Socioeconomic Progress across the Major Indian states: Converging or Diverging

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A B S T R A C T

The purpose of this paper is to examine the progress in socioeconomic conditions across the major states of India by using convergence hypothesis. Earlier studies that examined regional disparities of development used per capita State Net Domestic Product (SNDP) as an important proxy for assessing human well-being. This study attempts a more comprehensive assessment of socioeconomic convergence in terms of critical indicators of economic inequality, poverty ratios, literacy rate and Human Development Index (HDI) along with per capita SNDP. The results reveal that in the period between 1981 and 2011, statistically significant absolute and conditional Beta (β)-convergence in literacy rates and HDI have been observed but only conditional β-convergence has been evident in case of per capita SNDP and poverty ratios. β-convergence estimates for the recent period (post-2001) show, a divergence in per capita SNDP and poverty ratios but convergence in literacy rates and HDI. Kernel density plots for socioeconomic indicators show the existence of convergence clubs but not absolute convergence among all the major states. Thus, this study suggests that use of the non-parametric convergence measures is crucial to gain more clear insights on socioeconomic progress and to identify the short-term divergent paths.

1. Introduction

During India's post independence period, pronounced economic disparities among states received substantial attention of researchers and policy makers in India (e.g. Mishra, 1969; Rao, 1984; Dholakia, 1985; Pradhan, 1988; Roy Choudary, 1992, 1993; Dholakia, 1994; Ghosh et al., 1998; Kurian, 2000; Ahluwalia, 2002; Trivedi, 2002; Dholakia and Ravindra, 2003; Bhattacharya et al., 2004; Jha, 2004; Dreze' and Khera, 2012). Since 1951, balanced regional development has remained one of the objectives of planning process in India (Kurian, 2007). This is evident from the emphasis given to regional disparities in successive five year plans after independence. Many attempts have been made to address India's regional imbalances through institutions like the Planning Commission and Finance Commission. For example, in case of financial transfers from the centre to the states, the poorer states have been given priority over the richer states. Direct investment by the centre in development of public infrastructure is another such instance (Das, 1993; Ghosh et al., 1998; Kurian, 2007). There is no doubt that, despite these measures, substantial inter-state inequalities in socio-economic development have persisted.

With the introduction of economic reforms in the early 1990s, Indian economy witnessed a major shift in economic policies (Sarkar, 1994, 1995). Subsequently, in the last two

decades, even though India has experienced high economic growth rates, the economic growth has not been uniform across the states. Some studies show that, in the post reform period, India has experienced a sharp increase in regional inequalities (Nair, 2004; Pal and Ghosh, 2006; Jha, 2004). For instance, Pal and Ghosh (2006) pointed out, in 2002-2003, the per capita State Net Domestic Product (SNDP) of the richest state, Punjab, was about 4.7 times that of Bihar, the poorest state. This ratio had increased from 4.2 in 1993-1994 to 4.7 in 2002-2003. These regional inequalities are limited not only to the domain of economic indicators, but have also been reflected in the uneven human development among the states during this period. The recent Indian Human Development Report-2011 has shown that the ranking of the states in terms of HDI has not changed much between1999–2000 and 2007–08. The report points out that, the well-performing states like Kerala, Delhi, Himachal Pradesh, Goa, and Punjab, occupied the first five ranks in both 1999–2000 and 2007–08. On the other hand, Bihar, Jharkhand, Madhya Pradesh, Uttar Pradesh, Odisha, Rajasthan, and Chhattisgarh appear at the bottom of the list in both these years (Institute of Applied Manpower Research, 2011). Moreover, Kurian (2007) warns that if the existing trend in differential rate of socio-economic development continues, then it will not only accentuate but also will have serious adverse implications for the Indian economy, society and polity.

1.1. Concept of unequal regional progress and approaches

Socioeconomic space is often contentious and debatable (Hall, 1992; Parr, 1999). How do regions grow? Why do some regions/states grow more rapidly than others? Why are disparities in levels of economic-social welfare across regions/states so persistent? These critical questions have attracted the attention of a diverse group of social scientists (see for e.g. Perroux, 1950; Friedmann, 1956, 1964; Kuznets, 1955; Myrdal, 1957; Hirschman, 1958; Williamson, 1965; Hoover, 1971; Lipton, 1977; Krugman, 1979, 1991a, 1991b; Barro, 1995; Quah, 1993; Barro and Sala-I-Martin, 1995; Sala-I-Martin, 1996). Previous studies suggest that unequal regional progress emerge from the concentration of income in the hands of a few who prefer to direct them in already developed areas or near growth poles (Perroux, 1950; Kuznets, 1955; Myrdal, 1957; Friedmann, 1956; Hirschman, 1958; Romer, 1986). The growth-pole strategy implies the channelling of investment to a limited number of locations to boost economic activity and which in turn leads to increased economic growth within and outside these regions (Perroux, 1950; Parr, 1999).

Following Kuznets (1955), various scholars argue that regional inequalities follow inverted U-shaped curve (Fujita et al., 1999; Lucas, 2000; Ottaviano and Theses, 2004). This implies that in the course of economic development, initially regional disparities increase and in the later period, these disparities will narrow down owing to urbanization and industrialization (Kuznets, 1955). Similarly, a number of scholars have emphasized on resource distribution in explaining the cause of regional disparities. The resources across the regions are not uniformly distributed. The propensities of different regions of a nation often differ because the regions are naturally endowed with different resources and usually have different historical, sociological and political backgrounds (Perroux, 1950; Hoover, 1971; Hall, 1992). Moreover, as a nation develops socio-economically, the different regions of the nation may or may not share the benefits of this socio-economic development equally (Williamson, 1965). Several authors have built on this idea for regional analysis of economic growth and suggested that inequalities first rise as developed areas progress much faster compared to their counterparts. During transition period, developed areas more benefit from external economies, political power, and labour mobility (Friedmann, 1956, 1964; Myrdal, 1957; Hirschman, 1958; Williamson, 1965; Hoover, 1971; Barro, 1991).

However, later this growth approach has been widely criticized by other scholars such as Darwent (1969), Lipton (1977), Sen (1983), Das (1993), Parr (1999), Kurian (2000). This group claims that the socioeconomic disparities across the regions are by and large, an outcome of the working of the socio-economic and political system and its processes. They are also influenced by central and states socio-economic policies and political systems. Hence, it is a matter of great interest to examine the manner in which inter-regional differences in the levels of socio-economic development undergo change during the process of national economic development: whether such progress across sub-national level is converging or diverging is a pertinent research question. With this theoretical perspective in the background, this study examines the process of socioeconomic progress across the major states of India. In the first stage, we have reviewed the progress in socioeconomic progress assessed by previous studies in India. In the second stage, we adopted an empirical approach to re-examine the socioeconomic progress by using convergence hypothesis and econometric convergence models.

1.2. Review of previous studies on convergence of socioeconomic progress among India states

In the past, a number of attempts have been made to examine the regional imbalances in development in India. Most of these studies have tested convergence in economic growth across Indian states, covering different time periods, following Barro and Sala-i-Martin (1992, 1995).This section briefly reviews these studies.

Dholakia (1994) analyzed convergence of per capita Net State Domestic Product (PCSNDP) growth rates across 20 Indian states during the period 1960-61 to 1989-90. He observed tendencies of convergence in long-term PCSNDP growth rates across the states. Cashin and Sahay (1996) also examined convergence of per capita income for 20 states covering the period 1961-91. They found that there has been absolute β-Convergence of per capita income across the states during this period. On the contrary, Marjit et al. (1998) investigated convergence in 'properly measured real PCSNDP' for the period 1960-61 to 1994-95 across 26 Indian states. They argued that Indian states diverged in economic growth during 1960-61 to 1994-95.

Nagraj et al. (1998) showed the existence of conditional convergence among 14 states during 1970-1994, but they ruled out the existence of any absolute convergence. They explained inter-state variations in steady states in terms of variations in different factors like physical, economic and social infrastructure. Trivedi (2002) also reached a similar conclusion as Nagaraj et al (1997) and Aiyar (2001) by testing convergence hypothesis of levels and growth rates of per capita income among 16 states during 1960-1992. He asserted that no evidence is found to support absolute β-Convergence in the growth rates, but confirmed that there is clear and robust evidence for conditional convergence. Rao et al. (1999) based on their analysis of interstate differences in growth rates during 1965-1995 among 14 major states conclude that interstate disparities are increasing rather than converging. These interstate disparities in income are attributed to the differential capacity of the states in attracting private investment and further it is pointed out that the allocation of private investment is determined by the availability of better infrastructure in a state (Rao et al. 1999).

Particularly after the introduction of liberalization policies in the 1990s, different studies have sought to understand the impact of economic reforms on regional inequality and convergence among Indian states. Ahluwalia (2002), using a population weighted Gini coefficient framework, analysed interstate inequalities during the 1990s. He found that

inequality in real per capita regional output increased from 0.175 in 1991-1992 to 0.233 in 1998-1999 among 14 major states. He argued that the variation in the private investment across the states is responsible for cross-sectional differences in states' growth rates. Bhattacharya and Sakthivel (2004) analyzed interstate income disparities before and after the reform period. They showed that interstate income disparities almost remained unchanged during 1980s, but sharply increased during the 1990s. Kar and Sakthivel (2007) argued that regional inequality remained stable without much increase during the 1980s due to a fall in inequality within the industrial and the service sectors during this period. Further, rise in regional inequality in the post-1990s is attributed to a sharp rise in disparity in the industrial and service sectors' progress across the states. Another study by Ghosh (2011) also confirmed an increase in the interstate inequality of per capita income in the post-reform period since 1991.

The review of the above studies suggests that the study of regional inequalities has attracted considerable interest from social scientists in India. However, most of these studies have emphasised convergence or divergence of per capita SNDP across the sates by assuming per capita income as a measure of standard of living of the people. Per capita income may not be a true indicator of socio-economic well-being (Sen, 1998). Sen (1998) observed that economic variables like per capita income can be considered as important indicator of development, but they may not be adequate to capture the standard of living or quality of life of the people. Therefore, we believe that, a more meaningful way of testing the convergence in the regional imbalances is the analyses of convergence in terms of standard of living by using multiple socio-economic indicators across states over time.

Though, substantial empirical literature has dealt with inter-state disparities in India, only few studies have examined the regional disparities based on multiple socio-economic indicators across the states. Dholakia (2003) examined the trends in regional disparity in India in the average per capita SNDP and human development during 1977-80 to 1997-2000. He found that while per capita SNDP inequality does not show any significant trend in regional disparity, the overall indices of human development show a declining trend. Ghosh (2006) examined convergence of 15 major Indian states on human development during 1981-2001. He found that evidence for regional convergence in human development exists, despite considerable divergence in per capita income among states. Also, the Indian Human Development Report-2011 maintains that during 1999–2000 to 2007–8 the increase in HDI in the states that are among the poorest has been much faster than the national average, and hence there is a convergence taking place between states in terms of HDI (Institute of

Applied Manpower Research, 2011). However, the Indian Human Development Report-2011 does not test convergence hypothesis for HDI among Indian states.

Findings from some of the recent studies, which have examined inter-state regional disparities in social indicators, cast doubts over convergence in levels of human development across the states as pointed out by Dholakia (2003), Ghosh (2006) and IHDR (2011). Drèze and Khera (2012), based on their study on analysing child and human development deprivation at district level, observed that still substantial gap exist in HDI of states like Bihar, Madhya Pradesh, Rajasthan, Uttar Pradesh and Odisha and the rest of the states in India. In this context, this study tries to complement the existing studies in understanding regional inequalities and convergence not only when measured in terms of per capita SNDP, but also in terms of broader range of socio-economic indicators by evaluating the performance of Indian states in socioeconomic indicators during the period of 1971-2010.

2. Methods and materials

2.1. Data

This study assesses more recent trends rather than long-term trends in socioeconomic progress vis-à-vis convergence or divergence among the states, as this period represents the most critical phase of India's socioeconomic progress. Many previous studies have demonstrated economic reforms as a critical change-point in the analyses of trends in socioeconomic conditions of India. Therefore, this study examines data beginning a decade before the economic reforms to the latest available statistics on various socioeconomic indicators from multiple data sources. The data used from the different sources are described below: State Net Domestic Per Capita Income (SNDP) for major states was taken from Reserve Bank of India (RBI, 1981-2010); literacy rates was gathered from Census of India, 1981-2011 (Office of Registrar General, India 1981- 2011); poverty ratios were based on Planning Commission estimates of poverty, 1973-2006 (Government of India, 1973-2006; Human Development Index (HDI) estimates of Planning Commission for major states of India during 1981-2001 was used (Government of India, 1981-2001). However, the latest HDI statistics for the states are obtained from UNDP India estimates (UNDP India, 2011); Gini index estimates of per capita consumption expenditure for major states were taken from Planning Commission reports (Government of India 1973-2006 and; Data on Total Fertility Rate (TFR) Infant Mortality rate (IMR) and Life Expectancy at Birth (LEB) were taken from sample registration system (Office of Registrar General, India, 1981-2006).

2.2. Convergence hypothesis

The concept of convergence is widely employed to empirically validate the claims of neoclassical growth models about economic growth across the countries (Baumol, 1986; Barro and Sala-I-Martin, 1991, 1992; Sirioppulos and Asteriou, 1998). Majority of the recent empirical research on convergence begins from the Solow growth framework or the neoclassical growth theory (Barro and Sala-I-Martin, 1991, 1992; Mankiw et al., 1992; Workie, 2008; Dorius, 2008). Baumol (1986) defines 'convergence as an equivalent diminishing in the degree of economic inequality across the countries'. In general, convergence in economic growth is said to occur in a cross section of economies, if there is a negative relationship between the growth rate of income and the initial level of income in which poor economies tend to grow faster than wealthy ones (Barro, 1991; Sala-I-Martin, 1994, 1996a, 1996b; Barro and Sala-I-Martin, 1995). According to the endogenous theory of growth, it is not necessary that diminishing return to capital is certain in every case and the role of the market and technological factors plays a critical role (Romer, 1986, 1990; Quah, 1996a, 1996b). Also, a number of studies have highlighted problems associated with testing β-convergence using standard parametric methods. The main disadvantage of β-convergence is the assumption of linearity in the growth regression and the impossibility to detect convergence clubs, etc. (Quah, 1993; Johnson, 2000; Kumar and Russell, 2002). However, the application of nonparametric methods provides an alternative to standard parametric methods as non-parametric methods do not assume that data follow normal distribution and they are also helpful in capturing short-term divergent paths that can't be identified by Barro-regressions (Raileanu, 2011). Despite the persisting disputes among economists about the determinants of long-run growth, the convergence debate has enormous policy implications for policy makers both in the developed and developing countries because the concept of convergence is useful to examine the gaps in living standards between countries and within countries i.e. whether these gaps are narrowing or widening across countries and within countries over time (Pritchett, 1996). One of the key questions in this regard is to what extent policies in the countries/states have helped to achieve progress, hence allowing them to narrow the gaps in living standard between the richest and poorest part of the country (Workie, 2008).

2.3. Methodological specification of convergence metrics

We have not only used parametric methods, but also employ nonparametric methods to overcome the assumption of linearity, normal distribution in the growth regression. We also take into account population weights, absolute and relative distributions. The convergence analyses of this study comprises three parts: 1) examination of convergence process using standard parametric econometric models of convergence such as β-convergence and Sigma (σ) Convergence; 2) testing non-parametric econometric models such as Kernel Density estimates; and 3) assessment of inequality adjusted convergence.

2.3.1. Parametric convergence models: β-convergence

In the Indian context, an assessment of β-convergence testifies whether, the catching-up process of laggard states with advanced states in selected indicators is resulting into convergence or not. We measured two type of β-convergence: Absolute and Conditional β-convergence.

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):

$$\ln\left[\frac{Y_{i,\ t+k}}{Y_{i,t}}\right] = \alpha + \beta.\ln(Y_{i,t}) + \varepsilon_{it}$$

Where $\ln\left[\frac{Y_{i,\ t+k}}{Y_{i,t}}\right]$ is the mean annualized growth rate of the variable Y in state *i* in the period (t, t+k), $Y_{i.t}$ is the value in the initial time t and ε_{it} are corresponding residuals.

According to Dorius (2008), progress that took place in recent periods within the larger period is more important for a policy perspective. Therefore, this study also estimated piece-wise β-convergence by disaggregating the long period.

Conditional β-Convergence: When the analysis is focused at the national level, it will not be reasonable to assume that all states will share the same socio-economic conditions; however, it is recognized that each state may be converging towards its own steady state across socioeconomic strata. This is referred to as conditional β-Convergence and 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). The equation of this model can be written as

$$\ln\left[\frac{Y_{i,\ t+k}}{Y_{i,t}}\right] = \alpha + \beta.\ln\left(Y_{i,t}\ Y_{1,i.t}Y_{2,i.t}\right) + \varepsilon_{it}$$

Where $\ln\left[\frac{Y_{i,\ t+k}}{Y_{i,t}}\right]$ is the mean annualized growth rate of *Y* in the state *i* in period (t, t+k), $Y_{i,t}$ is the value in the initial time t and ε_{it} are the corresponding residuals. Similarly, $Y_{1,i,t}$ $Y_{2,i,t}$ etc are the additional socioeconomic variable in state *i* and period (t, t+k).

σ-Convergence: Another indicator of convergence is σ-convergence (Friedman, 1992; Quah, 1993a), usually measured either by the standard deviation or by the coefficient of variation in two different periods of time. However, presence of a β-convergence will not give warranty of σ-convergence. Quah clarifies that the β-convergence is necessary but not sufficient to achieve the σ-convergence, and therefore, he points out, β-convergence should be complemented by the analysis of σ-convergence (Sala-I-Martin ,1996; Young et al., 2008; Dorius, 2008, 2010). Hence, in the second stage, this study used absolute σ-Convergence measure as a method of convergence analyses. The σ-Convergence is useful to determine whether a variable turn out to be increasingly similar across the states or not. Fridenman (1992) suggest that decrease in the variation among the individual oberservations implies the presence of –convergence. In this study, the σ-convergence is derived by using Coefficient of Variation (CV). Coefficient of variation is estimated as

$$C_v = \frac{\sigma}{\mu}$$

2.3.2. Non-Parametric convergence models

Though, parametric convergence metrics methods are useful to examine the convergence process across states they have been criticized for using unreal assumption such as normal distribution. We use nonparametric methods to analyse convergence as they do not assume that the data will follow a normal distribution and is helpful to capture short-time divergent paths which occur in along convergence process (Raileanu, 2011). Among non-parametric convergence metrics histogram density estimates and Kernel density estimates are widely used methods. While the latter is closely related to histograms, it can be endowed with properties such as smoothness or continuity by using a suitable Kernel. The smoothness of the Kernel density estimate is better interpreted compared to the discreteness of the histogram

as Kernel density estimates converge faster to the true underlying density for continuous random variables (Scott, 1979). We used Gaussian Kernel which minimizes the mean integrated squared error (MISE) in deriving *h* (Scott, 1979; Silverman, 1978, 1986). A general form of Kernel densities is estimated by using the following equation:

$$\hat{f}(x) = \frac{1}{hn}\sum_{i=1}^{n} k\left(\frac{x-X_i}{h}\right)$$

where, $\hat{f}(x)$ is the density estimation of the variable x, n is the number of observations, *h* is the bandwidth (smoothing parameter) and K (.) is the smooth and symmetric Kernel function integrated to unity.

2.3.3. Inequality based measure of convergence

This study used inequality adjusted convergence measures weighted for population size of the states. The study estimated two types of inequality measures: 1) Average Inter-state Differences (AID) to indicate absolute dispersion in the variable across the states; and 2) Gini index to indicate relative dispersion in the variables across the states. The AID is estimated by using the following equation proposed by Shkolnikov et al. (2011):

$$AID = \frac{1}{2\,(u)^2}\sum_{x}\sum_{y} d_x\, d_y\, |\bar{x} - \bar{y}|$$

where, AID is Average Inter-state Differences, *u* is mean of socioeconomic variable, *dx* is the population proportion of states *x*, *dy* is the population proportion of states *y*, $\bar{x} - \bar{y}$ is the difference in socioeconomic variables of states *x* and *y*.

The Gini index is derived from the estimated AID as follows

$$G = {}^{AID}/_{u}$$

Where G is the Gini index, AID is Average Inter-state Differences and *u* is mean of socioeconomic variable.

The decline in AID and Gini index is considered as convergence and the increase is considered as divergence in socioeconomic indicators.

3. Results

3.1. Descriptive statistics

Table 1 presents the descriptive statistics of socioeconomic indicators selected for the study. Sample size (observations) of all selected socioeconomic indicators is 15. The results show multiple increases in mean per capita state net domestic product during 1981-2010. However, in the same period, the standard deviation and range of income distribution across the 15 major states has also increased multiple times. The mean poverty ratio of 15 states has declined by half in a period of 31 years. Minimum poverty ratios across the states also declined but the decline in maximum poverty ratio is not impressive. Moreover, the standard deviation and range of poverty ratios across the states has increased. The average literacy rates of the states increased considerably. The standard deviation and range of literacy rates across the states has decreased during 1981-2011. However, the average Gini index values in consumption expenditure increased over the given period. Further, the standard deviation and range in Gini index values across the states also increased considerably. In case of TFR and IMR, both average and standard deviation across the states have decreased during 1981-2009. The average life expectancy at birth increased; standard deviation and range across the states has decreased during 1981-2006. The trends in average HDI of the 15 major states shows a remarkable increase and standard deviation and range show considerable decline during 1981-2006. Overall, along with the considerable progress in the average SDP, poverty and life expectancy, the standard deviations and the Gini Index values have also increased.

3.2. Catching-up process

In the Solow growth framework or the neo-classical growth model, the catching-up mechanism is necessary for convergence. The catching-up process is identified by plotting a scatter diagram for change in an indicator in two points of time against values in the initial period. According to Solow growth framework, the advanced states experience less change with better values in the initial period; in contrast the laggard states experience greater change with poorer values in the initial period. In this study, we examine the catching-up process in socioeconomic indicators for 15 major states of India.

Figure 1 presents the scatter plots of change in selected socioeconomic indicators against the mean values in the initial period for 15 major states of India. In case of per capita SNDP, the results show a positive association between change and initial values of per capita SNDP. This indicates that the catching-up process is not yet evident from the laggard states in terms

of per capita SNDP. The economically advanced states (e.g. Punjab, Haryana, Maharashtra, Gujarat and Karnataka) in India have continued to experience higher growth rate in per capita SNDP compared to the laggard states (e.g. Bihar, Uttar Pradesh, Odisha, Rajasthan and Madhya Pradesh). A similar pattern is also evident for other two economic indicators: poverty ratios and Gini Index. Change in both these indicators is positively associated with values in the initial period; thus showing that the reduction in poverty and economic inequality (in terms of Gini index) in some states is much greater in comparison to other states. The catching-up process in terms of progress in reduction of poverty and economic inequality from laggard states of India is not evident as yet.

However, the results in case of literacy rate indicate a contrasting picture. The states (e.g. Rajasthan, Bihar, Uttar Pradesh, Andhra Pradesh, Madhya Pradesh and Odisha) with low literacy rates in the initial period are experiencing greater change in literacy rates compared to their counterparts (e.g. Kerala, Tamil Nadu, Karnataka, Gujarat, Maharashtra) with higher literacy rates in the initial period. This is an indication of the catching-up process in terms of progress in literacy rates in India by laggard states to leading states. Similarly, there is also clear evidence of the catching-up process in composite measure of human development. The results reveal a greater progress in human development index in laggard states (e.g. Bihar, Uttar Pradesh, Madhya Pradesh Rajasthan, and Odisha) compared to advanced states (e.g. Kerala, Maharashtra, Gujarat, Punjab, Haryana, Tamil Nadu, Karnataka) during 1981 to 2006.

3.3. β-convergences

Though, the catching-up process provides clues about convergence, the real convergence mechanism can be identified only by appropriate convergence models. Therefore, this study used β-convergence models to test convergence hypothesis for the progress of socio-economic indicators.

3.3.1. Absolute β-convergence

Table 2 presents the results of absolute β-convergence model for log per capita state net domestic product among the major states during 1981-2010. Though, the results reveal that in the period of 30 years, the per capita SNDP show absolute β-Convergence (β = -0.0138) across the 15 major states, but the estimate is statistically not significant and adjusted R^2 is very low. Moreover, the results of piece-wise convergence models (estimated for sub-periods

in a long period) are evidently a mixed pattern. During the initial period, 1981-91, the results show a clear divergence phase (β = .07587) in SNDP. In contrast, in 1991-01, the earlier phase of divergence is replaced with convergence (β = -.25090); moreover, the volume of convergence is high. For the recent period, convergence phase in the previous period is replaced by divergence (β = .12591; p<0.032) and the estimate is statistically significant.

Absolute β-Convergence model estimates for poverty ratios for 15 major states during 1974-2010 are presented in table 3. The results reveal that in the long run, the reduction of poverty ratios across the 15 major states are diverging (β =0.06291, p<0.036). However, the results of convergence model estimates for sub-periods during 1974-2010 again indicate a mixed pattern. The reduction of poverty rates across the states during 1974-84 show divergent progress (β =0.10874; p<0.008), but followed by convergence phase during 1984-94 (β = -0.00388; p<0.908) and again divergence (β = 0.12538) during 1994-2005. Though, the results show progress of convergence in the reduction of poverty ratios during 1984-94 but the model is not statistically significant and adjusted R^2 value shows poor goodness of fit. However, the absolute β-convergence estimates for the entire period, 1974-2005 and other sub-periods, 1974-84 and 1994-2005 show statistically significant divergence in the reduction of poverty across 15 major states.

Table 4 presents absolute β-convergence model estimates for literacy rates for major states of India. The results suggest a strong convergence phase (β = -0.04468, p<0.00) in literacy rates during 1981-2011. The results of piece-wise convergence model estimates show that estimates for all the sub periods support convergence. However, the convergence process is stronger in recent two decades (β = -.07056, p<0.00 during 1991-2001 and β = -.05189, p<0.00 during 2001-2011) compared to earlier initial period, 1981-1991 (β = -.07056, p<0.00). The absolute β-convergence model estimates for literacy rates show high goodness fit with adjust R^2 value is greater than 0.90. The absolute β-convergence model estimates for human development index values of the major states of India are presented in table 5. The results for the entire period, 1981-2006 (β = -6.3717, p<0.00) and for all the sub periods indicate a strong absolute β-Convergence in human development across the major states of India. However, the volume of convergence is greater in the recent period, 2001-06 (β = -9.5074, p<0.00) compared to the initial period, 1981-1991 (β = -4.4534, p<0.00). The β-Convergence model estimates for human development index values are statistically significant and goodness fit for the model is also high.

3.3.2. Conditional β-convergence

Table 6 presents the conditional β-convergence model estimates for log per capita SNDP of the major Indian states. The conditional β-convergence model estimates for per capita SNDP is estimated after controlling state's social indicators such as literacy rates, total fertility rates and life expectancy at birth of the initial period, 1981. The results show statistically significant convergence (β = -1559, p<0.000) in per capita SNDP of 15 major states of India during 1981-2010. The conditional β-convergence model estimates for poverty ratios of the major Indian states are presented in table 7. Commensurate with the absolute β-Convergence model estimates, the conditional β-Convergence model estimates show progress in the reduction of poverty ratios for major of states of India (β = 0.1132, p<0.002) during the period, 1974-2005 and the model is statistically significant. The adjusted R^2 value shows that the goodness fit for the model is also high.

Table 8 presents the conditional β-convergence model estimates for literacy rates of major Indian states. The model is conditioned for the initial levels of log SNDP, poverty ratios and TFR. Similar to absolute β-convergence model estimates for literacy rates of major states of India during 1981-2011, the conditional β-convergence model estimates shows that progress in literacy among 15 major Indian states have led to convergence (β = -.0368, p<0.000). The model is statistically significant and goodness of fit of the model is very high. Further, the conditional β-convergence model estimates for the human development index values of major Indian states are shown in table 9. Also, the model is conditioned for initial situation of the states in terms of inequality, poverty and fertility rates of the states. The results reveal a strong indication of convergence (β = -7.3343, p<0.000) in terms of progress in human development across the major states of India.

3.3.3. σ –Convergence

The σ-Convergence is measured by CV and is presented in figure 2. The estimates of trends in CV for per capita SNDP show increasing dispersion over the period, 1981-2010; hence indicated a divergence phase in per capita SNDP across the major states of India. A more careful examination of the trends reveals that the divergence has accelerated during the recent period, 2001-2010. The estimates of trends of CV for the poverty ratios indicate a divergent trend in reduction of poverty ratios across the states until 2000, but are replaced by

convergence trend during the post-2000 period. The trends of CV for literacy rates show a clear decline over the period, 1981-2011; hence, it supports the hypothesis of σ-convergence. The speed of convergence is highest during 1991-2001 but it slowed down in the post-2000 period. Similarly, the trends in HDI show a continued decline in CV over the period, 1981-2006 and support the hypothesis of convergence. Moreover, the speed of convergence is increasing in the recent period of 2001-2006 in comparison with the earlier period of 1981-1991 (Figure 2).

3.3.4. Kernel density estimates

Figure 3 presents the results of Gaussian Kernel density estimates. The first row shows the Kernel density plots for per capita log SNDP during 1981-2010. For the year 1981 and 1991, the distribution plots are showing bimodality in peaks that indicates presence of convergence clubs. During these two time points, the second and small peaks are on the left side, indicating that most of the states are fall in lower income states. For the year 2001, the second peak is clearly not evident but in the year 2010, the distribution clearly shows bimodality in the distribution of per capita log SNDP. In both 2001 and 2010, the major peak shifted to the right side showing maximum number of states incline to higher income side. Thus, in case of per capita SNDP the Kernel estimates reveal evidence to support divergence in progress across but convergence across the clubs of states during 1981-2010. These clubs are formed based on income levels such as groups of high and low income states.

The Kernel density estimates in case of poverty ratios across the major states also reveal bimodality for the year, 1974, 1984 and 1994 but are unimodal for the year 2005. Though, there is no secondary peak in the year 2005, but the Kernel plots are wider, thus, not showing a clear evidence of convergence in progress with respect to poverty ratios. The Kernel density distribution plots for literacy rates indicate the bimodal distribution for all the four periods, 1981, 1991, 2001 and 2011. However, the second peak for all the years is very small, thus majority of the states fall under higher and narrow peak thus, indicating convergence in literacy rates over the period. The Kernel density distribution plots for Gini indices indicate that over the period, the distribution of Gini index across the states becoming more dissimilar. During 1983, the Gini index distribution shows a unimodal, but it was slightly unsmoothed in 1994. However, during 2001 and 2005, the distribution of Gini is clearly showing a bimodal distribution. Thus, there is evidence for divergence in the progress of reduction in inequality of economic status across the major Indian states. The Kernel estimates in case of human development index indicate a bimodal distribution for all the years from 1981-2006. Though,

the size of secondary peak is very small in 2006, the distribution is wider. Kernel plots does not show clear pattern of convergence of progress in human development index in 15 major states of India.

3.3.5. Inequality based measure of convergence

The estimates of convergence in socioeconomic indicators by using AID and Gini index are presented in figure 4. The results in case of per capita SNDP show increasing dispersion in both absolute and relative distribution of income. Thus, the results of inequality based measure of convergence measure for per capita SNDP support a divergence hypothesis in terms of its progress during 1981-2010. The absolute inequalities in poverty ratios across states decreased during 1981-91, then increased sharply during 1991-2001; and declined again in post-2001 period. The trends in relative inequalities in terms of Gini index of poverty ratios show an increasing trend until 2000, but decreasing phase in the post-2000 period. The trends of absolute inter-state difference in literacy rates across the states indicate rising trend during 1981-91, but showed a declining trend thereafter. However, the trends in Gini index of literacy rates across the state show a continuous decline, but the decline is sharper during 1991-2001. The estimates of AID for HDI of major Indian states during 1981-2010 show declining trends for the entire period but, the decline is sharp in the recent period, 2001-10. The Gini index estimates for HDI of major states indicate a rising trend until-2000 but a sharp decline in the period after 2000.

4. Conclusion

This study tested convergence hypothesis to determine progress in socioeconomic indicators across 15 major states in India by using both parametric and non-parametric convergence metrics. The various convergence metrics used in this study give a number of interesting findings about progress in socioeconomic indicators. First, the scatter plots suggest that the laggard states are catching-up with the advanced states only in social indicators like literacy rates and HDI. However, in case of economic indicators (per capita SNDP, poverty ratios and Gini index), the advanced states show much higher levels of improvement compared to the laggard states; thus, no catching-up process is evident for economic indicators.

Second, the β-convergence estimates give more insights on the volume of convergence of the selected indicators. The absolute β-convergence estimates for the entire period indicate convergence in per capita SNDP, literacy rates and HDI, but divergence in poverty ratios across the major states. However, the estimates for per capita SNDP are not statistically significant. Further, convergence estimates for shorter intervals reveal statistically significant divergence in per capita SNDP and poverty ratios for the recent period but convergence in literacy rates and HDI. The conditional β-convergence estimates indicate statistically significant and greater volume of convergence than absolute β-convergence for per capita SNDP and HDI; but lesser volume of convergence in case of literacy rates. In case of poverty ratios both absolute and conditional β-convergence measure indicates divergence in economic progress. Another parametric convergence measure that is the σ-convergence or inequality based convergence measure reveals that in the long run, there is divergence in all economic indicators (per capita SNDP and poverty ratios) but clear convergence is seen in social indicators (literacy rates and HDI).

Third, the non-parametric measure in the form of Gaussian Kernel density plots support divergence hypothesis for per capita SNDP. However, there is a clear emergence of convergence clubs in case of per capita SNDP for all the years and the major peaks are shifting to higher values in the recent two decades. For poverty ratios, the major peaks are shifting to lower mean values as poverty ratio has dropped down in many states but there is still no clear evidence of convergence. In case of Gini index, the Kernel density plots show a divergent progress and shifting of peak to higher values. In contrast to parametric convergence measures, Kernel density plots, in case of HDI, support divergence hypothesis. Overall, parametric, non-parametric and inequality based convergence metrics support the hypothesis of convergence for progress in literacy rate but strong divergence in economic indicators like per capita SNDP and poverty ratios during 1981-2010.

Overall, the pattern of economic progress in the Indian states support divergence rather than the absolute β-convergence hypothesis. This suggests that the economic reform in India in post 1991 has certainly affected the pattern and volume of economic progress unequally in the major states. In case of both the economic measures: per capita SNDP and poverty ratios, the results clearly indicate that during a long period, there is statistically significant conditional β-convergence but there is no absolute β-convergence. These findings are also in tune with earlier studies (Bhattacharya and Sakthivel 2004; Kar and Sakthivel 2007 and Ghosh 2011). Additionally, through Kernel density plots, this study rules out the existence of

absolute convergence but reveals the presence of convergence clubs and that the trends have shifted in a major fashion post 1991.

Fifth, earlier studies (Dholakia, 2003; Ghosh, 2006) that focussed on social indicators which used only parametric convergence measure, have supported convergence which is well established in our analysis. All the selected convergence measure in case of literacy rates support convergence hypothesis, except Kernel density plots which show that though many states cluster together, still there are a few laggards which formed a small secondary peak. In case of HDI, parametric measure support existences of convergence but non-parametric measure support divergence and existence of convergence clubs. However, non-parametric measures in case of both social indicators reveal the existence of convergence clubs rather than clear convergence. Thus, this study suggests that use of non-parametric convergence measures is important to obtain insights on the overall progress as well as short-term divergent paths.

Lastly, though, initially the regional economic disparities may result from uneven resource-endowments; but persistence of regional imbalances in the long-run can be mainly attributed to the failure of our planning process. The convergence/divergence patterns, Kernel density distribution and inequality trends in selected socioeconomic indicators clearly indicate that the socioeconomic disparities across the regions are, by and large, an outcome of the working of the socio-economic and political system and its processes rather than disparities in natural endowments. The increasing divergence during the post-reform period in economic indicator is a clear evidence of influence of economic reforms on regional disparities. However, diffusion of education, health behaviour and special focus on demographically disadvantageous states contributed to improved literacy rates and life expectancy, and thus to the improvement in human development of laggard states. Unlike in the sphere of social and health policies, the laggard states had no special support in economic inputs as most of the economic decisions are guided by profit making motives of investors. Thus, in the context of increasing competition among states for attracting private investment, the laggard states are in more disadvantageous position compared to leading states and this can further accentuate the gap between the leading and the laggard states. Special policy efforts to promote more investment are required in laggard states and to bridge the economic and social gap among the leading and laggard states.

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Fig. 1. Scatter plots of change in selected socioeconomic indicator by values in the initial period of 15 major states of India.

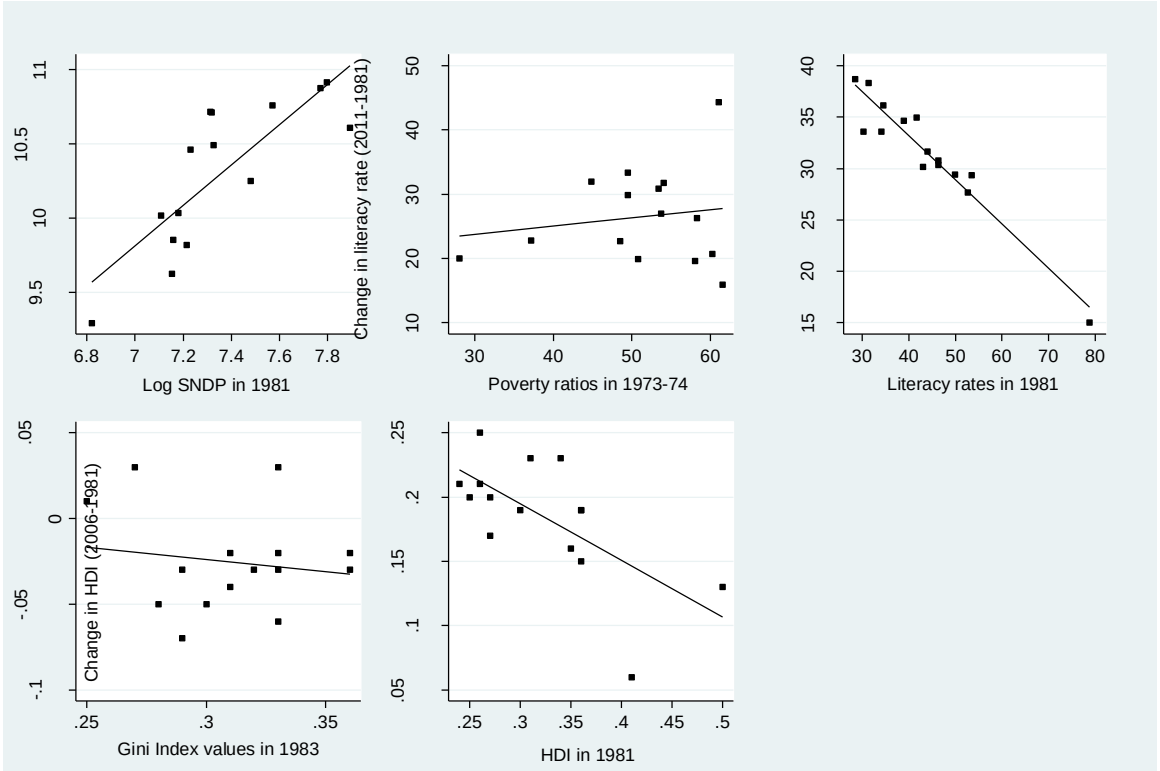
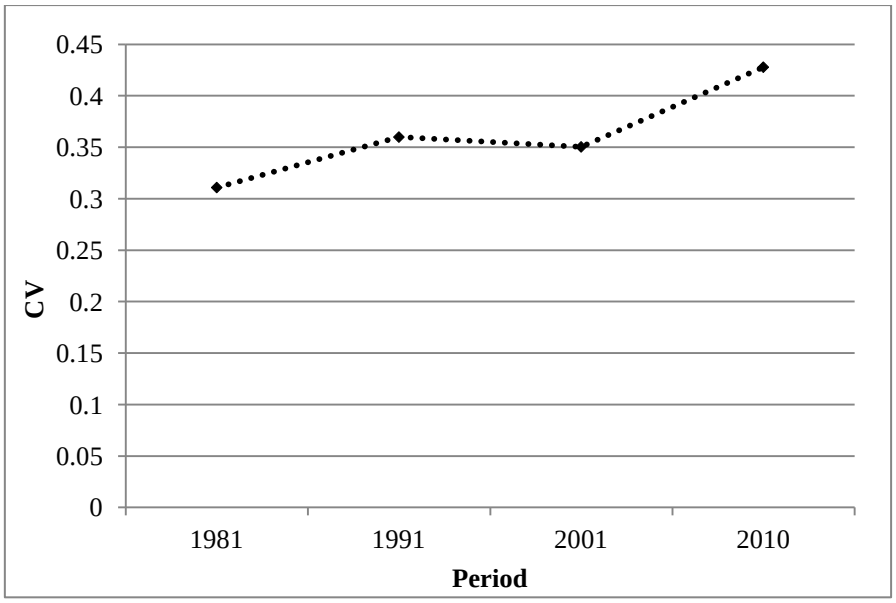
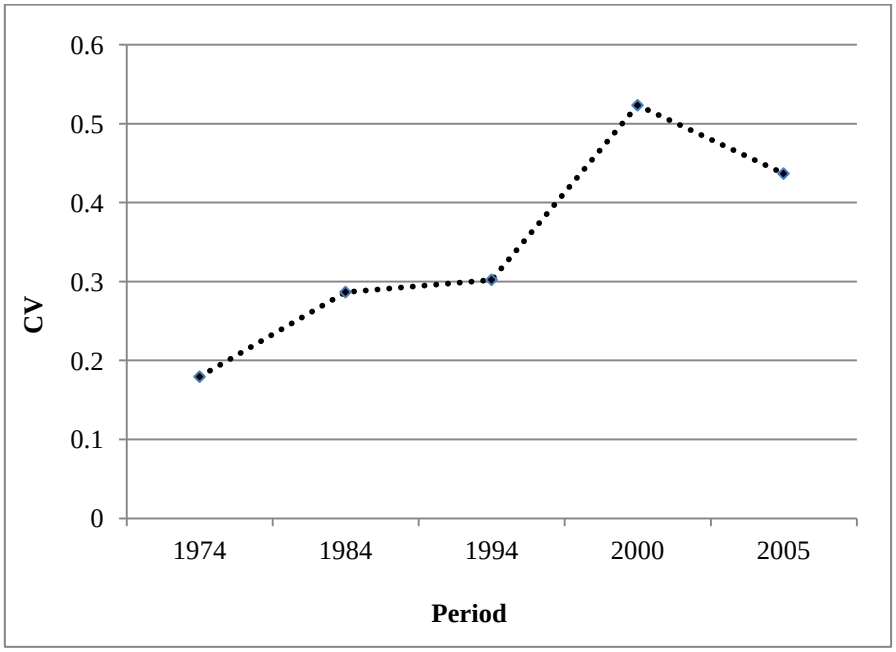


Fig. 2. Trends in coefficient of variation (CV) in selected socioeconomic indictors of the major states in India during 1973-2005.

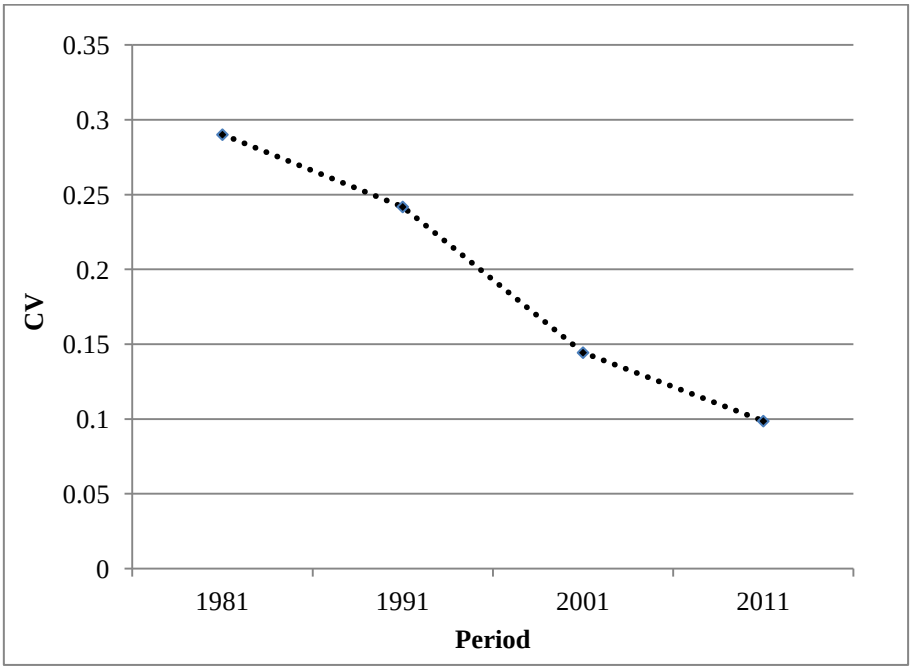
Per capita SNDP



Poverty ratios



Literacy rates



HDI values

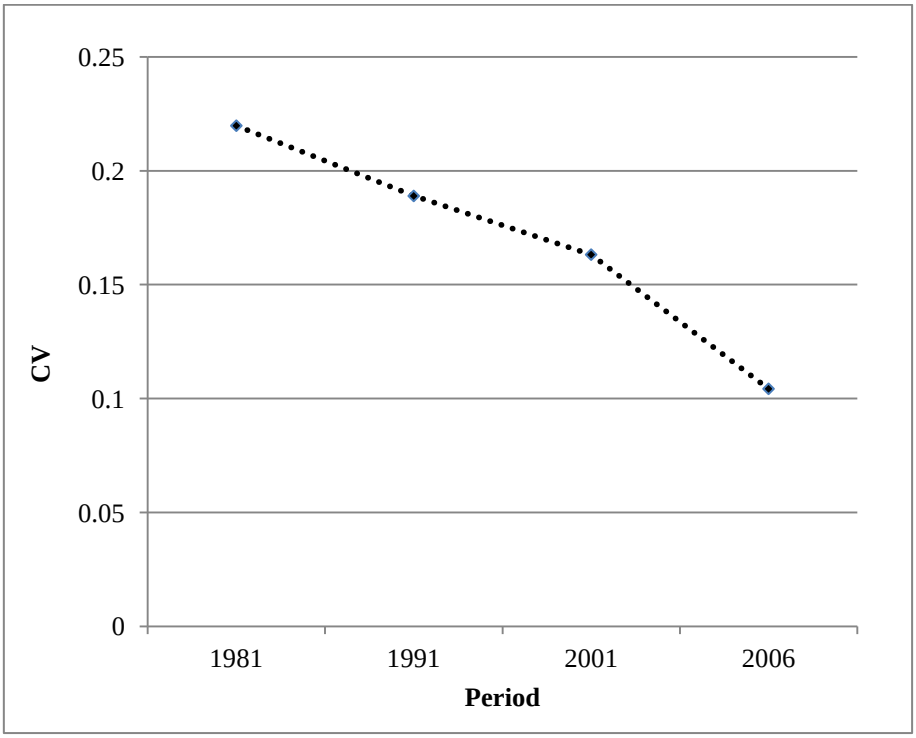
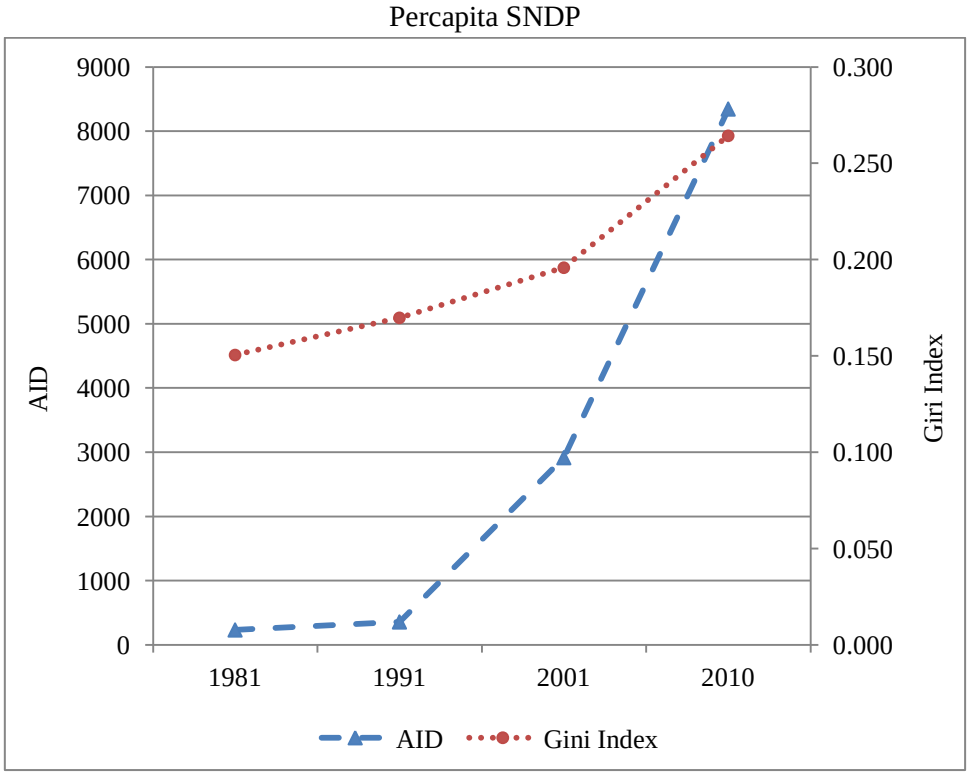
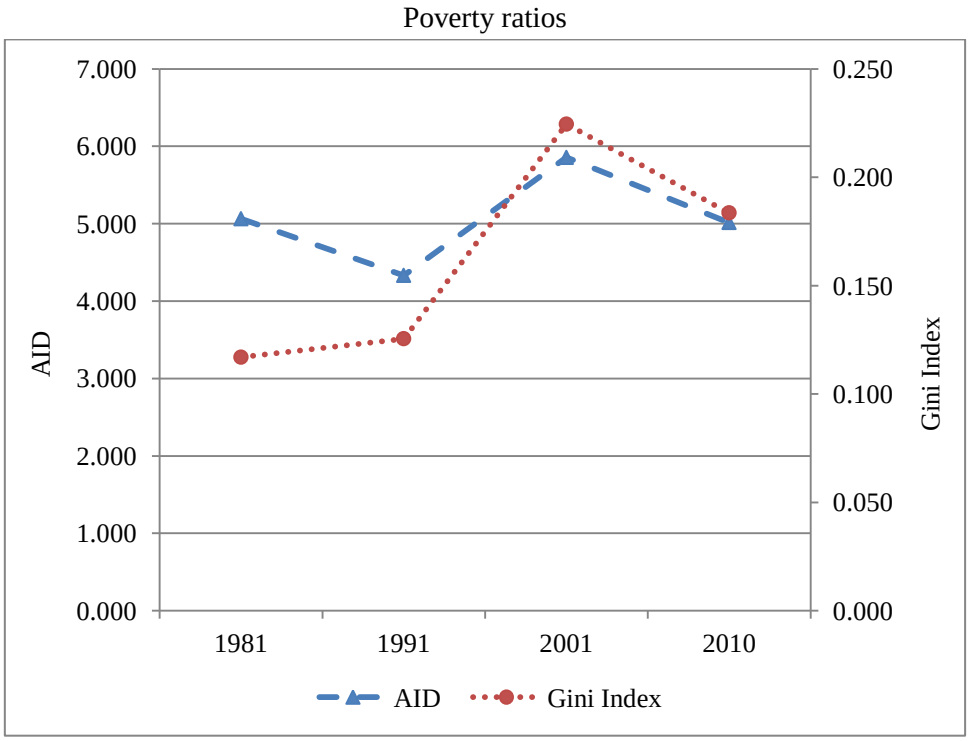


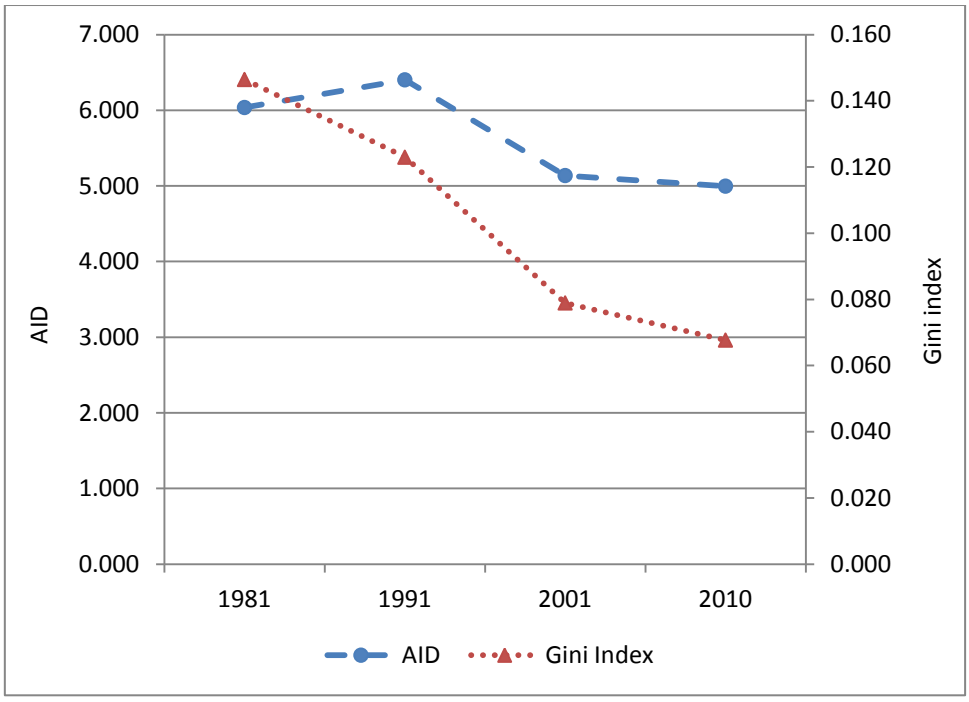
Fig. 3. Kernel density etimates and distribution curves for selected socioeconomic Indicators of 15 major states of India.

Fig. 4. Trends in Population weighted Average Inter-states Dispersion (AID) and Gini Index in selected socioeconomic indictors of the major states in India during 1981-2010.





Literacy rates



HDI

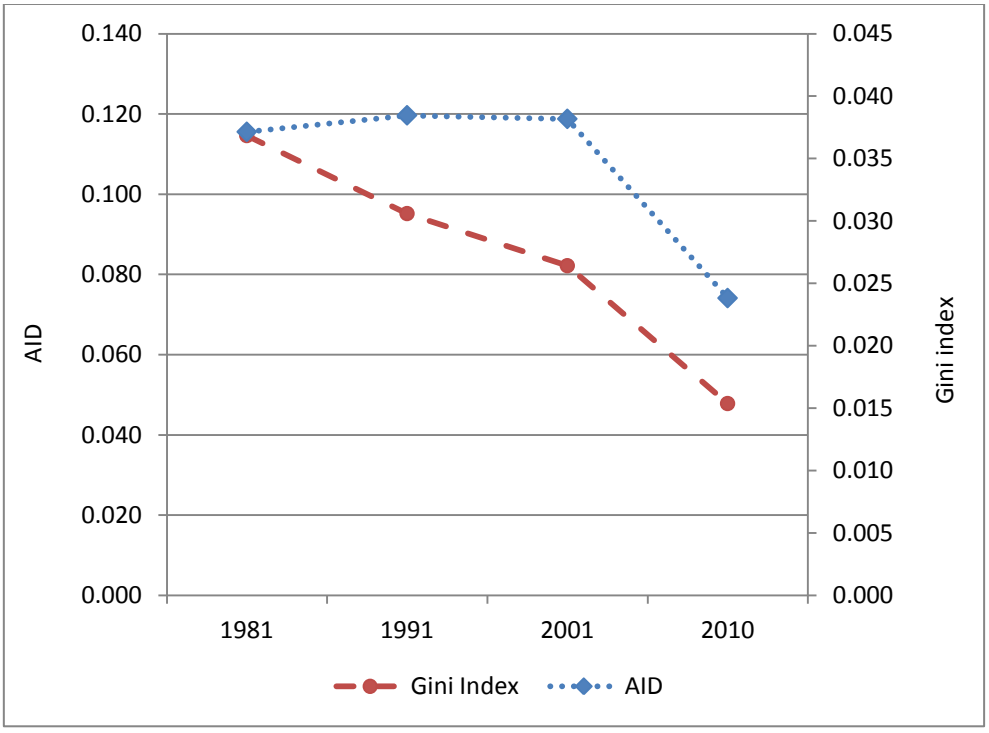


Table 1

Descriptive statistics of socioeconomic indicators in 15 major states of India.

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum	Range
Per capita SNDP_1981	15	1631.4	507.18	917	2674	1757
Per capita SNDP_1991	15	2204.86	793.61	1197	3730	2533
Per capita SNDP_2001	15	16183.07	5670.07	6554	25986	19432
Per capita SNDP_2010	15	34539.93	14777.34	11799	57458	45659
Poverty ratios_1974		51.23	9.1904	28.1	61.5	33.4
Poverty ratios_1984	15	40.75	11.68	18.5	58.4	39.9
Poverty ratios_1994	15	32.07	9.69	11.7	46.4	34.7
Poverty ratios_2000	15	24.02	12.57	6.16	47.15	40.99
Poverty ratios_2005	15	24.75	10.81	8.1	45.6	37.5
Literacy rates_1981	15	43.57	12.64	28.37	78.85	50.48
Literacy rates_1991	15	54.38	13.15	38.48	89.81	51.33
Literacy rates_2001	15	67.03	9.68	47.53	90.92	43.39
Literacy rates_2011	15	75.19	7.42	63.82	93.91	30.09
Gini index_1983	15	.3106	.0312	.25	.36	0.11
Gini index_1994	15	.3000	.03722	.22	.38	0.16
Gini index_2000	15	.3206	.0413	.23	.39	0.16
Gini index_2006	15	.3360	.04610	.24	.39	0.15
TFR_1981	15	4.34	.8683	2.8	5.8	3
TFR_1991	15	3.46	.9146	1.8	5.1	3.3
TFR_2001	15	2.94	.8666	1.8	4.5	2.7
TFR_2009	15	2.48	.7398	1.7	3.9	2.2
IMR_1981	15	100.66	29.58	37	150	113
IMR_1991	15	74.06	25.83	16	124	108
IMR_2001	15	62.26	20.10	11	91	80
IMR_2009	15	49.466	16.67	12	70	58
LEB_1981	15	57.13	4.92	50	68	18
LEB_1991	15	61.46	4.68	55	73	18
LEB_2001	15	63.93	4.30	58	74	16
LEB_2006	15	64.06	4.18	58	74	16
HDI_1981	15	.3226	.0709	.24	.5	0.26
HDI_1991	15	.4033	.0762	.31	.59	0.28
HDI_2001	15	.4633	.0756	.37	.64	0.27
HDI_2006	15	.5073	.0529	.44	.63	0.19

Note: SNDP-State Net Domestic Product; TFR- Total Fertility Rate; IMR-Infant Mortality Rate; LEB-Life Expectancy at Birth; HDI- Human Development Index

Table 2

Absolute β convergence model estimates for per capita SNDP of the major Indian states, 1981-2010.

Period	β coefficient	P value	Adjusted R^2	n	df
1981-2010	-.0138	0.877	0.0749	15	14
1981-1991	.07587	0.576	0.0503	15	14
1991-2001	-.25090	0.120	0.1123	15	14
2001-2010	.12591	.322	0.0041	15	14
Constant[a]	1.278	0.070			

Note- n=sample, df=degree of freedom, a= constant value is refer to convergence model of period, 1981-2010.

Table 3

Absolute β convergence model estimates for Poverty Ratios of the major Indian states, 1974-2005.

Period	β coefficient	P value	Adjusted R^2	n	df
1974-2010	.06291	0.036	0.2424	15	14
1974-1984	.10874	0.008	0.3809	15	14
1984-1994	-.00388	0.908	0.0758	15	14
1994-2005	.12538	0.019	0.3058	15	14
Constant[a]	-5.82597	0.001			

Note- n=sample, df=degree of freedom, a= constant value is refer to convergence model of period, 1974-2005.

Table 4

Absolute β convergence model estimates for literacy rates of the major Indian states, 1981-2011.

Period	β coefficient	P value	Adjusted R^2	n	df
1981-2011	-.04468	0.000	0.9408	15	14
1981-1991	-.03158	0.000	0.7334	15	14
1991-2001	-.07056	0.000	0.7079	15	14
2001-2011	-.05189	0.000	0.6777	15	14
Constant[a]	3.8670	0.000			

Note- n=sample, df=degree of freedom, a= constant value is refer to convergence model of period, 1981-2011.

Table 5

Absolute β convergence model estimates for Human Development Index values of the major Indian states, 1981-2006.

Period	β coefficient	P value	Adjusted R^2	n	df
1981-2006	-6.3717	0.000	0.7627	15	14
1981-1991	-4.4534	0.020	0.3020	15	14
1991-2001	-3.3580	0.006	0.4042	15	14
2001-2006	-9.5074	0.000	0.5951	15	14
Constant[a]	3.6714	0.000			

Note- n=sample, df=degree of freedom a= constant value is refer to convergence model of period, 1981-2010.

Table 6

Conditional β convergence model estimates for SNDP of the major Indian states, 1981-2010.

Factors	β coefficient	P value	Adjusted R^2	n	df
Log SNDP_1981	-.1559	0.090	.4143	15	14
Literacy Rate _1981	-.0013	0.660		15	14
TFR _1981	-.0745	0.094		15	14
LEB_1981	.0078	0.325		15	14
Constant	2.2584	0.004			

Note- n=sample, df=degree of freedom

Table 7

Conditional β convergence model estimates for poverty ratios of the major Indian states, 1974-2005.

Period	β coefficient	P value	Adjusted R^2	n	df
Poverty Ratios _1974	.1132511	0.002	0.6796	15	14
Log SNDP_1981	2.137415	0.040		15	14
TFR_1981	-.0862611	0.800		15	14
Literacy Rate_1981	-.0767969	0.012		15	14
Constant	-20.40596	0.022			

Note: n=sample, df=degree of freedom

Table 8

Conditional β convergence model estimates for Literacy Rate of the major Indian states, 1981-2010.

Period	β coefficient	P value	Adjusted R^2	n	df
Literacy Rate_1981	-.0368	0.000	.9502	15	14
Log SNDP_1981	-.0515	0.797		15	14
Poverty Ratios _1974	.0030	0.605		15	14
TFR_1981	.1320	0.095		15	14
Constant	3.1727	0.079		15	14

Note- n=sample, df=degree of freedom

Table 9

Conditional β convergence model estimates for HDI of the major Indian states, 1981-2010.

Period	β coefficient	P value	Adjusted R^2	n	df
HDI_1981	-7.3343	0.000	.8291	15	14
Gini Index_1981	1.5779	0.461		15	14
Poverty Ratios _1974	-.0069	0.292		15	14
TFR_1981	-.1476	0.084		15	14
Constant	4.4896	0.001		15	14

Note- n=sample, df=degree of freedom