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Fertility Transition in Uttar Pradesh: Trends, Patterns and Convergence

Achala Srivastava[1]

Abstract: The main objective of this paper is to give a brief description of fertility changes between 1981 and 2011 and to highlight those aspects that are most relevant to regional differentiation in fertility during that period. This paper is a first-time quantitative empirical assessment of convergence in fertility in the context of Uttar Pradesh (UP). The assessment of how different districts are converging in terms of total fertility rate is crucial for understanding the challenges of future fertility decline and convergence in UP. Our focal point is whether the current decline in fertility rates has occurred differentially across districts and what factors are responsible for explaining the inter-district differentials in fertility decline across districts. To assess the change and degree of district-level inequality in TFR, we have used two measures of beta convergence i.e., absolute convergence and conditional convergence. We have also used sigma convergence measures. The absolute β-convergence estimates for the decade 1981-1991, 1991-2001 and 2001-2011 indicate a statistically significant convergence in the decade 1981-1991, weak convergence during 1991-2001 and divergence during 2001-2011. The conditional β-convergence estimates indicate significant and greater volume of convergence than absolute β-convergence for fertility rates. This indicates a strong connection between fertility convergence and socio-economic development level of the districts. Hence, there is a need to modify the population programmes and policies in the light of regional and district level situations.

***Keywords*:** Convergence, Fertility, Female Literacy, Female Work Participation Rate, Uttar Pradesh.

Introduction

According to fertility transition literature, fertility decline in India is generally attributed to the widespread use of modern contraceptives and increasing female literacy levels. However, the progress in fertility transition is not uniform across the states and districts in India/ state. At the regional and state level a more distinct trend of fertility decline is apparent with substantially lower fertility in the southern region than in the northern region. Over the years, the fertility rate in southern India has been substantially lower than that in the northern region, especially in Uttar Pradesh which has the largest population in India and the highest fertility rate among the states. Fertility is one of the most significant causative factors of population growth in Uttar Pradesh. Uttar Pradesh along with three other northern states of Bihar, Madhya Pradesh and Rajasthan accounts for 40 percent of India's population. Among these states, Uttar Pradesh is the most populous state in the country with a population of 19.9 crore according to the 2011 Census, which is 17 percent of the total population of the country. The demographic backwardness of UP is reflected by the demographic parameters of high fertility, high mortality, lower use of contraception, lower age at marriage, lower utilization of reproductive and child healthcare, lower levels of literacy and so forth (Gulati and Sharma, 2002). High fertility has adversely influenced the socio-economic, demographic and environmental development of the state. The

[1]Research Associate, Giri Institute of Development Studies, Aliganj, Lucknow, Email:achalaraj@gmail.com

laggard performance of UP is affecting not only its socio-economic development but that of the nation as well.

Fertility rates in the districts of Uttar Pradesh have been above replacement level and are highest in the country; even fertility rate has fallen very low levels at the regional and district level. The pace of level of fertility transition in UP has remained relatively unexplored and has received very little attention as compared to other states, mainly southern states. Very few studies (Parikh and Gupta, 2001; Gulati, 1988; Bhattacharya and Singh,1995;Murthi and Guio, 1995; Gulati and Sharma,2001; Das,2001; Mishra and Chauhan,2006) are available on various aspects of demographic change in the state. These studies indicate that UP is the laggard among the Indian states with regard to demographic transition. There is a paucity of researches on the fertility trends and patterns in UP at the district level. Hence, the district level analysis of fertility and its trends is very necessary for UP for formulation of effective policy and programmes for fertility decline. A district level analysis of fertility is certainly necessary and expected to provide some useful insights because in the wake of decentralized planning, demographic indicators are often sought for policy and programme implementation at the district level (Das and Mohanty, 2012) since district is the basic unit of administration and is the lowest level at which spatially disaggregated information on fertility is available. In this background the present paper highlights fertility trends and differentials in the districts of Uttar Pradesh. Most importantly, the question of whether district level differentials in fertility are increasing or decreasing overtime has not been directly addressed in the literature of fertility in the state. Hence, the next aim of this paper is to employ an empirical approach by using convergence hypothesis and economic convergence model to examine whether regional disparities in fertility has been increasing or decreasing across the districts. If not, what factors can help to explain differential changes in fertility rates? Convergence in fertility can be defined as the process by which high fertility districts catch up with low fertility districts, and as a consequence, regional inequalities in fertility decrease. Therefore, the specific objectives of this paper are:

i. To examine trends and differentials in fertility rates across districts.
ii. To assess the strength of the association between initial TFR and change in TFR.
iii. To find out the factors responsible for convergence in fertility and differential changes in fertility across districts.

Data Source and Methods

The study has utilized secondary data for this purpose. To assess the relative positions of the districts in terms of TFR, data have been taken from Census of India, Annual Health Survey (AHS), Statistical Abstracts of Uttar Pradesh, and District Level Household Survey (DLHS) and also from other published reports of government departments. To test the fertility convergence hypothesis at the district level beta and sigma convergence method have been used. The idea of convergence has a prominent place in both demographic and economic theory. The convergence hypothesis is easily adopted to examine the behaviour of fertility change (Strulik, *et al.*, 2010) at global level. From methodological point of view, demographers draw on theoretical, methodological, and empirical literature developed mainly by economists where convergence lies at the heart of modern growth theory (Barro and Sala-i-Martin, 1992; 2004) and they applied a variety of statistical methods to test for convergence within and between countries. In demographic literature several studies (Herbertsson et al., 2004; Casterline, 2001; Franklin, 2002 Dorius, 2008, 2010; Lanzieri, 2010; Lee and Reher, 2011; Wilson, 2001) confined their interest to convergence methodologies. From the last few years, increasing interest of scholars (Wilson, 2001, 2011; Reher, 2004; Franklin, 2002; Dorius, 2008; 2010; Lee and Reher, 2011) has also evident on the studies of convergence in fertility across the world. Several authors have emphasised on regional analysis of fertility behavior in India and affirmed that inequality in fertility is more apparent in the developing society which is an outcome of different socio-economic and political system of the state. Few of them (Arokiasamy and Goli, 2011; Wilson Chris et al., 2012; Mohanty et al., 2015) have focused on fertility convergence across the states/districts of India.

Measures of Convergence

In the economic literature the convergence process is statistically examined with the test for beta (absolute and conditional) and sigma convergence. Our attempt is to use these three approaches of convergence to separate out socio- economic and demographic effects. **Sigma (σ) convergence** takes place when the variation in fertility rate (TFR) decreases overtime. It measures the temporal dispersion (variance) of variable across the regions using the standard deviation or the coefficient of variation. When the dispersion falls overtime it is a sign of convergence, otherwise there is a divergence and when it shows ups and down, there is a mix of both (Quah, 1996). Sigma convergence in fertility across the districts has been estimated because it is known that beta convergence is not a sufficient condition for standard deviation (SD) and coefficient of variation (CV) of fertility to converge, as socio-economic conditions may diverge through time. If the coefficient of variation/standard deviation declines overtime, it implies a convergence ($\sigma t+T<\sigma t$). This measure has been used because it represents the simplest way to ignore the fluctuation of the mean. Sigma convergence (by using CV) is estimated as:

$$\mathbf{CV=\sigma/\mu}$$

Where, CV=Coefficient of variation,σ=Standard Deviation,μ=Mean
And to test the standard deviation of the variable following formula has been used:

$$\sigma t=\frac{\sqrt{(\sum_i{}^N=1(yit-\overline{yt})^2/(N-1)}}{\overline{yt}}$$

Where, σt = Standard deviation of variables at time t, $\sqrt{(\sum_i{}^N=1(yit-yt)^2/(N-1)}$ represents the standard deviation, N= Number of observation and yt represent the mean of TFR.

Beta (β) Convergence measure

Absolute beta (β) convergence: If the coefficient on initial level of a variable bears a statistically significant negative sign, i.e. if β<0, then we say that there exists absolute β-convergence. Rejecting the null hypothesis of β=0 against the alternative of β<0 implies a negative correlation between the initial level of a variable (TFR) and its percentage decline. It is used where high fertility regions experienced a faster decline in fertility rates than lower fertility regions during the study period 1981-2011. This work is originated from the work of Barro and Sala-I Martin (1992). To test the absolute or unconditional convergence, the following linear regression model was specified in Rey and Montouri (1999):

$$\text{In}\ (TFRit+k/TFRi,\ t) = \alpha + \beta\ \text{In}\ (TFRi,\ t) + \varepsilon it \text{ ------------------- (i)}$$

Where (TFRit+k/ TFRi, t) is change in fertility rate in district i in the year t, and TFRi,t, is initial fertility rate in district i and year t. β is the convergence coefficient and εit are corresponding residuals.

Conditional convergence may be computed with the inclusion of the Barro regression model of an additional set of explicative variables that account for varying socio-economic conditions (Dorius, 2008). When, it is recognized that each district has different socio-economic conditions, a more meaningful way of exploring the convergence and divergence in regional fertility inequality is the analysis of fertility convergence in terms of various socio-economic and demographic indicators. We include per capita income, female literacy rate, female work participation rate, infant mortality rate, proportion of Muslims (%), proportion of SC (%) and mean age at marriage as additional explanatory variables in the β-convergence model in this analysis. The following equation is used for calculating this:

$$\text{In}\ (TFRit+k/\ TFRi,\ t) = \alpha + \beta\ \text{In}\ (TFRi,t+PCIi,t+MAMi,t+FLRi,t+FWPRi,t+\%MUSi,t+\%SCi,t+IMRi,t) + \varepsilon it \text{ -----(ii)}$$

Thus, these factors allow convergence of regions to different steady states due to differences in the key factors of the fertility behavior with respect to the level of education, per capita income and infant mortality etc.

Findings

District-level Patterns of Fertility Transition:

The purpose of this section is to present a brief description of fertility changes during 1981 to 2011 across the districts. Table 1 presents descriptive statistics at the district level. The mean TFR of all the districts declined from 6.0 in 1981 to 3.7 by 2011. Fall in the gap in mean fertility of the districts does not imply that fertility rates across the districts are converging. Convergence occurs when the relative difference between the unit declines (Dorious, 2008). In the year 1981, district-level fertility in UP varied between minimum 5 children per woman and a maximum 7.2 children per woman. Whereas it further declined to the minimum range of 2.2 children per woman and a maximum range of 4.7 per woman during 2011. Also, the SD (standard deviation) of fertility rate across the districts increased slightly from 0.46 to 0.50, indicating that disparities in fertility rate are expanding across districts. It has been observed that, when all districts have taken together, mean TFR in UP is 3.66 in the decade 2011.

Table 1: Descriptive Statistics of TFR across Districts, 1981-2011

Statistics	1981	1991	2001	2011
Mean	6.02	5.51	4.45	3.66
Standard error	0.07	0.08	0.06	0.06
Standard Deviation	0.46	0.58	0.50	0.50
Variance	0.22	0.34	0.25	0.25
Kurtosis	-0.01	0.39	2.29	0.54
Skewness	0.16	-0.56	-1.05	-0.19
Range	2.20	2.80	2.90	2.50
Minimum	5.00	3.90	2.60	2.20
Maximum	7.20	6.70	5.50	4.70

Source: calculated by author

This value is quite significant as it is below 4. The values of skewness and kurtosis point to the fact that the distribution of TFR is not symmetrical across the districts during 1981 to 2011. Similarly, variance analysis shows that difference across the districts explain most of the variations in UP.

Since 1981, TFR in the districts of UP has declined steadily. Figures 1, 2, 3, and 4 illustrate these developments by plotting the TFR histograms for each decade using the census data 1981, 1991, 2001and 2011. During the four decades (1981-2011) all districts of UP have experienced a reduction in fertility. The figures show fertility histograms at the beginning of each decade and the number (proportion) of districts for each TFR interval. These figures indicating the change in the shape of the distribution of fertility overtime (1981-2011). In 1981 half of the districts of the state had a fertility rate between 6 and 7 children per woman, with the mean TFR in the distribution equal to 6.4(Figure 1). In 1991 majority of the districts i.e. 47 out of 54 showed fertility rates between 5 children to 6.7 children per woman, indicating a decline in fertility rate in this period with mean fertility rate as 5.5 children per woman (Figure 2). Only 5 percent of the districts in the year 2001had a total fertility rate below 3.5 and 7 percent of the districts had TFR above 5.0 children per woman during this period. The mean fertility rate fell from 5.5 in 1991 to 4.5 in 2001 (Figure 3). In 2011 the largest group of the districts is concentrated between 3 to 4 children per woman, with the mean TFR equal to 3.7. Fertility rate fell from 6.0 in 1981 to 3.7 in 2011. The analysis reveals that a significant change has taken place from higher to lower fertility rates over this period. In 1981 only 12.5 percent of districts in the sample had a total fertility rate below 5.5. By 1991 the proportion of districts with fertility rates below this level had increased to 38.8 percent. The proportion of districts with fertility rates below the level of 5 has further increased to 90 percent in 2001. We also observed that the mean fertility rate fell from 6.0 in 1981 to 3.2 in 2011 (Table 1).

Figure 1: Distribution of Fertility Rates across Districts, 1981

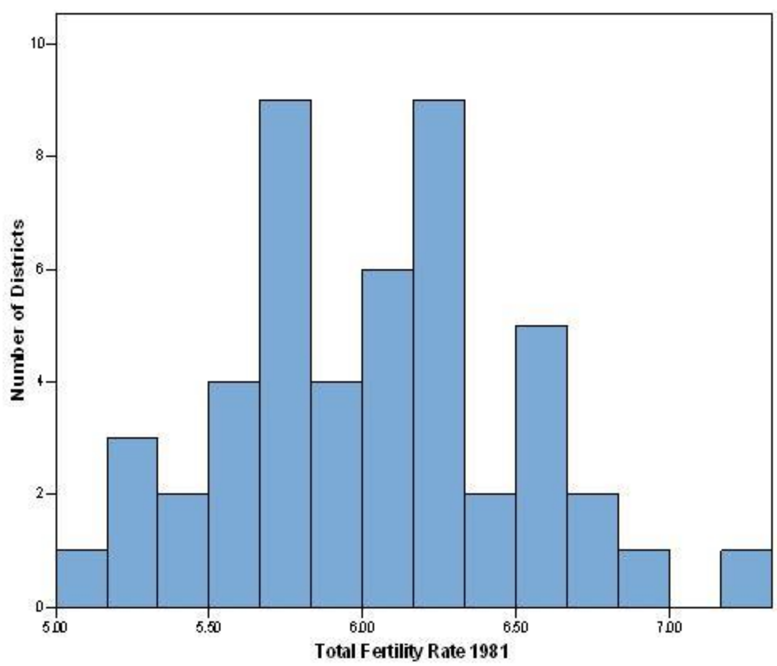


Figure 2: Distribution of Fertility Rates across Districts, 1991

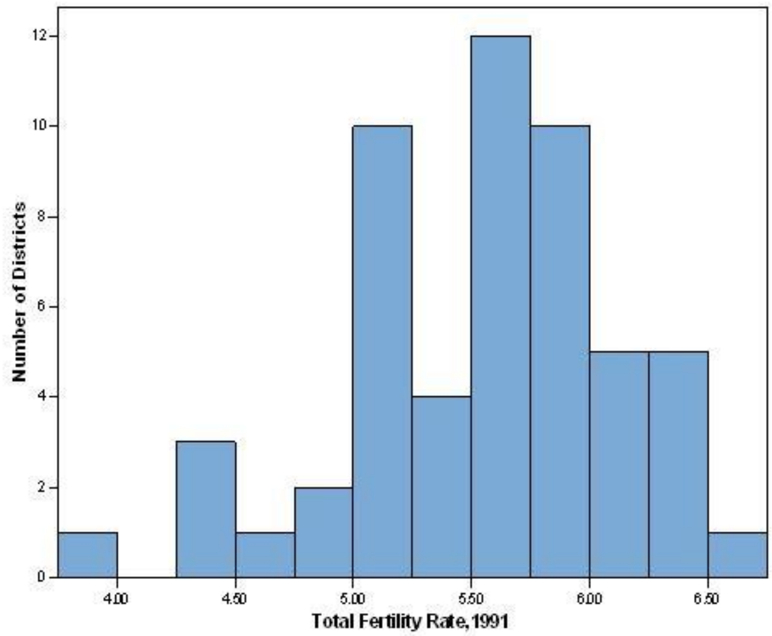


Figure 3: Distribution of Fertility Rates across Districts, 2001

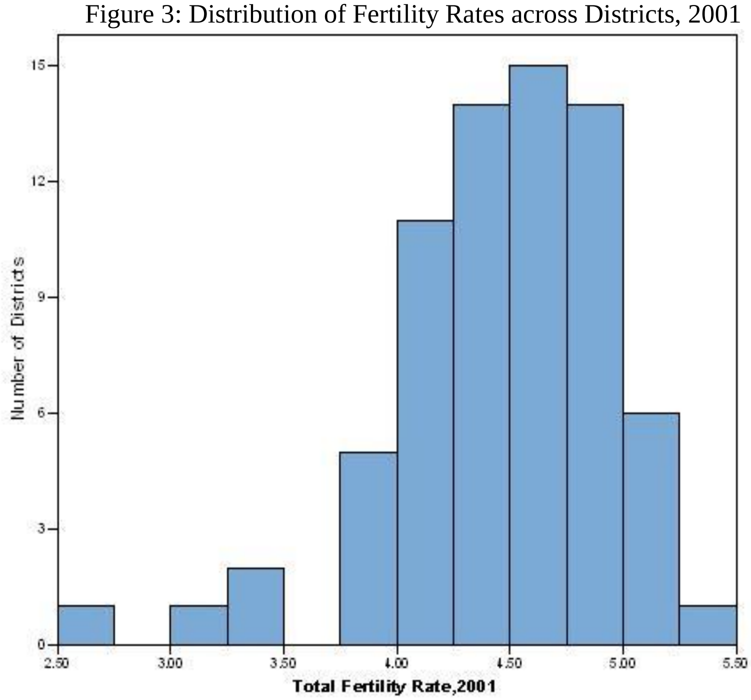
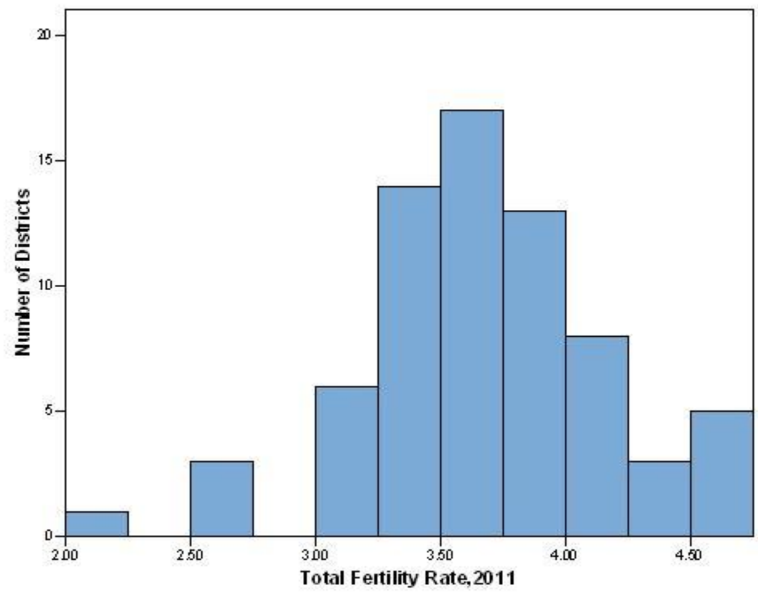


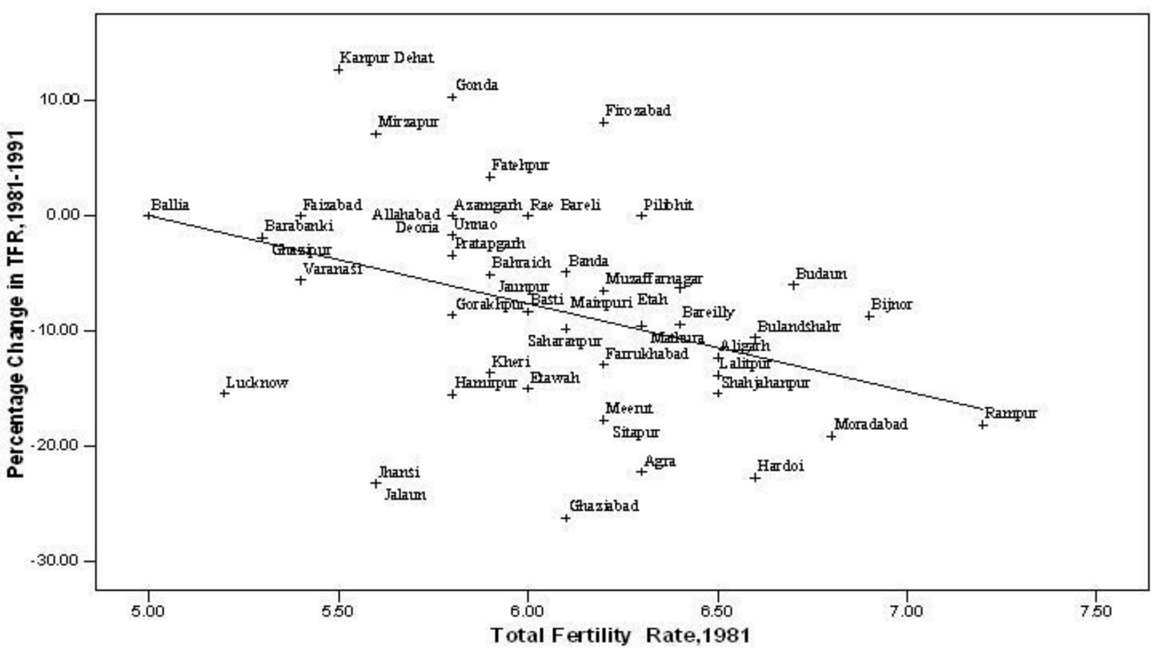
Figure 4: Distribution of Fertility Rates across Districts, 2011



Relationship between initial TFR and change in TFR

To examine whether or not districts with initially higher fertility levels experienced rapid changes in the subsequent decades we test the strength of the association between initial TFR and change in TFR. We plot the relative change in TFR in Figures 5, 6, 7, and 8 respectively which show the relative change during the 30 years as a 1981 function of initial fertility level in different decades. Figures 5, 6, 7, and 8 show the relative changes in TFR during the period -91,1991-2001 and 2001-2011 as a function of initial TFR levels (1981,1991 and 2001).

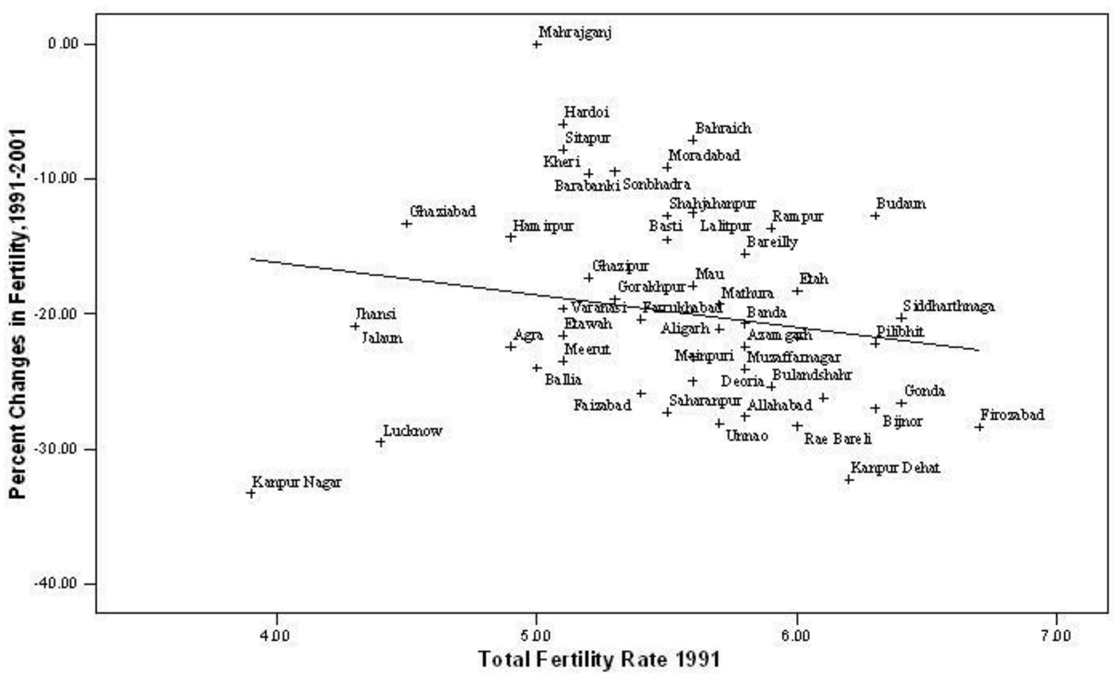
Figure 5: Relationship between Initial TFR (1981) and Changes in TFR, 1981-91



It is interesting to note that in 1981 Lucknow had the lowest TFR (5.2) which declined by 15.38 per cent during the decade 1981-1991. The highest TFR (7.2) in 1981 was observed in Rampur followed by Bijnor (6.9) and Moradabad (6.8) with a reduction of 18.06, 8.70 and 19.12 percent respectively in TFR during 1981-1991.The maximum decline in TFR has been noticed in Ghaziabad (26.23%) followed by Jhansi and Jalaun (23.21%). Majority of the high fertility districts are from the western part of the state as shown in Figure 5.There is a significant differential in the change observed, and this difference is particularly large among districts that had TFR of 4 and above in 1991. Some districts of the state have experienced marginal change in fertility.

Again in 1991 Kanpur Nagar had the lowest TFR (3.9) followed by Lucknow (4.4) which further declined by 33.33 percent and 29.55 per cent respectively (Figure 6). The highest TFR in 1991 was observed in Firozabad (6.7) followed by Gonda (6.4) and Siddarthnagar (6.4) with a decline of 28.36 percent, 26.56 per cent and 20.31 percent respectively. The maximum decline during this period has occurred in Kanpur Nagar (33.33%), closely followed by Kanpur Dehat (32.26) and Lucknow (29.55). It is quite interesting that the largest decline was observed in the central region districts.

Figure 6: Relationship between Initial TFR (1991) and Changes in TFR, 1991-2001



Similarly, during 2001-2011, Kanpur Nagar registered the lowest fertility rate of 2.6 children per woman and Badaun had the highest fertility rate of 5.5 children per woman.

Figure 7: Relationship between Initial TFR (2001) and Changes in TFR, 2001-2011

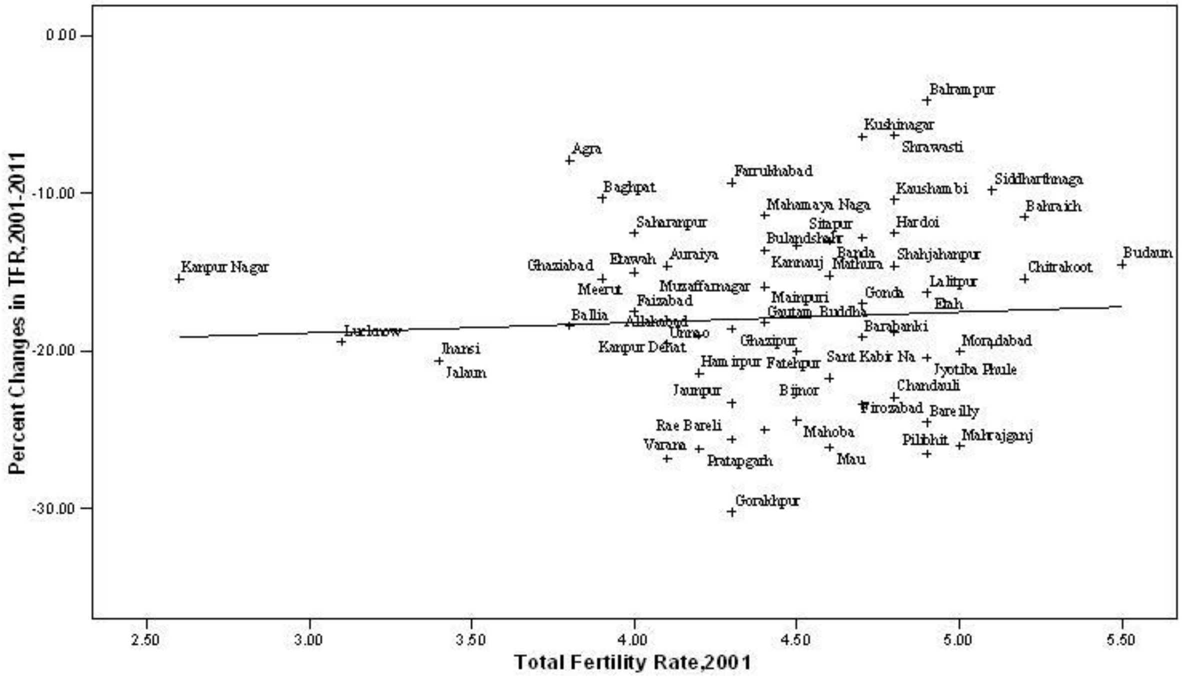
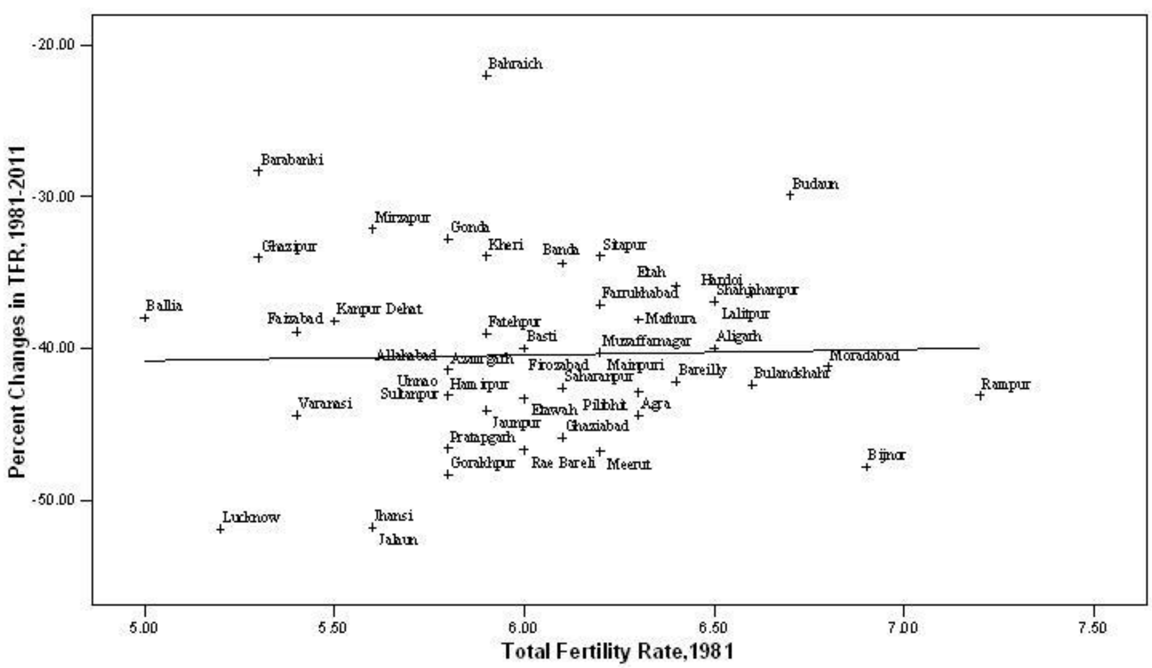


Figure 8: Relationship between Initial TFR (1981) and Changes in TFR, 1981-2011



A large decline in fertility rate has been noticed in Gorakhpur (30.2%) followed by Varanasi (26.8 percent) and Pillibhit (26.5%). While some of these districts experienced a very slight change in fertility rate.68 out of 71 districts have experienced a reduction in TFR during 1981-2011. Figures 5, 6, 7, and 8 show the changes in TFR during the period 1981-2011 as a function of initial TFR levels in different decades. The districts with higher fertility rate in the initial year experienced larger declines in fertility during 1981-2011 than districts with lower fertility rates. Many of the higher fertility districts showed a significant reduction in fertility. However, the convergence in TFR was slow. There are some districts where fertility has not changed or has even increased. So, analysis shows that the patterns of convergence in fertility are not very significant in the decade 2001-2011. In general, in the districts of the state, we observed significant convergence in fertility in the years1981-1991 than 1991-2001 and 2001-2011.

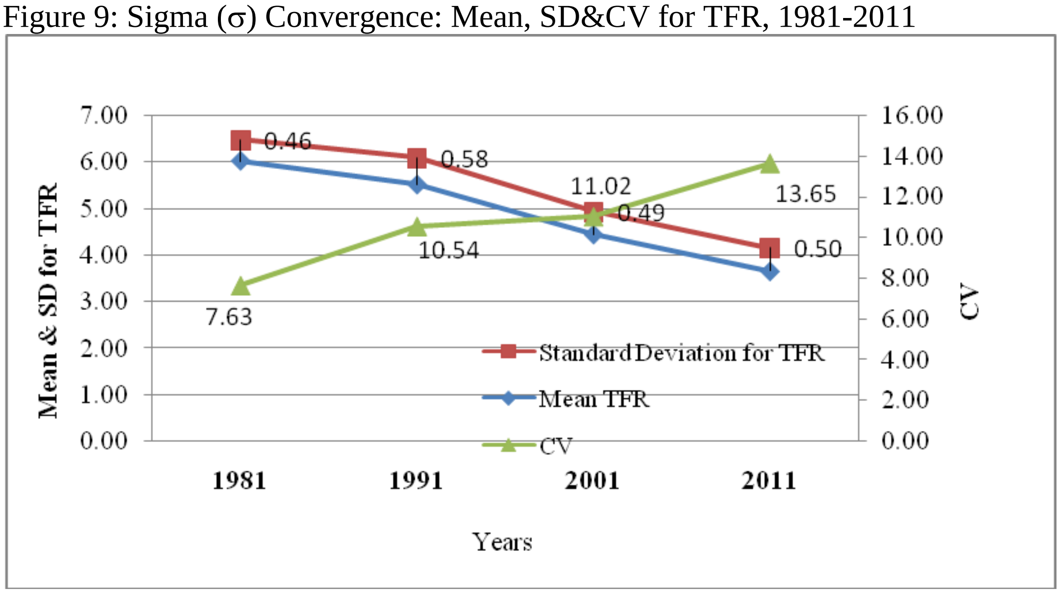
Fertility convergence: An empirical Analysis

We now turn to examine whether the negative relationship between the change in fertility rates and the initial fertility rate is strong in more formal analyses.

Sigma (σ) Convergence:

During 1981-2011 the CV has shown an upward trend at an increasing rate, reflecting increasing inequality among districts. However, CV has increased at a decreasing rate during the period 1991-2001. As a result, the analysis shows a trend of divergence rather than convergence during 1981-2011 across the districts. Across all the districts, the standard deviation increased until 2001 and then declined to a level somewhat below the starting point (Figure 9).

Figure 9: Sigma (σ) Convergence: Mean, SD&CV for TFR, 1981-2011



We found no sigma convergence instead of divergence under the period of analysis. At the same time, we observed diverging fertility rates within states during 2001-2011.

Beta (β) Convergence:

To investigate whether there is Beta convergence of fertility across the districts, we have regressed the change of fertility rates from 1981-1991 to its initial level in 1981 following Barro and Sala-i-martin (1992).This beta coefficient indicates the relationship between the fall in fertility over a period and the level of fertility at the start of the interval (Chris Wilson et al., 2011).The beta coefficient is statistically significant in regression (1), indicating an unconditional or absolute convergence regression of fertility rates. The sign is negative which rejects the null hypothesis of no convergence in the years 1981-1991and 1991-2001. There is evidence of significant convergence in fertility rate during the earlier period (1981-91) β=-5.78, P>0.02. There is also evidence of weak convergence in fertility rates during 1991-2001 across the districts (Table 2) β=-2.41, P>0.28. The beta coefficient is positive and insignificant during 2001-2011(β=0.66, P>0.56), implying that there is evidence of beta divergence during the recent (i.e., 2011) period.

The absolute or unconditional convergence model does not include other factors that bring change in fertility levels across the districts. Fertility reduction is associated with the change in various socio-economic and other determinants. So, we also considered conditional convergence and divergence in fertility across districts. Under this framework we have estimated conditional β-convergence by adding five important and relevant socio-economic and demographic factors viz., Per Capita Income, Female Literacy Rate (FLR), Infant Mortality Rate (IMR), Mean Age at Marriage, and Female Work Participation Rate (FWPR) to explain the changes in fertility rates during the three time periods i.e. 1981-2011 in addition to the initial fertility rate of the respective periods (i.e., 1981, 1991, 2001, and 2011). Columns (2) to (6) of regression show conditional convergence regression.

Initial Fertility Rates (1981): The negative coefficient on total fertility rates shows evidence of convergence in TFR across the districts in the year 1981-1991.The negative beta coefficients are found to be statistically significant at 10%, 5% and 1% level (Table 3). Table 2, column 1 depicts the unconditional and absolute convergence in fertility rate across the districts during 1981-1991. This means that a decline in fertility rate is high in high fertility districts as compared to low fertility districts. The other variables that are included in the model do not alter these results. There is unconditional convergence/divergence taking place in TFR during the period 1991 (Table 4). However, it is not significant. TFR has declined in high fertility districts but at a slower pace than the low fertility districts. Similarly, regression results of columns (2) to (6) show conditional convergence. The inclusion of other variables shows an impact on results of absolute convergence, as the coefficient increased in regressions 3, 4, 5 and 6 (-6.11, -5.78,-5.76 and -6.21) indicating significant convergence. The negative coefficients are statistically significant in terms of p-value in all the regressions (Table 4). This would mean that the rate of fertility decline increased with an increase in income, age at marriage, FWPR, FLR and decrease in IMR, etc. In the decade 2001-2011, there is no strong unconditional convergence, conditional convergence, and divergence (Table 5). However, the sign of the coefficient of TFR is negative which means that the rate of decline in TFR has increased to some extent with the inclusion of other variables across the districts. Coefficient values are small and not significant. However, the fertility rate has fallen significantly throughout the state; even the inclusion of additional variables does not seem to change these results in regressions (2) and (6).

Table 2: Beta Convergence in Fertility Rates across the Districts,1981-2011

	1981-1991		1991-2001		2001-2011	
	Absolute/ Unconditional	Conditional	Absolute/ Unconditional	Conditional	Absolute/ Unconditional	Conditional
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
TFR 1981	-5.78	-9.53	-2.41	-6.21	0.66	-3.07
P>t	(0.02)	(0.00)	(0.28)	(0.00)	(0.56)	(0.12)
PCI		-1.99		3.391		0.036
P>t		(0.37)		(0.11)		(0.99)
IMR		0.035		0.106		0.068
P>t		(0.52)		(0.03)		(0.22)
FMAM		2.73		-1.30		2.339
P>t		(0.08)		(0.17)		(0.01)
FWPR		0.331		-0.275		0.224
P>t		(0.14)		(0.02)		(0.37)
FLR		-0.931		-0.522		-0.227
P>t		(0.00)		(0.00)		(0.07)
Constant	25.78	24.10	-6.54	12.78	-20.8	-43.056
P>t	(0.09)	(0.36)	(0.60)	(0.05)	(0.00)	(0.02)
R2	0.09	0.53	0.04	0.56	0.00	0.17
Rate /Speed of Convergence	**0.16**	**0.21**	**0.03**	**0.17**	**0.05**	**0.07**
Districts (Nos.)		**48**		**54**		**70**

The annual rate or speed of convergence over the decade is reported to be 16 percent (0.16), 3 per cent (0.3) and 5 per cent (0.5) in the case of absolute convergence and 21 per cent, 17 per cent and 7 per cent in the case of conditional convergence during 1981-91,1991-01 and 2001-2011 respectively (Table 2). However, it appears that the rate of convergence was not stable over the entire period. Because the annual rate of convergence in the initial years (1981-1991) is more than that of the later years.

Income Effect: Existing literature suggests that income per capita is an important correlate of fertility (Becker and Barro, 1988; Herbertsson, 2004 Siddqui, 1996). However, in our analysis, the sign of the coefficient of Per capita income (PCI) is found to be negative during the decade 1981-1991. This means that the rate of fertility decline increased with an increase in income. B-Coefficient of regressions (2) to (6) is statistically significant at 1% level except in regression (6). In the decade 1991-2001 no significant effect of income on fertility decline is found. It shows very weak evidence of convergence by adding per capita income (Table 3). In the decade 2001-2011, there is no evidence of strong convergence. Inclusion of per capita income in the model did not modify these findings. Only in regressions (4) and (5) very weak evidence of conditional convergence has been noticed (Table 4). Regressions 2, 3 and 6 show positive coefficients of income on fertility suggesting the fact that fertility decline slows with the increase in income.

Infant Mortality Effect: Regressions (2) to (6) in Table 3 support the hypothesis that with the decline of IMR level of the districts the rate of fertility decline has also registered an increasing trend. During the decade 1981-1991infant mortality showed a strong effect on fertility decline in the conditional convergence model in regressions 3, 4 & 5 with the significant p-value (Table 3). Similarly, in 1991-2001 and 2001-2011, the impact of infant mortality rate in fertility decline is strongly significant. The p-value is highly significant in regressions 3, 4, 5 and 6 (Table 4 and5). The overall analysis suggests that IMR explains the significant association with fertility decline across the districts.

Table 3: Test of Beta Convergence in TFR across Districts, 1981-1991

	Absolute/Unconditional		**(Beta) β- Conditional Convergence**			
	(1)	(2)	(3)	(4)	(5)	(6)
TFR(1981)	-5.78	-4.68	-8.66	-7.19	-7.64	-9.53
P>t	(0.02)	(0.09)	(0.00)	(0.02)	(0.02)	(0.00)
PCI		-5.79	-5.63	-5.31	-4.94	-1.99
P>t		(0.03)	(0.03)	(0.05)	(0.06)	(0.37)
IMR			0.123	0.107	0.147	0.035
P>t			(0.06)	(0.09)	(0.02)	(0.52)
FMAM				-1.35	1.45	2.73
P>t				(0.40)	(0.41)	(0.08)
FWPR					0.599	0.331
P>t					(0.01)	(0.14)
FLR						-0.931
P>t						(0.00)
Constant	25.78	60.33	67.17	79.96	25.47	24.10
P>t	(0.09)	(0.00)	(0.00)	(0.00)	(0.31)	(0.36)
R-squared	0.09	0.18	0.25	0.26	0.34	0.53
Districts			**48**			

Table 4: Test of Beta Convergence in TFR across Districts, 1991-2001

	Absolute/Unconditional		**(Beta) β- Conditional Convergence**			
	(1)	(2)	(3)	(4)	(5)	(6)
TFR(1991)	-2.41	-2.82	-6.11	-5.78	-5.76	-6.21
P>t	-(1.10)	(0.20)	(0.01)	(0.01)	(0.01)	(0.00)
PCI		-2.349	-0.649	0.600	0.660	3.391
P>t		(0.48)	(0.82)	(0.85)	(0.84)	(0.11)
IMR			0.213	0.204	0.203	0.106
P>t			(0.00)	(0.00)	(0.00)	(0.03)
FMAM				-1.34	-1.52	-1.30
P>t				(0.38)	(0.36)	(0.17)
FWPR					-0.043	-0.275
P>t					(0.86)	(0.02)
FLR						-0.522
P>t						(0.00)
Constant	-6.54	15.96	0.32	11.66	14.50	12.78
P>t	-(0.52)	(0.63)	(0.99)	(0.66)	(0.66)	(0.05)
R-squared	0.04	0.05	0.27	0.28	0.28	0.56
Districts			**54**			

Female Marriage-Age Effect: In terms of female mean age at marriage (FMAM), no significant convergence has been evident in the fertility rate in 1981-1991 across the districts. The values of coefficient in regressions 4, 5 and 6 are negative which is expected. However, the coefficient is significant only in regression 6 (at 10% level), implying that, with the increase in mean age at marriage of females the rate of fertility decline has increased. A similar trend has been noticed in the year 1991-2001. Negative coefficients are found insignificant in the regressions 4, 5 & 6. In the recent decade (2001-2011) coefficients are positive and significant; indicating that with the increase in FMAM, the rate of fertility decline has increased.

Table 5: Test of Beta Convergence in TFR across Districts,2001-2011

	Absolute/Unconditional		**(Beta) β- Conditional Convergence**			
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
TFR(2001)	0.66	1.11	0.06	-0.446	-0.61	-3.07
P>t	(0.56)	(0.31)	(0.97)	(0.76)	(0.68)	(0.12)
PCI		2.52	2.60	-0.626	-0.95	0.036
P>t		(0.17)	(0.18)	(0.79)	(0.70)	(0.99)
IMR			0.07	0.091	0.10	0.068
P>t			(0.25)	(0.10)	(0.10)	(0.22)
FMAM				1.738	2.14	2.34
P>t				(0.03)	(0.01)	(0.01)
FWPR					0.26	0.224
P>t					(0.30)	(0.37)
FLR						-0.227
P>t						(0.07)
Constant	-20.8	-46.23	-47.88	-47.89	-53.36	-43.06
P>t	(0.00)	(0.11)	(0.02)	(0.02)	(0.01)	(0.02)
R-squared	0.00	0.03	0.05	0.10	0.11	0.17
Districts			**70**			

Female Employment Effect

According to Easterlin (1975) women's wages will be a key influence on fertility and that fertility and female labour force participation will be inversely related. However, female work participation rate may affect the fertility decline in both ways. It can increase fertility decline by reducing family size through better childbearing options. On the other hand, it has also an impact on reducing the rate of fertility decline by increasing the family size for supporting their economic needs. In the year 1981-91 it shows positive coefficient, meaning that, with the increase in the female work participation rate (FWPR) the rate of fertility decline increases significantly in regressions 5 & 6. Similarly, evidence of convergence has been noticed in the recent decade (2001-2011). However, FWPR is not statistically significant. FWPR shows negative coefficient during 1991-2001, indicating the reduction in the rate of fertility decline, with the increase in FWPR by 2 percent in regression (6). Consequently, FWPR showed a diverging trend during 1991-2001.

Education Effect:

The observed change in fertility due to change in female literacy was -0.931 in 1981-1991, 0.522 in 1991-2001 and -0.16 in 2001-2011 (Tables 4, 5 &6). Increase in female literacy accounted for a maximum increase in the rate of fertility decline in TFR. To test the impact of the female literacy on the decline in fertility rate across the districts, we have taken female literacy variable in regression 6. The coefficient of this variable is negative as expected and statistically significant. With the inclusion of female literacy as a control variable in our analysis, the value of R-square has also increased (53% in 1981-91, 56% in 1991-2001 and 17% in 2001-2011) as shown in tables 3, 4, and5, Indicating the fact that other variables have limited power in explaining fertility reduction in the districts of the state as compared to female literacy.

In our analysis, initial TFR, female literacy and infant mortality have emerged as the key predictor of fertility decline across the districts, indicating that these determinants are significant predictors of fertility-convergence across the districts. On the whole, beta convergence estimates imply that convergence in the earlier period i.e. in 1981-91 has disappeared in 1991-2001 showing the diverging trends in fertility rates in the later period. The result provides much support for evidence of beta convergence during 1981-2001 as the overall fit of the sample specification is generally high with an adjusted R^2 i.e. above 0.50 (0.53 in 1981 and 0.56 in 1991-2001) in 1981-91 and 1991-2001. Additionally, the regression of 2001-2011 yields insignificant and positive coefficients for the income level, confirming the weak beta-convergence for the districts during this period.

Conclusion

In the nutshell, the progress in fertility transition is not uniform across the districts of the state. TFR in the state is declining with divergent rates. Districts with higher fertility rate in the initial year experienced larger declines than districts with lower fertility rates. The pattern of convergence in fertility is not very significant in the recent decade. Although the fertility transition is universal in the districts, the fertility decline has been lowest in the districts with highest fertility because of the region and district specific socio-economic factors. The absolute β-convergence estimates indicate a statistically significant convergence in the decade 1981-1991, weak convergence during 1991-2001 and divergence during 2001-2011. The conditional β-convergence estimates indicate the significant and greater volume of convergence than absolute β-convergence for fertility rates. This indicates a strong connection between fertility convergence and socio-economic development level of the districts. No sigma convergence found during 1981-2011. The results suggest that the pattern of fertility change is an outcome of various interacting socio-economic, cultural and other factors. Though initial TFR has emerged as the single largest factor of fertility decline, this analysis also demonstrates the significance of female literacy rate, female age at marriage, infant mortality rate and per capita income in fertility decline. These results are of great importance for policy formulation. Due to difference in socio-economic and cultural background of the districts, spatial variations should be considered with priority in targeting policy directions at least for those districts where fertility decline seems slow. Moreover, there is a need to modify the programmes and policies in the light of regional and district level situations. Adoption of equitable and affordable family planning programmes along with increased female literacy rate can reduce differentials in fertility rate across districts.

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