Convergence in Rural and Urban Fertility

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Introduction

Several authors have built an idea of regional analysis of fertility behaviour and suggested that inequality in fertility is more apparent in the developing societies which are an outcome of different socio-economic and political system of the state. Though socio-economic differentials within the states have reduced to some extent, but when it comes to fertility variation there is no statistically significant evidence of convergence. In many states of India, fertility decline is still half way and demographers and researchers need to pay much more attention to what happens then. Fertility is usually higher in less developed region than developed region, higher in rural than urban areas, higher among uneducated women than their better-educated counterparts, and higher in households with low incomes than their higher income counterparts (Wilson 2001, 2011; Dorius 2008; 2010). The trend and pattern suggest strong prospects of continued fertility convergence among the Indian states. Thus, a consensus is yet to be reached on the convergence issues relating to the Indian states by place of residence. The urban areas of the states are impending low fertility rates with some factors such as high per capita income, low poverty level and high female literacy. Contrary to this rural areas still have higher fertility rates (Guilmoto and Rajan 2001; Kulkarni and Alagarajan 2008).Numerous studies (Arikosamy and Goli, 2011; Wilson et al., 2012 and Mohanty, 2015) in India have focused on the state pattern of fertility change and convergence but there is still a lack of studies focusing exclusively on the convergence pattern of rural-urban fertility. Hence the primary objective of this paper is to examine trends and pattern of fertility convergence across the states by place of residence. For this purpose an empirical analysis is conducted using fertility data from 1971 to 2013 to assess the extent to which fertility levels have converged overtime.

Measures of Fertility Convergence

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) – applying this logic to Indian case we accept the difference between TFR across the states to eventually shrink. Friedman suggested that the sigma convergence is estimated by using CV (coefficient of variation) which is estimated as:

$$CV=\sigma/\mu$$

Beta (β) Convergence measure

A second form of convergence which has primarily been the focus of macro-economics, occurs when the poor regions or higher fertility regions grow faster than the rich regions or low fertility regions, resulting in the former (high fertility states) eventually catching up with the latter (low fertility states) in total fertility levels, has been defined as β-convergence. We measure two types of β-convergence i.e. (i) absolute and (ii) conditional 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.

Absolute β Convergence

Absolute β convergence is used where the gap between the rich and poor states shrinks especially due to greater progress in the laggard states, a concept that originated from the work of Barro and Sala-I-Martin (1992). In this study, absolute β- Convergence was tested using the following linear regression model specified in Rey and Montouri (1999):

$$\ln (yi, T/yi, 0) = ά+β^* \ln (yi, 0) +ε_i \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where ln (yi, 0) is the initial value of the TFR and
ln (yi, T/yi, 0) is change in fertility rates in T period. i corresponds to the state/district as the cross sectional unit, Coefficient ά is a constant and β is the coefficient of convergence and $\boldsymbol{\varepsilon_i}$ represents an error term.

Conditional β-Convergence

When the analysis is focused at the national or state level it will not be reasonable to assume that all states/districts will share the same socio-economic conditions. However, it is recognized that each state may be converging towards its own stable state across socio-economic strata. This condition is defined as conditional beta convergence since it may be detected with the inclusion of the Barro regression of an additional set of variables that are likely to account for varying socio-economic conditions (Herbertsson, 2000).

In this analysis conditional β-convergence model is estimated by adding variables such as female literacy rate (FLR), percentage of population below poverty line (POV), contraceptive prevalence rate (CPR) and infant mortality rate (IMR) as covariates in the conditional β-convergence measure. The equation of the model can be estimated as:

$$\ln (yi, T/yi, 0) =ά +β^*\ln (yi, 0) +Y^*Zi, 0+ ε_i \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where ln (yi, T/yi, 0) is change in TFR in state/district i in the period T, 0

yi, 0 is the TFR value in initial time 0

Zi, 0 denotes variables like female literacy rate (FLR), % of population below poverty line (POV) and contraceptive prevalence rate (CPR) etc. at time t=0 as further explanatory variables.

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, poverty level and adoption of family planning method etc.

The rate of speed of convergence measures the speed at which the states converge towards the steady state (If beta turn positive there is convergence, otherwise divergence). This is calculated as:

$$\lambda = \ln (\beta+1)/t)$$

Where, λ = Rate or speed of convergence, β is the beta convergence in t time period i.e. number of years

Convergence in Urban and in Rural Fertility

In this section we have examined the fertility convergence across the states for rural and urban areas separately. Table I show statistics of sigma convergence in terms of mean TFR and Standard Deviation. The table exhibits the fact that fertility rates are declining in both rural and urban areas. But not much improvement is found in the inter-state disparities in fertility as the decline in CV (Coefficient of variation) is not very significant (i.e. from 29 per cent in 1971 to 26 per cent in 2013) indicating that inter-state inequality in rural fertility is still high across the states of India.

Table I: Descriptive Statistics

Place of Residence	Mean	SD	Coefficient of Variation	Minimum TFR	Maximum TFR
Rural					
1971	5.36	1.55	0.29	4.1	6.9
1981	3.87	1.24	0.32	2.5	5.9
1991	3.68	0.91	0.25	1.9	5.5
2001	3.04	0.92	0.30	1.8	4.8
2011	2.39	0.67	0.28	1.7	3.7
2013	2.29	0.59	0.26	1.7	3.5
,Urban					
1971	4.09	1.18	0.29	3.1	5.4
1981	2.82	0.89	0.31	1.8	3.9
1991	2.65	0.58	0.22	1.8	3.8
2001	2.22	0.50	0.23	1.6	3.4
2011	1.81	0.43	0.24	1.2	2.6
2013	1.76	0.40	0.23	1.2	2.5

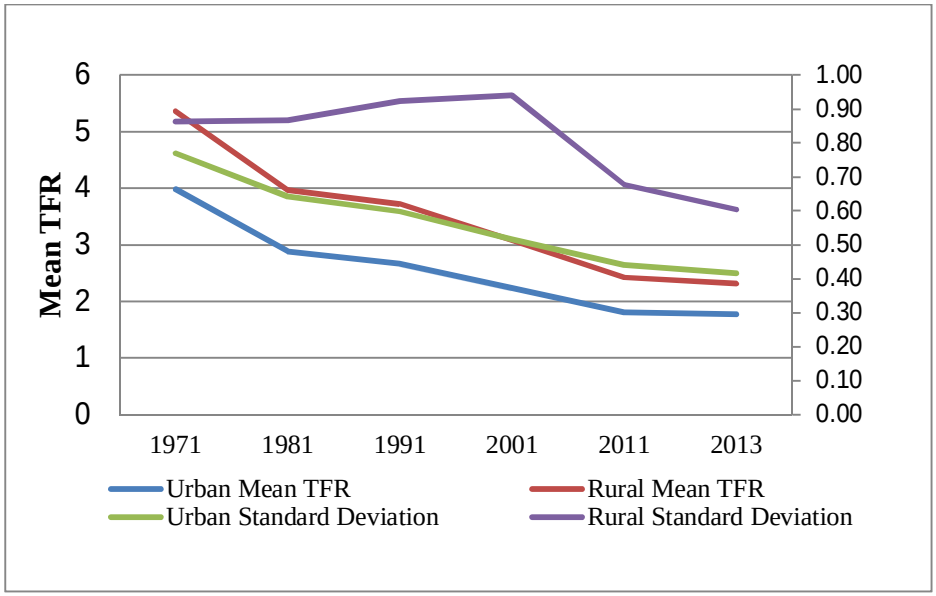

Figure 1. Sigma Convergence

In Fig. 1, SD shows downward trends since 1971, both in rural and urban areas, indicating convergence. In urban areas fertility rate in 1971 was 3.1 which came down at the level of 2.4 in 2011. Mean Urban TFR also shows a declining trend. This means that there is a decline in fertility rate but not evenly because CV has not been showing significant improvement in the inter-state inequality in fertility. It was 29 per cent in 1971 and came down to the level of 23 per cent in 2011.

We further investigate as to what factors are responsible for these rural-urban differentials in fertility decline across the states. For this purpose we estimated β-convergence (absolute and conditional convergence). The results for rural and urban areas computed separately through OLS regression.

Table II: β-Convergence in Fertility Rates in Indian States by Residence

Period	Absolute (unconditional)		R-Squared		Rate of Convergence	
	Rural	Urban	Rural	Urban	Rural	Urban
1971-1981	0.2472	-3.4025	0.0005	0.0343	0.02	0.09
P>t	(0.93)	(0.47)	(0.93)	(0.47)		
1981-1991	-0.1536	-10.1619	0.0001	0.1495	-0.02	0.22
P>t	(0.98)	(0.10)	(0.98)	(0.10)		
1991-2001	1.5776	-1.6379	0.0239	0.0264	0.09	-0.04
P>t	(0.57)	(0.59)	(0.57)	(0.59)		
2001-2011	-2.5947	3.3405	0.1445	0.0567	0.05	0.15
P>t	(0.08)	(0.41)	(0.08)	(0.41)		
1971-2013	0.3031	1.5820	0.0014	0.0293	0.03	0.09
P>t	(0.81)	(0.50)	(0.81)	(0.50)		

Absolute Convergence

The negative beta coefficient of the initial TFR shows that there is a significant convergence across states in the decades 1981-91 and 2001-2011 in rural fertility as shown by regression 2 and 4 (table II). However, in the decade 1971-1981 there is divergence in TFR. In the decade 1981-91 beta coefficient (β=-0.1536, P>0.98) indicates that the states with higher fertility show a larger decline but this decline is not significant because in this period some low fertility states also registered a decline in TFR i.e. Kerala, Tamil Nadu and Himachal Pradesh. Again in 1991-2001 high fertility states show a very small decline as compared to low fertility states, resulting in divergence in fertility rate across the states. In the recent decade (2001-11) some convergence in rural fertility rate has been noticed as fertility decline has occurred in most of the states and fertility decline is found high in high fertility states (table II). B-coefficient in regression 4 in the recent period (2001-2011) is found highly significant (β=-2.5947, P>t=0.08).

Convergence in urban fertility shows significant results in regressions 1, 2 and 3. In the most recent period (2001-2011) fertility rate is showing divergence. When testing convergence in the overall period (1971-2011) we found no convergence in fertility. No evidence of convergence is found in 1971-2013 due to larger decline in fertility among the low fertility states (see table II). Speed and rate of convergence is found higher in urban than in rural areas. It is found highest in the decade 1991-2001 in rural areas (9% per annum) and in 1981-1991 in urban areas (22% per annum).

Conditional Convergence

Conditional convergence is estimated because all the states and their rural-urban divisions do not have same physical, socio-economic and demographic conditions. For this we have included two more explanatory variables viz. female literacy and poverty ratio as the control variables in our OLS model. The results are presented in Tables III & IV separately for rural and urban areas.

Table III: β - Conditional Convergence in Rural Fertility Rates in Indian States

			β-Coefficient				
	Period	**Constant**	**TFR**	**POVERTY**	**FLR**	**R-Squared**	**Convergence Rate**
Regression 1	**1971-1981**	77.49878	-15.0560	-0.1744	-0.9609	0.5377	0.26
	P>t	(0.10)	(0.04)	(0.36)	(0.01)	(0.07)	
Regression 2	**1981-1991**	7.788168	-3.9711	0.4238	-0.5069	0.4893	0.11
	P>t	(0.62)	(0.20)	(0.09)	(0.00)	(0.01)	
Regression 3	**1991-2001**	-54.21549	3.9273	0.3179	0.2263	0.2321	0.16
	P>t	(0.00)	(0.07)	(0.08)	(0.21)	(0.03)	
Regression 4	**2001-2011**	-33.27088	-1.7865	0.0889	0.2943	0.3287	-0.02
	P>t	(0.03)	(0.27)	(0.61)	(0.26)	(0.27)	
Regression 5	**1971-2013**	-87.01854	2.3398	0.3860	-0.0681	0.3673	0.12
	P>t	(0.00)	(0.04)	(0.00)	(0.73)	(0.00)	

Table IV: β - Conditional Convergence in Urban Fertility Rates in Indian States

	Period	Constant	β-Coefficient			R-Squared	Convergence Rate
			TFR	POVERTY	FLR		
Regression 1	**1971-1981**	10.37557	-5.111239	-0.208644	-0.2285201	0.1711	0.14
	P>t	(0.68)	(0.15)	(0.53)	(0.50)	(0.39)	
Regression 2	**1981-1991**	99.51419	-20.7015	0.234216	-1.092155	0.5272	0.30
	P>t	(0.00)	(0.00)	(0.48)	(0.00)	(0.01)	
Regression 3	**1991-2001**	-18.57661	-1.844975	0.138848	0.0511169	0.0767	0.10
	P>t	(0.24)	(0.59)	(0.37)	(0.75)	(0.70)	
Regression 4	**2001-2011**	-82.23497	2.231671	0.332884	0.6994481	0.2747	0.12
	P>t	(0.64)	(0.07)	(0.02)	(0.41)	(0.23)	
Regression 5	**1971-2013**	-70.28972	0.56728	0.38568	-0.08200	0.3406	0.04
	P>t	(0.79)	(0.61)	(0.00)	(0.01)	(0.03)	

Female Literacy Rate

An increase in female education would encourage women to have less or fewer children. Inclusion of female literacy and poverty ratio in our model results in significant convergence in rural fertility rate as these variables contribute to increase the value of beta coefficient during 1971-81 (β=-15.0560,P>0.04,R2=0.054) and 1981-1991 (β=-3.9711,P>0.20,R2=0.49). However, regressions 3 and 5 show significant divergence in rural fertility (table III). In this model TFR shows high convergence rate or speed (26%) and goodness of fit (R2=54%) during 1971-81 than 1981-91 and other decades. In the case of urban TFR, female literacy shows significant impact in fertility convergence in regression 1 in 1971-81 (β=-5.111239P>0.15), Regression 2 in 1981-1991 (β=-20.7015, P>0.00) and regression 3 in 1991-2001 (β=-1.844975, P>0.59). But in the recent period (2001-2011) it is showing a diverging trend (table IV). The estimates of rate or speed of convergence and goodness of fit measured by adjusted R2 indicate significant convergence during 1981-1991(rate of convergence =30% & R2=0.53) than in other decades in urban areas.

Poverty Ratio

It is generally argued that high poverty in India increases the fertility level of women. The coefficient of this variable is statistically significant and positive in regressions 2, 3 & 5. Indicating the fact that the inclusion of poverty with female literacy in this model shows evidence of convergence as indicated by negative β-coefficient (β=-15.056, P<0.04) during 1971-81 in table III. Regression 1 also shows high speed or rate of convergence (26% per annum) in the case of rural fertility rate which is higher than that in other decades. In the case of urban fertility, speed of convergence (i.e., 31 per cent per annum) is found higher in the decade 1981-1991 (β=-20.7015, P<0.00). This means that the rate of decline in fertility increased with decline in poverty and increase in female literacy rate. However, during 1991-2001 in rural areas and during 2001-2011 in urban areas TFR shows some divergent trends as the beta coefficient is positive and significant. Both absolute and conditional β-beta convergence indicate that Indian states are becoming comparable in TFR levels during 1971-2011, to some extent. However, speed or rate of convergence is higher for conditional convergence than absolute convergence. Secondly, convergence in rural and urban fertility is high in the initial periods than in the most recent periods.

Conclusion

Rural-urban difference in fertility varies widely among the states. It is significantly below the national average in the southern and western states and higher in the other states, particularly in the northern states. The rural-urban gap in the total fertility rate is narrowing but is still significant. In the beginning, urban fertility was much lower than that of rural but in the recent decades the fertility gap between rural-urban areas has narrowed significantly. The decline in rural-urban gap in fertility has been noticed in all the states except MP during the 40 years.

Above analysis reveals that there is no significant evidence of sigma convergence in rural as well as in urban fertility in the initial period across the states of India, even though fertility rates have been falling for many decades in these states. The fastest decline in rural-urban fertility gap has been noticed in Gujarat followed by UP. The analysis shows a strong linkage between socio-economic and demographic factors and fertility in the Indian states. Inclusion of female literacy and poverty ratio in our model results in significant convergence in rural and urban fertility rate as these variables contribute to increase the value of beta coefficient during the initial period.

Rural-urban analysis of fertility convergence indicates that Indian states are becoming comparable in TFR levels during 1971-2013, to some extent. However, convergence in rural and urban fertility is high in the initial periods than in the most recent periods. Secondly, the speed or rate of convergence is higher for conditional convergence than the absolute convergence. Thirdly, the speed and rate of convergence is found higher in urban than in rural areas. The analysis has also shown that much of the rural-urban difference is on account of lower level of female education in rural areas than in urban areas. Therefore, programmes focusing on female education, family planning and poverty removal need to be revamped in rural areas.

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