	2.9
Mizoram	2.3	2.9	2.9	2.3	1.9
Nagaland	3.3	3.8	3.7	2.7	1.7
New Delhi	3.0	2.4	2.1	1.8	1.6
Odisha	2.9	2.5	2.4	2.0	1.8
Puducherry	na	na	na	1.7	1.5
Punjab	2.9	2.2	2.0	1.6	1.6
Rajasthan	3.6	3.8	3.2	2.4	2.0
Sikkim	na	2.7	2.0	1.2	1.0
Tamil Nadu	2.5	2.2	1.8	1.7	1.8
Telangana	na	na	na	1.8	1.7
Tripura	2.7	1.9	2.2	1.7	1.7
Uttar Pradesh, including Uttarakhand	4.8	4.0	3.8	2.7	2.3
Uttarakhand	na	na	2.5	2.1	1.8
West Bengal	2.9	2.3	2.3	1.8	1.6
Andhra Pradesh	na	na	na	1.8	1.7
Bihar	na	na	4.0	3.4	3.0
Madhya Pradesh	na	na	3.1	2.3	2.0
Uttar Pradesh	na	na	3.8	2.7	2.3
Median	3.0	2.5	2.4	2.0	1.7
Index of variation	0.700	0.734	0.676	0.457	0.340

na Not available

Source: Government of India (1995; 2000; 2007; 2017; 2022b)

Table 2: Trend in CPR in India, States, and Union Territories, 1992-93 through 2019-21.

Country/State/Union Territory	1992-93	1998-99	2005-06	2015-16	2019-21
India	40.7	48.2	56.3	53.5	66.7
Andaman and Nicobar Islands	na	na	na	50.8	65.8
Andhra Pradesh, including Telangana	47.4	59.6	67.6	64.5	69.9
Arunachal Pradesh	23.6	35.4	43.2	31.7	59.1
Assam	43.0	43.3	56.5	52.4	60.8
Bihar, including Jharkhand	23.2	24.5	34.5	27.8	57.1
Chandigarh	na	na	na	74.0	77.4
Chhattisgarh	na	na	53.2	57.7	67.8
Dadra and Nagar Haveli	na	na	na	38.0	na
Dadra and Nagar Haveli, Daman and Diu	na	na	na	na	68.0
Daman and Diu	na	na	na	32.3	na
Goa	47.8	47.5	48.2	26.3	67.9
Gujarat	49.3	59.0	66.6	46.9	65.3
Haryana	49.7	62.4	63.4	63.7	73.1
Himachal Pradesh	58.4	67.7	72.6	57.0	74.2
Jharkhand	na	na	52.6	57.3	59.6
Jammu, Kashmir & Ladakh	49.4	49.1	35.7	40.4	61.7
Karnataka	49.4	58.3	63.6	51.8	68.7
Kerala	63.3	63.7	68.6	53.1	60.7
Ladakh	na	na	na	na	51.3
Lakshadweep	na	na	na	29.7	52.6
Madhya Pradesh, including Chhattisgarh	36.7	44.3	55.2	53.0	70.7
Maharashtra	54.1	60.9	66.9	64.7	66.2
Manipur	34.9	38.7	48.7	23.6	61.3
Meghalaya	20.7	20.2	24.3	24.3	27.4
Mizoram	53.8	57.7	59.9	35.3	31.2
Nagaland	13.0	30.3	29.7	26.5	57.4
New Delhi	60.3	63.8	66.9	54.8	76.4
Odisha	36.3	46.8	50.7	57.3	74.1
Puducherry	na	na	na	61.9	66.0
Punjab	58.7	66.7	63.3	75.8	66.6
Rajasthan	31.8	40.3	47.2	59.7	72.3
Sikkim	na	53.8	57.6	46.7	69.1
Tamil Nadu	49.8	52.1	61.4	53.2	68.6
Telangana	na	na	na	57.2	68.1
Tripura	56.4	55.5	65.7	64.1	71.2
Uttar Pradesh, including Uttarakhand	19.8	28.1	44.3	45.9	62.8
Uttarakhand	na	na	59.3	53.4	70.8
West Bengal	57.7	66.6	71.2	70.9	74.4
Andhra Pradesh	na	na	na	69.5	71.1
Bihar	na	na	34.1	24.1	55.8
Madhya Pradesh	na	na	55.9	51.4	71.7
Uttar Pradesh	na	na	43.6	45.5	62.4
Median	49.3	53.0	57.6	52.8	66.6
Index of variation	15.346	13.940	12.825	15.176	10.759

na Not available

Source: Government of India (1995; 2000; 2007; 2017; 2022b)

Tables 1 and 2 suggest that the index of variation across states and Union Territories of the country has decreased over time in both TFR and CPR, although the decrease has not been consistent during the period under reference. This implies that states/Union Territories of the country have sigma-converged over time in both TFR and CPR or the disparities in TFR and CPR across the states and Union Territories of the country have reduced over time (Monfort, 2008). The sigma convergence in TFR and CPR, across states/Union Territories, has, however, not been consistent as there have been periods when disparity across states/Union Territories appears to have increased. More specifically, the inter-state/Union Territory disparity in TFR increased in the and the second (1998-1999) round of the National Family Health Survey compared to the first round of the survey (1992-1993), but then states/Union Territories sigma converged in terms of fertility as the index of variation in TFR across states/Union Territories decreased from 0.734 during 1998-1999 to 0.340 during 2019-2021. On the other hand, the CPR sigma-converged during the first three rounds of the National Family Health Survey as the index of inter-state/Union Territory variation in CPR decreased from around 15 during the first (1992-1993) to around 13 during the third round (2005-2006). However, states and Union Territories of the country appear to have diverged in terms of CPR during the fourth round (2015-2016) of the survey as the index of inter-state/Union Territory variation in CPR increased during the period 2015-2016 compared to that during the period 2005-2006. However, during the period 2019-2021, states/Union Territories of the country appear to have converged again as the inter-state/Union Territory index of variation decreased to around 10 as revealed through the fifth (2019-2021) round of the National Family Health Survey.

Table 4 presents the trend in CPR in India and in states/Union Territories. The increase in CPR in the country has been faster than the decrease in TFR. The increase in CPR in the country has been the most rapid during the period 2015-2016 through 2019-2021 whereas the CPR decreased, instead increased, during the period 2005-2006 through 2015-2016. Among different states and Union Territories, trend in CPR has varied widely and Mizoram is the only state/Union Territory in the country where average annual per cent change in CPR was negative during the period 1992-1993 through 2019-2021 suggesting a decrease in the contraceptive use. Besides Mizoram, there has been virtually little increase in CPR in Kerala during the period under reference. Other states/Union Territories where the increase in CPR has been very slow are Jharkhand, Maharashtra, Punjab, Tripura, and West Bengal. In all these states, AAPC during the period under reference has been less than 1 per cent per year. A notable feature of table 4 is that in 20 states/Union Territories, the CPR decreased during the period 2005-2006 through 2015-2016.

Trend in TFR and CPR

The trend in TFR or CPR during a given time period is conventionally measured in terms of annual per cent change (APC) under the assumption that the trend is linear which means a constant rate of change. If the time-period is defined by the interval (t_b, t_e), $t_b < t_e$, then APC is defined as

$$APC(x_{t_e}\, x_{t_b}) = \frac{x_{t_e} - x_{t_b}}{(t_e - t_b) * x_{t_b}} \qquad (1)$$

However, when the trend is not linear, then APC does not characterise the trend completely and can lead to erroneous conclusions (Clegg et al, 2009). In such a situation, it is more appropriate to estimate APC in different time-segments of the given time-period and then to combine APC in different time-segments into a single summary measure of trend in the given time-period. If the trend period (t_b, t_e), $t_b<t_e$, is divided into time segments $t_b<t_1<t_2<\ldots..<t_e$, then the APC in the time segment (t_i t_{i+1}) is first calculated as

$$APC_i = \frac{x_{t_{i+1}} - x_{t_i}}{(t_{i+1} - t_i) * x_{t_i}} \quad (2)$$

and then a summary measure of the trend during the trend period (t_b, t_e) may be calculated as (Clegg et al, 2009)

$$AAPC = \sum_i w_i * APC_i \quad (3)$$

where

$$w_i = \frac{t_{i+1} - t_i}{t_e - t_b} \quad (4)$$

The advantage of AAPC in analysing the trend over time is that it takes into consideration the differential rate of change in different time segments of the trend period. When the annual rate of change in different time segments of the trend period is the same, the AAPC is equal to the conventional annual rate of change. The AAPC depicts a more accurate picture of the trend than the conventional annual rate of change when the trend in different time segments of the trend period is different and different time segments are of unequal length.

Table 3 presents the APC in TFR between different rounds of the National Family Health Survey along with AAPC for the period 1992-1993 through 2019-2021. The AAPC in TFR in India, during 1992-1993 through 2019-2021, was -1.776 per cent whereas the APC during the same period was -1.497 which shows considerably slower trend in TFR as compared to the trend shown by AAPC because the trend has been different between different rounds of the survey. The decrease in TFR in India was the most rapid during the period 1992-1993 through 1998-1999 but the slowest during the period 1998-1999 through 2005-2006 when the decrease in TFR in the country nearly stagnated. Although, the decrease in TFR accelerated since then but the decrease in TFR during 2015-2016 through 2019-2021 has been slower than that during 1992-1993 through 1998-1999.

The AAPC during 1992-1993 through 2019-2021 was also higher than APC during the same period in most of the states of the country. There are only three states – Kerala, Mizoram, and Tripura – where the APC during 1992-1993 through 2019-2021 is estimated to be higher than the AAPC during the same period. The trend in TFR has also been different in different states/Union Territories. The decrease in TFR has been the most rapid in Lakshadweep followed by Sikkim and Uttar Pradesh (including Uttarakhand) but the slowest in Kerala followed by Mizoram and Meghalaya. In majority of the states, the decrease in TFR has been the most rapid during the period 1992-1993 through 1998-1999. During the period 2015-2016 through 2019-2021, the decrease in TFR was very rapid in Nagaland, Jammu and Kashmir (including Ladakh) and Goa. On the other hand, the decrease in TFR virtually stagnated in Punjab and Tripura during this period and was very slow in Meghalaya where it decreased by less than 1 per cent per year.

Table 3: Trend in TFR 1992-93 through 2019-2021, India and States/Union Territories.

Country/State/Union Territory	APC_1	APC_2	APC_3	APC_4	AAPC	APC
India	-2.941	-0.510	-1.852	-2.020	-1.776	-1.497
Andaman and Nicobar Islands	-	-	-	-1.587	-1.587	-1.587
Andhra Pradesh, including Telangana	-2.564	-2.597	0.000	-1.235	-1.423	-1.259
Arunachal Pradesh	-6.977	2.857	-3.000	-3.175	-2.405	-2.114
Assam	-5.714	0.621	-0.833	-3.030	-1.888	-1.662
Bihar, including Jharkhand	-2.083	1.224	-1.579	-2.778	-1.172	-1.091
Chandigarh	-	-	-	-2.778	-2.778	-2.778
Chhattisgarh	-	-	-1.538	-4.040	-2.315	-2.122
Goa	-0.877	0.000	-0.556	-5.229	-1.249	-1.148
Gujarat	-1.667	-1.587	-1.667	-1.111	-1.556	-1.333
Haryana	-4.583	-0.985	-2.222	-2.116	-2.405	-1.909
Himachal Pradesh	-5.000	-1.361	0.000	-2.339	-1.820	-1.576
Jharkhand	-	-	-2.424	-1.778	-2.224	-2.090
Jammu, Kashmir & Ladakh	-2.151	-1.587	-1.667	-6.667	-2.570	-1.994
Karnataka	-4.167	0.000	-1.429	-1.235	-1.631	-1.429
Kerala	0.000	-0.714	-1.579	2.778	-0.301	-0.364
Lakshadweep	-	-	-	-4.938	-4.938	-4.938
Madhya Pradesh, including Chhattisgarh	-2.564	-1.299	-2.333	-3.865	-2.371	-1.865
Maharashtra	-2.299	-2.286	-0.952	-2.339	-1.812	-1.505
Manipur	1.190	-0.952	-0.714	-3.419	-0.802	-0.779
Meghalaya	4.054	-2.484	-2.105	-0.741	-0.635	-0.786
Mizoram	4.348	0.000	-2.069	-3.865	-0.436	-0.632
Nagaland	2.525	-0.376	-2.703	-8.230	-1.874	-1.763
New Delhi	-3.333	-1.786	-1.429	-2.469	-2.105	-1.697
Odisha	-2.299	-0.571	-1.667	-2.222	-1.617	-1.379
Puducherry	-	-	-	-2.614	-2.614	-2.614
Punjab	-4.023	-1.299	-2.000	0.000	-1.936	-1.630
Rajasthan	0.926	-2.256	-2.500	-3.704	-1.887	-1.616
Sikkim	-	-3.704	-4.000	-3.704	-3.842	-2.929
Tamil Nadu	-2.000	-2.597	-0.556	1.307	-1.086	-1.018
Telangana	-	-	-	-1.235	-1.235	-1.235
Tripura	-4.938	2.256	-2.273	0.000	-1.330	-1.347
Uttar Pradesh, including Uttarakhand	-2.778	-0.714	-2.895	-3.292	-2.379	-1.894
Uttarakhand			-1.600	-3.175	-2.089	-1.931
West Bengal	-3.448	0.000	-2.174	-2.469	-1.947	-1.630
Andhra Pradesh	-	-	-	-1.235	-1.235	-1.235
Bihar	-	-	-1.500	-2.614	-1.846	-1.724
Madhya Pradesh	-	-	-2.581	-2.899	-2.679	-2.447
Uttar Pradesh	-	-	-2.895	-3.292	-3.018	-2.722

AAPC Average annual per cent change between 1992-1993 and 2019-2021
APC Annual per cent change between 1992-1993 and 2019-2021
APC_1 Annual per cent change between 1992-1993 and 1998-1999
APC_2 Annual per cent change between 1998-1999 and 2005-2006
APC_3 Annual per cent change between 2005-2006 and 2015-2016
APC_4 Annual per cent change between 2015-2016 and 2019-2021
Remarks APC could not be calculated for Dadra & Nagar Haveli; Dadra & Nagar Haveli, Daman & Diu; and Daman & Diu as data are available at one point in time only.
Source: Authors

Table 4: Trend in CPR 1992-1993 through 2019-2021, India and States/Union Territories.

Country/State/Union Territory	APC_1	APC_2	APC_3	APC_4	AAPC	APC
India	3.071	2.401	-0.497	5.483	1.998	2.323
Andaman and Nicobar Islands	-	-	-	6.562	6.562	6.562
Andhra Pradesh, including Telangana	4.290	1.918	-0.459	1.860	1.562	1.726
Arunachal Pradesh	8.333	3.148	-2.662	19.208	4.795	5.470
Assam	0.116	4.355	-0.726	3.562	1.453	1.505
Bihar, including Jharkhand	0.934	5.831	-1.942	23.421	4.814	5.313
Chandigarh	-	-	-	1.021	1.021	1.021
Chhattisgarh	-	-	0.846	3.890	1.791	1.893
Goa	-0.105	0.211	-4.544	35.150	4.130	1.529
Gujarat	3.279	1.840	-2.958	8.718	1.535	1.180
Haryana	4.259	0.229	0.047	3.279	1.541	1.712
Himachal Pradesh	2.654	1.034	-2.149	6.706	1.158	0.984
Jharkhand	-	-	0.894	0.892	0.893	0.918
Jammu, Kashmir & Ladakh	-0.101	-3.899	1.317	11.716	1.381	0.905
Karnataka	3.003	1.299	-1.855	7.250	1.497	1.421
Kerala	0.105	1.099	-2.259	3.181	0.002	-0.149
Lakshadweep	-	-	-	17.134	17.134	17.134
Madhya Pradesh, including Chhattisgarh	3.451	3.515	-0.399	7.421	2.717	3.369
Maharashtra	2.095	1.407	-0.329	0.515	0.780	0.813
Manipur	1.815	3.691	-5.154	35.499	5.270	2.751
Meghalaya	-0.403	2.900	0.000	2.835	1.114	1.177
Mizoram	1.208	0.545	-4.107	-2.581	-1.514	-1.528
Nagaland	22.179	-0.283	-1.077	25.912	8.615	12.420
New Delhi	0.967	0.694	-1.809	8.759	1.163	0.971
Odisha	4.821	1.190	1.302	6.515	2.894	3.787
Puducherry	-	-	-	1.472	1.472	1.472
Punjab	2.271	-0.728	1.975	-2.697	0.587	0.489
Rajasthan	4.455	2.446	2.648	4.690	3.325	4.631
Sikkim	-	1.009	-1.892	10.659	1.679	1.323
Tamil Nadu	0.770	2.550	-1.336	6.433	1.384	1.373
Telangana	-	-	-	4.235	4.235	4.235
Tripura	-0.266	2.625	-0.244	2.461	0.925	0.954
Uttar Pradesh, including Uttarakhand	6.987	7.880	0.528	8.182	5.061	7.897
Uttarakhand	-	-	2.054	7.241	3.664	4.125
West Bengal	2.571	0.987	-0.042	1.097	0.976	1.052
Andhra Pradesh	-	-	-	0.512	0.512	0.512
Bihar	-	-	-2.933	29.230	7.049	4.389
Madhya Pradesh	-	-	-0.805	8.776	2.169	1.949
Uttar Pradesh	-	-	-2.327	8.254	0.957	0.361

AAPC Average annual per cent change between 1992-1993 and 2019-2021
APC Annual per cent change between 1992-1993 and 2019-2021
APC_1 Annual per cent change between 1992-1993 and 1998-1999
APC_2 Annual per cent change between 1998-1999 and 2005-2006
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Remarks APC could not be calculated for Dadra & Nagar Haveli; Dadra & Nagar Haveli, Daman & Diu; and Daman & Diu as data are available at one point in time only.
Source: Authors

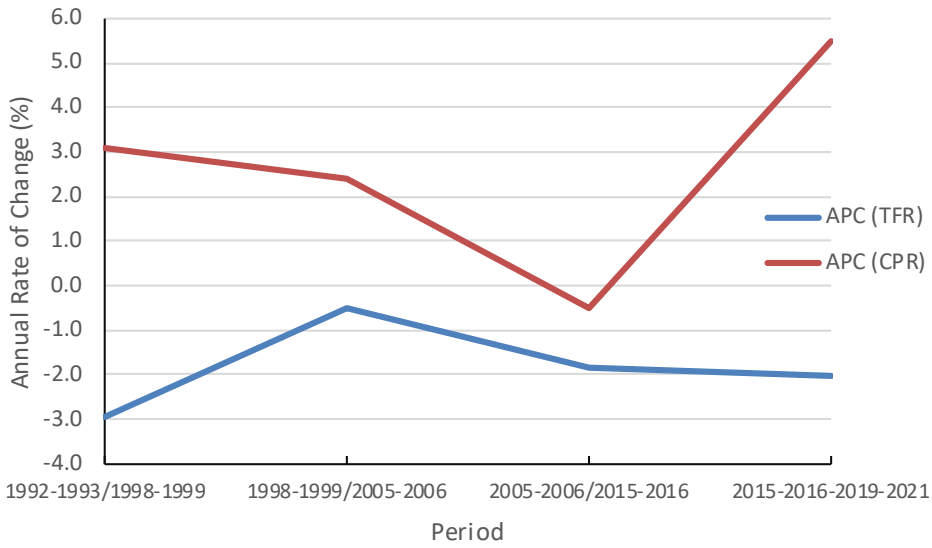

Figure 1: Annual per cent change in TFR and CPR in different time segment of the period 1992-1993 through 2019-2021.
Source: Authors

The trend in TFR and CPR between different rounds of the National Family Health Survey, measured in terms of annual per cent change (APC), has, however, been different. The decrease in TFR slowed down considerably between the second (1998-1999) and the third (2005-2006) round of the National Family Health Survey compared to the decrease between the first (1992-1993) and the second (1998-1999) round of the survey. The decrease in TFR accelerated between the third (2005-2006) round and the fourth (2015-2016) round but the acceleration in the decrease in TFR slowed down considerably between the fourth (2015-2016) round and the fifth (2019-2021) round of the survey (Figure 1). By comparison, the increase in CPR slowed down during the period between the first (1992-1993) round and the third (2015-2016) round of the survey but the increase in CPR accelerated very rapidly between the fourth (2015-2016) round and the fifth (2019-2021) round of the survey. It is apparent from the figure 1 that the trend in TFR in the country during the period 1992-1993 through 2019-2021 has not been commensurate with the trend in CPR in the country during the same period. Between the first (1992-1993) and the third (2005-2006) round of the survey, the decrease in TFR slowed down along with the slowdown in the increase in CPR but the slowdown in the decrease in TFR has been more marked compared to the slowdown in the increase in CPR during this period. On the other hand, Between the third (2005-2006) round and the fourth round (2015-2016)of the survey, the decrease in TFR accelerated despite a slowdown in the increase in CPR. Between the fourth (2015-2016) round and the fifth (2019-2021) round of the survey, the increase in CPR accelerated very rapidly but the decrease in TFR accelerated only marginally during this period.

Fertility Impact of Family Planning

Table 5 presents results of ordinary least square regression of TFR on CPR based on state/Union Territory level data available from different rounds of the National Family Health Survey. The relationship appears to be different in the first three rounds of the survey compared to the last two rounds of the survey. The regression coefficient of TFR on CPR is higher in the first three rounds of the survey as compared to the last two rounds of the survey. Moreover, the first three rounds of the survey suggest that the impact of CPR in reducing TFR has increased over time but the impact of CPR on TFR has not only been low, but it has decreased over time according to the last two rounds of the survey. The last two rounds of the survey suggest that inter-state/Union Territory variation in CPR explains only a small proportion of inter-state/Union Territory variation in TFR whereas in the first three rounds of the survey, inter-state/Union Territory variation in CPR explains a substantial proportion of the inter-state/Union Territory variation in TFR. The regression coefficient of TFR on CPR is, however, found to be statistically significant in all the five rounds of the National Family Health Survey or during the 30 years period between 1992-1993 through 2019-2021.

Table 5: Results of OLS regression of TFR on CPR in different rounds of the National Family Health Survey

Parameter	National Family Health Survey				
	1992-1993	1998-1999	2005-2006	2015-2016	2019-2021
R^2	0.449	0.579	0.671	0.285	0.149
Adjusted R^2	0.425	0.562	0.659	0.264	0.124
Residual sum of square	6.497	5.393	4.021	5.168	4.864
B	-0.032	-0.039	-0.042	-0.016	-0.014
β	-0.670	-0.761	-0.819	-0.534	-0.385
't'	-4.332	-5.746	-7.427	-3.679	-2.471
'p'	0.000	0.000	0.000	-0.001	-0.018
N	25	26	29	36	37

Source: Authors

Table 5 suggests that the fertility impact of family planning in India is lower than that reflected from the cross-country data. At the same time, there appears to be regression discontinuity in the fertility impact of family planning based on the first three rounds of the National Family Health Survey and the fertility impact of family planning based on the last two rounds of the survey. Table 5 suggests that the causal effect of CPR on TFR based on the data from the first three rounds of the National Family Health Survey is essentially different from the causal effect based on the last two rounds of the survey. One implication of regression discontinuity is that the data from the first three rounds of the National Family Health Survey cannot be pooled with the data from the last three rounds of the survey for analysing fertility impact of family planning. It is also clear from table 5 suggests that the causal effect of CPR on TFR obtained from the data from the first three rounds of the survey is very similar and it has increased with time. On the other hand, the causal effect of CPR on TFR obtained from data from the last two rounds of the survey is very similar and, more importantly, the effect has decreased over time. However, the causal effect of CPR on TFR

obtained from the first three rounds of the survey is different from the causal effect obtained from the last two rounds of the survey. Similarly, the proportion of the inter-state/Union Territory variation in TFR which is explained by the inter-state/Union Territory variation in CPR is substantially higher in the first three rounds of the survey as compared to that in the last two rounds of the survey. More importantly, this proportion has decreased substantially between the fourth (2015-2016) and the fifth (2019-2021) round of the survey whereas it increased between the first (1992-1993) and the third (2005-2006) round of the survey.

We have applied the Chow Test (Chow, 1960) to examine the regression discontinuity in the fertility impact of family planning between the first three rounds of the survey and the last two rounds of the survey. Results of the Chow test are presented in table 6 which confirms that there is regression continuity in fertility impact of family planning between the first three rounds of the survey and the last two rounds of the survey. There is no regression discontinuity between the first three rounds of the survey. Similarly, there is no regression continuity between the last two rounds of the survey. There is, however, regression discontinuity between the 2005-2006 round and the 2015-2016 round of the survey. Application of the Chow test suggests that the data from the first three rounds of the survey can be pooled for analysing the fertility impact of family planning. Similarly, data from the last two rounds of the survey can be pooled but the data from the first three rounds of the survey cannot be pooled with the data from the last two rounds of the survey for analysing the fertility family planning relationship.

Table 6: Results of the Chow test to examine regression discontinuity in fertility family planning relationship based on different rounds of the National Family Health Survey.

NFHS rounds	Source	Sum of Square	df	Mean Square	F	Sig
1992-1993	Contrast	0.525	2	0.263	1.038	0.362
1998-1999	Error	11.890	47	0.253		
1998-1999	Contrast	0.092	2	0.046	0.250	0.780
2005-2006	Error	9.413	51	0.185		
2005-2006	Contrast	9.365	2	4.682	31.085	0.000
2015-2016	Error	9.188	61	0.151		
2015-2016	Contrast	0.027	2	0.014	0.093	0.911
2019-2021	Error	10.032	69	0.145		

Source: Authors

The application of the Chow test reveals that there is a discontinuity between the fertility family planning relationship as revealed through the first three rounds of the National Family Health Survey and the fertility family planning relationship revealed through the last two rounds of the survey. We have, therefore, fitted two regression models to characterise the fertility impact of family planning in India. The first model is based on the data from the first three rounds of the National Family Health Survey and refers to the period 1992-1993 through 2005-2006 while the second model is based on the data from the last two rounds of the survey and refers to the period 2015-2016 through 2019-2021. For the first model, we have pooled the data from the first three rounds of the National Family Health Survey. Similarly, for the second model, we have pooled the data from the

last two rounds of the National Family Health Survey. Moreover, since fertility impact of family planning is expected to be different in different states and Union Territories of the country, we have used the fixed effects regression model in place of ordinary regression model to control the variation in the fertility impact of family planning across states and Union Territories. The univariate general linear model has been used for analysing the association between inter-state/Union Territory variation in TFR and inter-state/Union Territory variation in CPR.

Table 7: Fertility impact of family planning in India during the period 1992-1993 through 2005-2006 and during the period 2015-2016 through 2019-2021 based on data from different rounds of the National Family Health Survey.

Particulars	Model 1	Model 2	Model 1a	Model 2a	Model 1b	Model 2b
Period	1992-1993 2005-2006	2015-2016 2019-2021	1992-1993 2005-2006	2015-2016 2019-2021	2015-2016 2019-2021	2015-2016 2019-2021
Dependent variable	TFR	TFR	TFR	TFR	TFR	TFR
Mean	2.810	1.916	2.810	1.916	2.810	1.916
SD	0.711	0.439	0.711	0.439	0.711	0.439
Independent variable	CPR	CPR	Adj CPR	Adj CPR	CPRM	CPRM
Mean	49.737	57.020	47.166	59.912	42.571	48.558
SD	14.132	14.816	12.641	15.803	14.232	14.035
R^2	0.864	0.957	0.847	0.955	0.890	0.948
Adjusted R^2	0.768	0.906	0.739	0.900	0.812	0.885
B	-0.043	-0.013	-0.049	-0.012	-0.055	-0.018
SE	0.007	0.002	0.010	0.002	0.008	0.003
't'	-5.773	-7.419	-4.934	-7.044	-7.217	-6.231
P	0.000	0.000	0.000	0.000	0.000	0.000
95% confidence interval						
Lower	-0.058	-0.017	-0.068	-0.016	-0.070	-0.024
Upper	-0.028	-0.010	-0.029	-0.009	-0.040	-0.012
Intercept	5.038	2.893	5.290	2.875	5.311	3.047
N	83	74	83	74	83	74

Source: Authors

Results of the regression modelling exercise are presented in table 7 (Model 1 and Model 2). The table shows that both models, model based on the pooled data from the first three rounds (1992-1993 through 2005-2006) and the model based on the pooled data from the last two rounds (2015-2016 through 2019-2021) of the National Family Health Survey, fit the observed data very well. In the first model (Model 1), the simple zero order correlation coefficient between the observed TFR and the TFR predicted by the model is 0.930 whereas it is 0.978 in the second model (Model 2). In both models, the regression coefficient of TFR on CPR is negative and statistically significant after controlling the state/Union Territory effects (fixed effects). However, the fertility reducing effect of CPR is substantially lower in the second model as compared to the first model. In the first model, an increase of 10 per cent points in CPR is associated, on average, with a decrease of 0.43 points in TFR whereas, in the second model, an increase of 10 per cent points in CPR is

associated, on average, with a decrease of only 0.13 points in TFR. A comparison of model 1 with model 2 suggests that the fertility reducing effect of CPR has reduced in the country during the period 2015-2016 through 2019-2021 as compared to the period 1992-1993 through 2005-2006. This decrease in the fertility reducing effect of CPR is illustrated in figures 2 and 3. Although, the regression coefficient of TFR on CPR is statistically significant in both models, the inter-state/Union Territory variation in CPR explained around 60 per cent of the inter-state/Union Territory variation in TFR during the period 1992-1993 through 2005-2006 (Model 1). By contrast, the inter-state/Union Territory variation in CPR explained only around 29 per cent of the inter-state/Union Territory variation in TFR during the period 2015-2016 through 2019-2021 (Model 2).

It has been argued that a potentially important reason behind the decrease in the fertility reducing effect of CPR is the 'mis-alignment' in the TFR-CPR relationship. It is argued that TFR, by definition, is not influenced by the population age structure, but the CPR is influenced by the population age structure (Choi et al, 2018). It has, therefore been suggested that an age-adjusted contraceptive prevalence (Adj CPR) which is independent of the population age structure should be used to analyse the fertility family planning relationship. Using the data from 259 surveys from 85 countries, it has been shown that inter-country variation in Adj CPR better explained the inter-country variation in TFR. However, even after using the Adj CPR, the regression model explained a lower amount of within-country variance during the recent time-period, compared to the within-country variance during the earlier time-period. (Choi et al, 2018).

We have also regressed TFR on Adj CPR using the state/Union Territory level data and the results are presented in table 7 (Model 1a and Model 1b) for the two time periods 1992-1993 through 2005-2006 and 2015-2016 through 2019-2021 (Modal 1a and Model 2a). The table shows that there has been virtually little change in the explanatory power of regression models after replacing CPR by Adj CPR as the independent variable. In fact, the explanatory power of regression models decreased, albeit marginally, when Adj CPR was used as the independent variable. The weakening of the relationship may also be observed from figures 4 and 5. During the period 1992-1993 through 2005-2006, inter-state/Union Territory variation in Adj CPR accounted for about 49 per cent of the inter-state/Union Territory variation in TFR, although the fertility reducing effect of Adj CPR increased marginally. On the other hand, during the period 2015-2016 through 2019-2021, inter-state/Union Territory variation in Adj CPR accounted for less than 25 per cent of the inter-state/Union Territory variation in TFR and the regression coefficient of TFR on CPR has also decreased indicating that the fertility reducing effect of Adj CPR is even lower than the fertility reducing effect of CPR during this period. It is clear from the table that the population age structure effect on CPR in India has not been substantial enough to have a significant impact on the fertility reducing effect of CPR. Even if the CPR is adjusted for the change in the population age structure during 1992-1993 through 2005-2006 and during 2015-2016 through 2019-2021, there has been a significant decrease in the fertility reducing effect of contraceptive use in the country during the period 2015-2016 through 2019-2021 as compared to the fertility reducing effect of contraceptive use during the period 1992-1993 through 2005-2006.

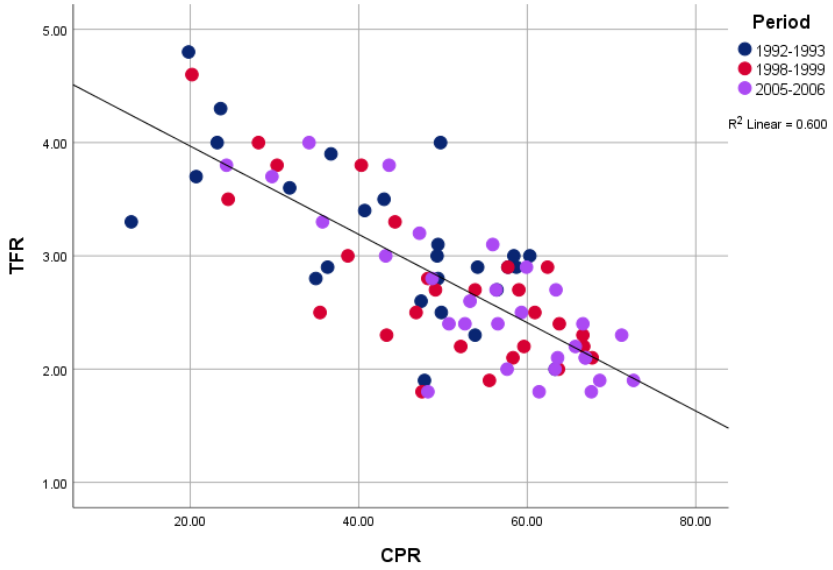

Figure 2: Relationship between TFR and CPR in India during the period 1992-93 through 2005-2006
Source: Authors

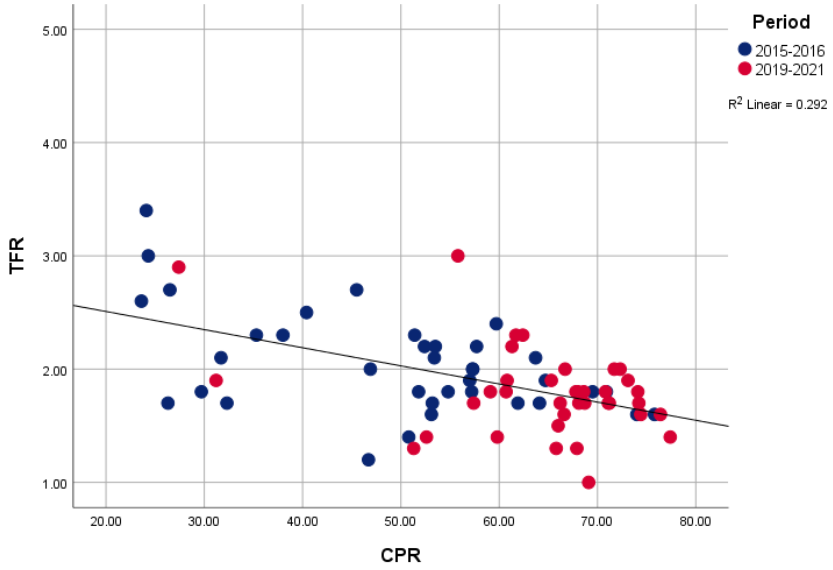

Figure 3: Relationship between TFR and CPR in India during the period 2015-2016 through 2019-2021
Source: Authors

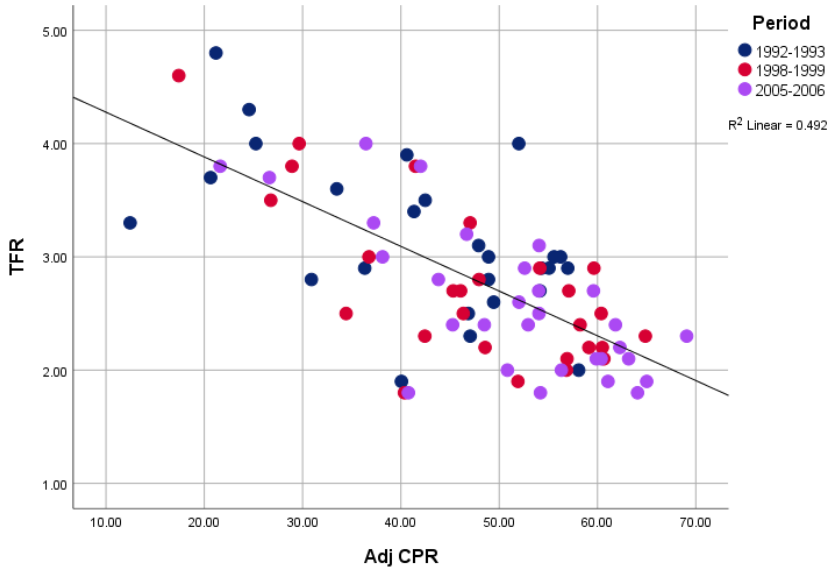

Figure 4: Relationship between TFR and Adj CPR in India during the period 1992-1993 through 2005-2006
Source: Authors

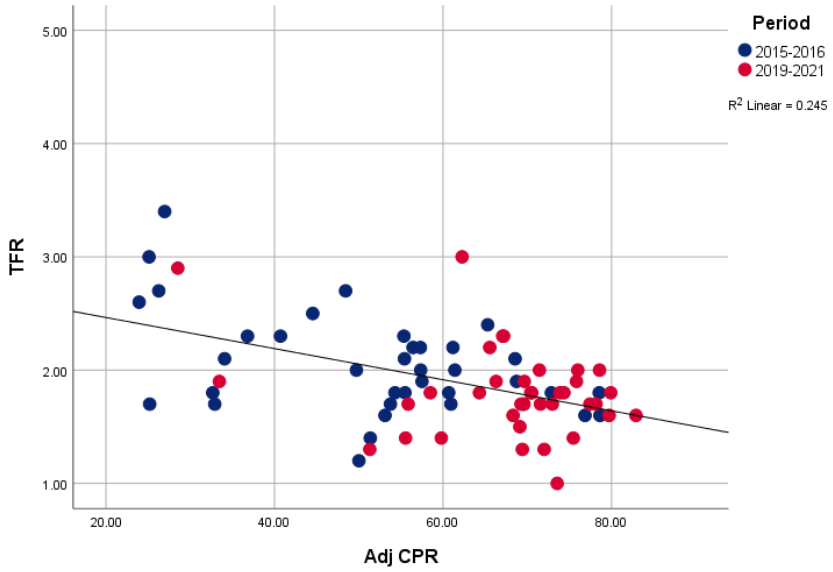

Figure 5: Relationship between TFR and Adj CPR in India during the period 2015-2016 through 2019-2021
Source: Authors

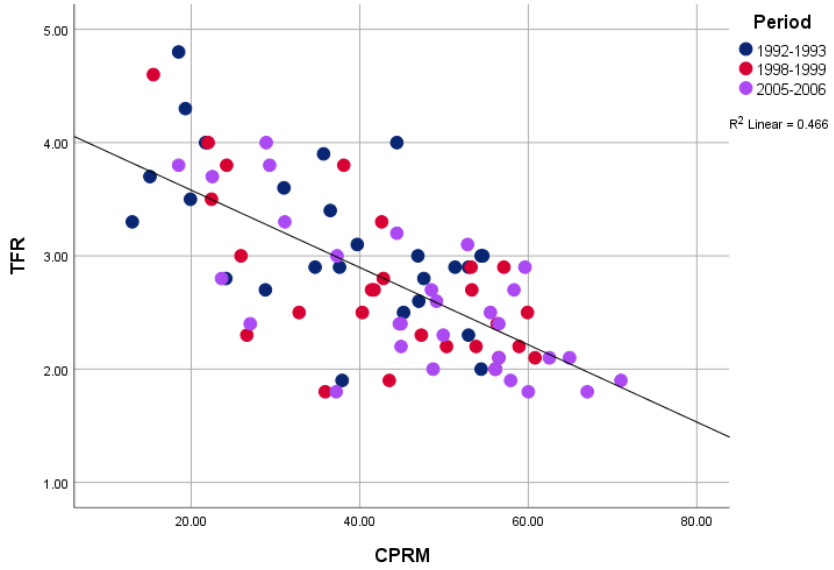

Figure 6: Relationship between TFR and CPRM in India during the period 1992-1993 through 2005-2006
Source: Authors

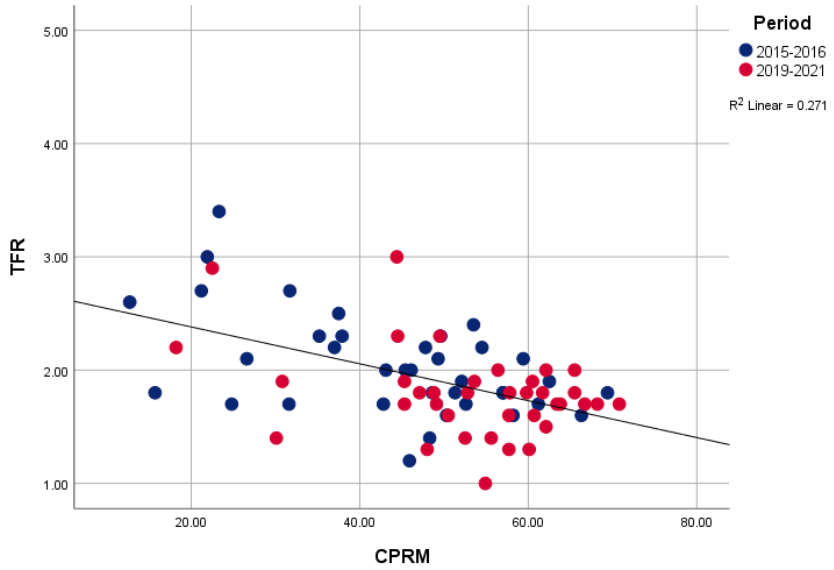

Figure 7: Relationship between TFR and CPRM in India during the period 2015-2016 through 2019-2021
Source: Authors

We have also regressed TFR on modern methods prevalence (CPRM). Table 7 (Model 1b and Model 2b) shows that fertility reducing effect of CPRM is greater than that of CPR in both models but there is a marginal decrease in the explanatory power of both models in explaining the inter-state/Union Territory variation in TFR as may be seen from figures 6 and 7. A substantial decrease in the fertility reducing effect of family planning in the recent period as compared to the earlier period is very much evident from table 7.

Decomposition of the Change in TFR

Given that fertility impact of family planning in India was essentially different during 1992-1993 through 2005-2006 as compared to 2015-2016 through 2019-2021, we have analysed how the change in fertility impact of family planning has contributed to the decrease in TFR. If f_1 and c_1 denote, respectively, the TFR and CPR at time 1 and f_2 and c_2 denote respectively the CPR and TFR at time 2, then

$$f_1 = \alpha_1 + \beta_1 * c_1 \quad (5)$$

$$f_2 = \alpha_2 + \beta_2 * c_2 \quad (6)$$

Now,

$$f_2 - f_1 = (\alpha_2 - \alpha_1) + (\beta_2 * c_2 - \beta_1 * c_1) \quad (7)$$

Now, following Ang (2016), we can write

$$(\beta_2 * c_2 - \beta_1 * c_1) = \frac{(\beta_2 * c_2 - \beta_1 * c_1)}{\ln\left(\frac{\beta_2 * c_2}{\beta_1 * c_1}\right)} * \ln\left(\frac{\beta_2 * c_2}{\beta_1 * c_1}\right) \quad (8)$$

$$(\beta_2 * c_2 - \beta_1 * c_1) = \frac{(\beta_2 * c_2 - \beta_1 * c_1)}{\ln\left(\frac{\beta_2 * c_2}{\beta_1 * c_1}\right)} * \ln\left(\frac{\beta_2}{\beta_1}\right) + \frac{(\beta_2 * c_2 - \beta_1 * c_1)}{\ln\left(\frac{\beta_2 * c_2}{\beta_1 * c_1}\right)} * \ln\left(\frac{c_2}{c_1}\right) \quad (9)$$

or

$$(\beta_2 * c_2 - \beta_1 * c_1) = B + C \quad (10)$$

where

$$B = \frac{(\beta_2 * c_2 - \beta_1 * c_1)}{\ln\left(\frac{\beta_2 * c_2}{\beta_1 * c_1}\right)} * \ln\left(\frac{\beta_2}{\beta_1}\right) \quad (11)$$

$$C = \frac{(\beta_2 * c_2 - \beta_1 * c_1)}{\ln\left(\frac{\beta_2 * c_2}{\beta_1 * c_1}\right)} * \ln\left(\frac{c_2}{c_1}\right) \quad (12)$$

Let

$$A = \alpha_2 - \alpha_1 \quad (13)$$

Then

$$f_2 - f_1 = A + B + C \quad (14)$$

In other words, the difference in fertility between two points of time can be decomposed into three components: 1) difference in the intercept (A) which is attributed

to the change in those factors which are not included in the regression model; 2) change in the regression coefficient (B) which is attributed to the change in the fertility reducing effect of contraceptive prevalence; and (3) change in the contraceptive prevalence (C). Since there is a regression discontinuity in fertility family planning relationship between the first three rounds (1992-1993 through 2005-2006) and the last two rounds (2015-2016 and 2019-2021), we have decomposed the change in TFR between 2005-2006 and 2015-2016. Results of the decomposition analysis are presented in table 8.

Table 8: Regression decomposition of the change in TFR in India between 2005-2006 and 2015-2016.

Particulars	Dependent variable	
	CPR	CPRM
Reported TFR, 2005-2006	2.700	2.700
Reported TFR, 2015-2016	2.200	2.200
Decrease in reported TFR	-0.500	-0.500
Estimated TFR, 2005-2006 (model 1)	2.629	2.642
Estimated TFR, 2015-2016 (model 2)	2.188	2.178
Decrease in estimated TFR between 2005-2006 and 2015-2016	-0.441	-0.464
Decrease in TFR attributed to the		
Change in the intercept	-2.138	-2.264
Change in fertility reducing effect of CPR	1.626	
Change in fertility reducing effect of CPRM		1.777
The change in CPR	0.071	
The change in CPRM		0.023
Total	-0.441	-0.464

Source: Authors

According to the third round of the National Family Health Survey, the CPR in India was 56.3 per cent during the period 2005-2006. This CPR implies a TFR of 2.629 according to the model 1 which is a close approximation of the TFR of 2.7 obtained directly from the birth history data collected during the third round of the survey. On the other hand, according to the fourth round of the National Family Health Survey, the CPR in India was 53.5 per cent during the period 2015-2016. This CPR implies a TFR of 2.188 according to the model 2 which is a close approximation of the TFR of 2.2 obtained from the birth history data collected during the fifth round of the survey. This means that between 2005-2006 and 2015-2016, the TFR in India is estimated to have decreased by around 0.441 absolute points according to regression models 1 and 2. The decomposition exercise suggests that the change in the intercept of the two regression models accounted for a decrease of 2.138 absolute points in TFR whereas the decrease in CPR accounted for an increase of 0.071 absolute points in TFR as CPR decreased, instead increased, during this period. On the other hand, the decrease in the fertility reducing effect of CPR between 2005-2006 and 2015-2016 accounted for an increase of 1.626 absolute points in TFR so that the net decrease in TFR between 2005-2006 and 2019-2021 was 0.441 points (Table 8). The decrease in TFR attributed to the change in the intercept of the regression model may be attributed to those factors which are not included in the regression model. This means that the entire decrease in TFR in the country between 2005-2006 and 2015-2016 may be attributed to factors other

than family planning as not only the CPR decreased during this period but also the fertility reducing effect of CPR has also decreased.

Similarly, the prevalence of modern family planning methods (CPRM) was 48.5 per cent during the period 2005-2006 which implies a TFR of 2.642, according to model 1b, whereas CPRM was 47.8 per cent during the period 2015-2016 which implies a TFR of 2.178 according to model 2b (Table 7). This means that TFR in the country decreased by 0.464 absolute points between 2005-2006 and 2015-2016. The difference attributed to the change in the intercept of the two regression models accounted for a decrease of 2.264 absolute points in TFR whereas the change in fertility reducing impact of CPRM accounted for an increase of 1.777 absolute points in TFR. At the same time, the decrease in CPRM from 48.5 per cent to 47.8 per cent between 2005-2006 and 2015-2016 accounted for an increase of 0.023 absolute points in TFR. As the result, the net decrease in TFR in the country during the period 2005-2006 and the period 2015-2016 was 0.464 absolute points. Both models suggest that a decrease in the fertility reducing effect of all methods contraceptive use or only modern contraceptive methods use has accounted for a deceleration in the decrease in TFR during the period 2015-2016 as compared to the period 2005-2006 or between the third and the fourth round of the National Family Health Survey.

Discussions and Conclusions

The present analysis reveals that the fertility reducing effect of family planning in India has always been lower than the global norm of 1 point decrease in TFR for 15 per cent points increase in CPR and this effect has decreased considerably during the period 2015-2016 through 2019-2021 as compared to the period 1992-1993 through 2005-2006. Another revealing finding of the analysis is that there is a regression discontinuity in the fertility family planning relationship based on the first three rounds (1992-1993, 1998-1999 and 2005-2006) and the fertility family planning relationship based on the last two rounds (2015-2016 and 2019-2021) of the National Family Health Survey. A decrease in the fertility reducing effect of family planning around 2020 as compared to that around 1990 has also been reported globally based on the cross-country data (Choi et al, 2018; Dasgupta et al, 2022; United Nations, 2020). However, the decrease in the fertility reducing effect of family planning in India has been very rapid. The evidence based on the first three rounds of the National Family Health Survey suggests that 10 per cent points increase in CPR is associated with a decrease of 0.43 absolute points in TFR but the evidence from the last two rounds of the survey suggests that 10 per cent points increase in CPR is associated with a decrease of only 0.13 points in TFR. When the analysis is limited to modern family planning methods only, the fertility reducing effect of modern family planning methods increases in both periods, but the increase is more during the period 1992-1993 through 2005-2006 as compared to the period 2015-2016 through 2019-2021 so that the decrease in the fertility reducing effect of family planning in recent years becomes even more marked. The evidence based on the latest (2019-2021) round of the National Family Health Survey indicates that inter-state/Union Territory variation in the use of modern family planning methods explains less than 15 per cent of the inter-state/Union Territory variation in the total fertility rate (TFR). This suggests that inter-state/Union Territory variation in contraceptive prevalence is

now not the primary determinant of inter-state/Union Territory variation in fertility within the country.

Reasons for the low and diminishing fertility reducing effect of family planning in India are not known at present. One probable reason is that there is a difference between the age location of fertility and the age location of family planning use, and this difference has increased over time. During the period 1992-1993, the mean age at childbearing in the country was around 26 years which decreased to around 25 years during the period 2019-2021. During 1992-1993, around 76 per cent of the fertility in the country was confined to younger ages, ages below 25 years. This proportion increased to 83 per cent during the period 2019-2021. By contrast, the mean age of the users of modern family planning methods increased from around 34 years during the period 1992-1993 to almost 36 years during the period 2019-2021. During the period 1992-1993, around 32 per cent of the users of modern family planning methods were below 25 years of age. This proportion decreased to around 26 per cent during the period 2019-2021. The reason behind the increasing difference in the age pattern of fertility and the age pattern of contraceptive use appears to be the continued dominance of permanent methods of family planning – female and male sterilisation - in the country. India is the only country in the world where more than two-third of the total family planning users were using a permanent family planning method – female or male sterilisation.

Another reason that may be responsible for the decrease in the fertility reducing effect of family planning is the decrease in the effectiveness of family planning use in preventing births because of the shift in the family planning method mix. The family planning method mix in India has historically been highly skewed in favour of permanent family planning methods – female and male sterilisation – which have the maximum effectiveness in preventing a birth. This skewness in favour of permanent family planning methods has decreased over time (Chaurasia, 2021) which implies that the effectiveness of family planning use in reducing fertility has decreased. There has also been a very rapid increase in the prevalence of traditional family planning methods between the fourth and the fifth rounds of the National Family Health Survey. This increase in the prevalence of traditional methods also appears to have contributed to the decrease in the fertility reducing effect of CPR as the present analysis reveals that the fertility reducing effect of CPRM is higher than the fertility reducing effect of CPR.

The near disconnect between fertility and family planning as revealed through the present analysis calls for a comprehensive reinvigoration of family planning efforts in India. The family planning in the country needs to be remodelled as a family building strategy rather than a birth limitation intervention. The preoccupation of the country with limiting births to reduce fertility and control population growth has dictated family planning efforts, especially, official family planning efforts for almost 70 years. The country and most of its states and Union Territories have now achieved the replacement fertility so that the policy and programme impetus for reducing fertility through birth limitation no longer exists. Moreover, with the continued decrease in fertility, more and more births in the country are getting concentrated in the younger ages of the reproductive period. It is therefore necessary that family planning efforts in the country are aligned to the changing fertility scenario of the country. This need of the time has policy and programme implications as

the official family planning efforts are the mainstay of the delivery of family planning services in the country. It is now the high time that the official family planning efforts must be directed towards meeting family planning needs of couples rather than focussing on limiting births. This is a major challenge to planning and programming family planning services as family planning needs of couples are very diverse and dynamic.

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