

Economic Growth and Disparities in India

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In the long run, prosperity and development of a region is best measured by economic growth. The paper reexamines the topic of economic growth of the states of India. The per capita net State domestic product at factor cost and current prices taken as a proxy of income for 21 states accounting for 97.5 percent of the population and 95 percent of income is analyzed for the period 1986-87 to 2013-14. The sample of states and duration of study is the largest among the various studies reviewed by the authors. The growth disparities are analyzed through the traditional popular measures of convergence supplemented by specially modeled tools. The empirical result indicates widening income disparities and identifies states for policy focus. The data is sourced from "Handbook of statistics of the Indian economy 2013-14".

Keywords: Convergence; Divergence; Inequalities; Per capita income

INTRODUCTION

Economic growth can best be summarized as a long run process spanning decades/generations leading to a significant and sustained increase in the standard of living of the people. As noted by (Smith, 1776), the true wealth of a nation and hence its prosperity can be gauged from its national and per capita income. Thus, the absolute and per capita figures of income are identified as critical indicators of prosperity and economic health of a region.

With the adoption of planned economic model post independence, India's growth rate for decades hovered in the range of 3 percent to 3.5 percent, prompting economists and analysts to coin the phrase "Hindu rate of growth". The low growth rate which was primarily due to our closed economic model, red tapism, absence of long term planning, fiscal imprudence by the governments and corruption led to a balance of payment (BOP) crisis in the early decade of 1990's. To correct the BOP situation, the country resorted to loans from IMF and the World Bank with the expected riders of opening the doors of the Indian economy to foreign players. Thus, we ushered in the era of liberalization, globalization and privatization in 1991-92 to break free from the shackles of low growth. The foreign players who were long eyeing the large Indian market were expected to bring in technology and capital which they did. Post the reforms, the Indian economy has been growing at healthy rate of 6-7 percent which is second only to China.

But, one of the salient features of the Indian economic development has been the wide disparities in the growth of the states. Is this expected in a large and diverse economy like India consisting of 29 states and 7 union territories? The regions differ widely in terms of population, area, natural endowments, land fertility, availability of capital, access to technology, governance, efficiency of labor and many more factors. For example, in the sample of 21 largest states taken in the study, the population of Meghalaya is only 1.5 percent of the population of Uttar Pradesh in 2013-14. In the same year, the lowest per capita income of Rs.15257 is of Bihar and the highest per capita income of Rs.70197 is of Haryana. An analysis of regional imbalances in growth is necessary for identifying the states which need special focus. As noted by a report by the World Bank (2009), "if large and populous spatial segments of the economy remained backward while the other regions move ahead for long periods of time, the overall national development strategy becomes unsustainable". The purpose of the paper is an analysis of how the states have performed relative to one another during the period from 1986-87 to 2013-14.

The conventional theory of regional development postulates that in the long run, the growth of the regions converges to the national average (Barro, 1992, 1995). This hypothesis of convergence is contested by many authors who postulate divergence in growth with time (Myrdal, 1957; Hirschman, 1958; and Kaldor, 1967). The paper tests the hypothesis of convergence /divergence for each of the sample states.

The study is divided into 4 main parts. The first part covers the review of literature citing important works on economic growth and regional disparities. The second part is a brief on the sample of states, data sources and methods and models used in data analysis. The third part deals with empirical analysis and results. This has three sub parts. The first sub part analyses the growth of the states. The second sub part deals with rank analysis. The third and final

sub part deals with an analysis of regional inequalities in growth and testing of convergence /divergence in growth. The last part summarizes the key findings of the study.

REVIEW OF LITERATURE

There are several studies on regional income inequalities in India. Almost all studies have focused on testing for convergence/divergence in growth. Prakash, S. and Rajan, P. (1977) are probably the first who studied the divergence between the planned targets and actual development of states with special reference to Madhya Pradesh. In another study, Prakash, S. and Mohapatra (1980) analyzed inter and intra state inequalities of development with special reference to M.P. They used 33 socio-economic variables for the measurement of status of development by an innovative method of factor analysis; their method was a modified form of M.G. Kendall's method of factor analysis by change in rank order as a result of inclusion or exclusion of specific attribute/variable in analysis. They covered a period of about one and a half decades. But several other studies also lend credence to Prakash-Mohapatra hypothesis of not only existence but accentuation of divergence of development of states. Among the prominent studies which have concluded that the regional inequalities have increased over time include Williamson (1965, 1968), which was perhaps the first study on regional inequalities in India covering the decade of 1950's, Venkatamariah (1969), Rao (1973), Nair (1973), Sarkar (1994), Raman (1996), Marjit & Mitra (1996), Ghosh et al (1998) and Dasgupta et al (2000) covering 16 states and the period 1960-61 to 1995-96. Several other studies have found convergence among the Indian states, some of which are Dhar & Sastry (1969), Mahajan (1982), Dholakia (1994) covering 20 states and the period 1960-61 to 1989-90 and Cashin & Sahay (1996). One of the most extensive works in this area was undertaken by Mathur (2000) who covered the period 1950-51 to 1996-97. He found the regional inequalities to

decrease till the mid sixties and then increase thereafter. The differing conclusions of various studies have most likely been influenced by the period of the study, selection of the base and terminal year, selection of the states/regions, the selected tools of analysis and choice of absolute /per capita figures.

RESEARCH APPROACH

Data Sources

The data is cross sectional, covering the period 1986-87 to 2012-13. It has been procured from "Handbook of Statistics on the Indian Economy 2012-13" published by RBI, Economic Survey 2011-12 published by the Government of India and Indiatat.com. Thus all data is secondary in nature. 21 of the 29 states are covered in the study. The states excluded are Arunachal Pradesh, Manipur, Mizoram, Nagaland, Tripura, Sikkim, Goa and Telangana. The first five of these states are from North Eastern Region, Sikkim is from Eastern region, Goa is from Western region and Telangana is the newly formed state. The omitted states on an average account for 2.5 percent of the total population and 5 percent of the total NGDP. Thus the exclusion of the states is not expected to affect the findings in the study. Three newly created states in 2000 namely Chhattisgarh, Jharkhand and Uttarakhand have been included in the study on account of their large population and significant contribution in NGDP. The per capita NSDP of the newly formed states for the period 1986-87 to 1999-00 is estimated as a proportion similar to their proportion with the clubbed state from where they were carved out.

Methods and Models

The year on year (YOY) growth rates for the states is estimated for the period. For measuring regional disparities, we use the traditionally used t values (estimated as the difference between the mean and median of a series), coefficient of variation

(CV), Gini coefficient and Theil Index. The cross section data is also subjected to the tests of sigma and beta convergence. This is supplemented by the use of special models to test for convergence / divergence in growth rates of the states. A brief on the models is explained with the empirical results.

EMPIRICAL ANALYSIS AND RESULTS

The results are presented sequentially pertaining to (i) YOY growth rates of the states; (ii) Rank analysis; and (iii) Disparities in the growth of states and testing for convergence/divergence

Analysis of YOY Growth Rates

The states in India vary widely in size and population. A more reasonable assessment of income growth can be arrived at by analyzing the per capita figures instead of absolute figures.

The mean annual growth rate, standard deviation (SD) of the growth rates, CV of the growth rates and the trend of the states for the period 1986-87 to 2013-14 is estimated.

Arithmetic Mean (AM) of the growth rates is estimated as mean of the YOY growth of each state, Geometric mean (GM) is estimated as the nth root of the YOY growth rate, Compound Annual Growth Rate (CAGR) for each state is estimated as the slope coefficient of the natural log values regressed on time, standard deviation is calculated by the formula

$$\frac{1}{n} \sqrt{\sum_{i,t=1}^n (G_{i,t} - \bar{X}_a)^2}, \text{ G is the YOY growth rate, t is 1 to 27 (1987-88 to 2013-14), } \bar{X}_a \text{ represent Arithmetic}$$

Mean. CV is estimated as the ratio of the Standard Deviation to AM. The highest and lowest growth figures of a year are captured as Max and Min growth rate, while the range is calculated as the difference between the maximum and minimum growth rate.

Table 1: Summary figures of Growth in Per Capita Income of the States of India for the Period 1987-88 to 2013-14

	States	AM	GM	Trend Exp Growth rate	SD	CV	Max Growth rate	Min Growth rate	Range
1	Andhra Pradesh	6.60	6.36	5.84	7.38	111.7	30.17	-12.20	42.38
2	Assam	3.65	3.24	3.31	9.74	266.7	38.43	-18.24	56.68
3	Bihar	4.48	4.00	3.68	10.41	232.3	35.13	-17.56	52.69
4	Chhattisgarh	5.53	5.09	4.62	10.27	185.9	44.56	-11.20	55.76
5	Gujarat	5.30	4.95	5.34	8.85	167.0	27.42	-11.15	38.56
6	Haryana	6.13	5.96	5.89	6.20	101.3	24.64	-5.58	30.22
7	HP	6.08	5.96	6.12	5.39	88.6	27.70	1.18	26.51
8	J & Kashmir	2.97	2.74	3.44	7.09	238.7	22.01	-13.11	35.12
9	Jharkhand	3.68	3.24	3.53	10.00	271.5	32.76	-13.34	46.10
10	Karnataka	5.27	5.18	5.35	4.49	85.2	12.95	-1.90	14.85
11	Kerala	6.09	6.03	6.23	3.89	63.8	18.20	-0.24	18.43
12	Madhya Pradesh	5.55	5.15	4.13	9.85	177.4	42.08	-9.32	51.41
13	Maharashtra	5.54	5.41	5.15	5.47	98.6	17.50	-4.36	21.87
14	Meghalaya	4.46	4.31	4.42	5.96	133.6	22.33	-3.08	25.41
15	Orissa	4.91	4.55	4.99	8.74	178.0	17.41	-13.71	31.12
16	Punjab	4.19	4.11	3.95	4.16	99.3	16.84	-2.54	19.38
17	Rajasthan	5.38	5.06	4.50	8.35	155.3	23.47	-10.67	34.14
18	Tamil Nadu	5.96	5.88	5.77	4.25	71.4	15.45	-3.70	19.15
19	Uttar Pradesh	3.77	3.68	3.43	4.64	123.0	18.87	-2.54	21.41
20	Uttarakhand	5.25	5.10	5.17	5.78	110.2	16.44	-6.37	22.81
21	West Bengal	4.21	4.15	4.26	3.67	87.0	11.05	-3.76	14.81
	India	4.48	4.46	4.51	2.35	52.4	8.07	-1.21	9.28

(All figures in percentage)

The growth in per capita income has been the highest for Kerala with a CAGR of 6.23 percent closely followed by Himachal Pradesh and Haryana at 6.12 percent and 5.89 percent respectively. For only 9 of the 21 states, the per capita income has grown in excess of 5 percent per annum. The per capita income growth of the country has also been very mediocre at 4.51 percent p.a. Assam, UP and J&K are at the bottom with 3.31 percent, 3.43 percent and 3.44 percent per annum respective growth in income. Eleven states have grown at a faster rate in comparison to the national average while the rest

namely Assam, Bihar, J&K, Jharkhand, MP, Meghalaya, Punjab, Rajasthan, UP and West Bengal have grown at a pace slower than the growth rate in the national per capita income. All states except for HP have seen at least one year of negative growth in per capita income. Surprisingly, Gujarat has the maximum of 10 years of negative growth in per capita income. Eight of these were from the period 1986-87 to 2000-01 while it has also witnessed negative growth in 2012-13 and 2013-14. The compound annual growth for the entire period of Gujarat at 5.34 percent is significantly higher than the

national average of 4.51percent. Thus, it can be inferred that the period 2000-01 to 2011-12 was a period of high income growth for the state. Gujarat is followed closely by Bihar with 9 years of negative growth. 1991-92 was the only year when the national per capita declined. This year also saw the negative growth of 11 states. The year 1992-93 was equally bad with a similar number of states registering negative growth. All the states have had wide fluctuations in growth levels. Significantly, the states of Assam, Bihar, J&K and Jharkhand display the highest fluctuations in year on year growth as evident from their CV values.

Rank Analysis

For estimating whether the rankings of the states as determined by their per capita income have changed with time, rank analysis is used. The states are ranked each year in descending order of their per capita income and the mean ranking of each state is estimated for the period. Punjab, Haryana and Maharashtra had the highest mean ranking of 1.74, 1.96 and 2.3 respectively. Thus on an average these three states amongst themselves enjoyed the top three rankings in income during the entire period. Bihar had the lowest mean ranking of 21 with a standard deviation of 0. Thus, it has the dubious distinction of being ranked at the bottom for all the years during the period.

We estimate the rank correlation matrix for the states and all the coefficients are statistically significant at 0.01 level. Thus, it can be inferred that the state rankings have been relatively consistent during the period. The high income states have continued to have a higher income compared to their peers while the low income states have continued to be poorer as compared to other states.

Result of the overall test of Concordance among the states of India is reported below

Overall test of W Statistic	H ₀ : The ranking of the states over the years are not concordant with each other
Kendall's W =	0.90389
F Statistic =	244.5*
Friedman' chi-square =	488.09*

*significant at 1 per cent level

Coefficient of concordance

The coefficient of concordance (W) was proposed by M.G.Kendall and Bernard Babington Smith. In the present case, it is used to test the degree of consistency in the ranking of the states in different years taken as a whole. Numerically it is estimated from equation

$$W = \frac{12 S}{m^2(n^3 - n)}$$

$S = \sum_{i=1}^n (R_i - \bar{R})^2$, R_i is the row sum of the ranks of the states over the years, \bar{R} is the mean of the R_i values, m is the number of variables (number of years) and n is the number of objects (number of states) whose ranking has been done.

W is an estimate of the ratio of the variance of the row sum of squares and the maximum possible value of the variance. Thus, W lies between 0 and 1, with a value of 1 signifying perfect concordance or agreement in the rankings.

There are two alternative approaches to testing the significance of W namely Friedman's chi-square statistic and F statistic (Legendre, P.2010)

- Friedman's chi-square statistic- it is estimated by the formula, $\chi^2 = m(n-1)W$, the quantity follows a chi-square distribution with $(n-1)$ degrees of freedom. Kendall has suggested the use of this approach for moderately large values of m and n .
- F Statistic- it is estimated by the equation, $F = \frac{(m-1)W}{(1-W)}$, the quantity follows a F distribution with $(n-1-2/m)$ numerator degrees of freedom and $((n-1-2/m)(m-1))$ denominator degrees of freedom. Kendall has recommended the use of this approach for moderate values of m and n .

The high value of W (0.903), coupled with the F statistic and χ^2 being statistically significant point to a near perfect concordance in the ranking of the states during the period. The result corroborates the findings from the rank correlation matrix that the rankings of the states have not changed during the period. Thus poor states have continued to be poor while the better off states have continued to be above the country average.

Analysis of Regional Inequalities

We start with estimating the t values of the difference between the mean per capita income and the median per capita income for each year with the hypothesis that a zero value will indicate normality of data distribution or uniform income distribution. Thus, an increasing or decreasing t value over the years will indicate increasing or decreasing inequality over the years. This is supplemented by coefficient of variation CV. Since both SD and mean are measured in the same units, CV is scale invariant or independent of the unit of measurement. The higher the CV, the higher is the divergence. As the Indian states vary largely in population, therefore the measures of inequality is further supplemented by the use of weighted CV (CV_w) defined as

$$CV_{wt} = \frac{1}{Y^t} \sqrt{\sum (Y_{it} - Y^t)^2 \frac{P_{it}}{P_t}}$$

Y_{it} is the per capita state income for year t , Y^t is the national per capita of year t , P_{it} is the population of the state in year t and P_t is the population of the country in year t . The time period " t " varies from 1986-87 to 2013-14. The value of " i " will vary from 1 to 21 for the different states.

A plot of the t values, CV and CV_w is shown in Figure 1

Unlike the CV and weighted CV values which have a gradual upward slope, the t values of the difference between the mean and median widely fluctuates during the period. The value of t increased steeply from 1987-88 to 1996-97 and then declined steeply till 2002-03, almost an inverse V formation. Again between the period 1995-96 and 2011-12, the graph of t has a V formation. This seems to suggest a cyclical movement in its value over time. Overall, the t values infer an increased inequality in income distribution.

To have a closer look at the movement of CV and weighted CV, they are plotted separately

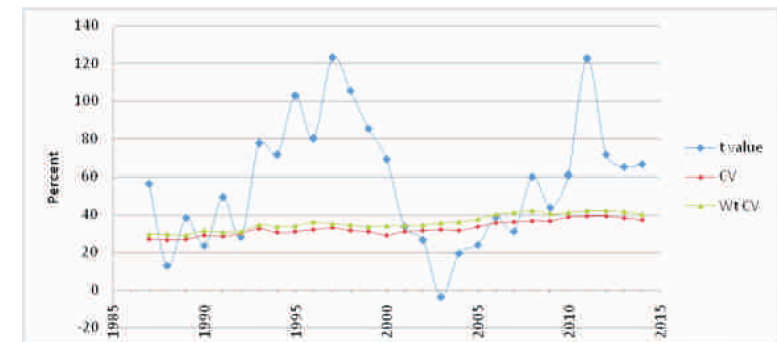


Figure 1: Plot of t values, CV and Wt CV for the Period 1986-87 to 2013-14

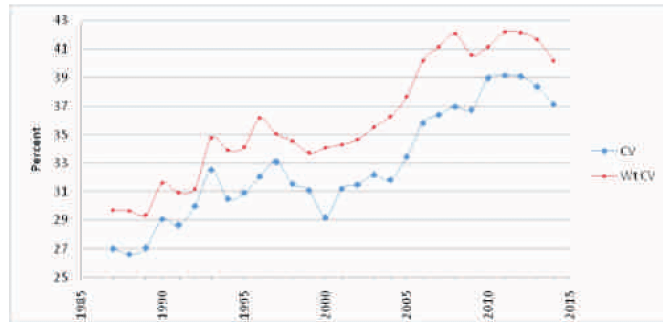


Figure 2: Plot of CV and weighted CV for the period 1986-87 to 2013-14

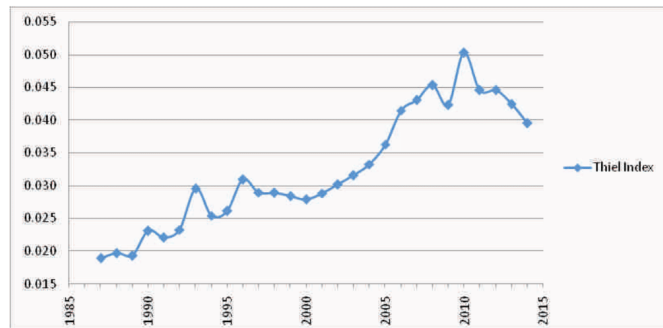


Figure 3: Plot of TE values for the Period 1986-87 to 2013-14

The values of CV and weighted CV were 27percent and 29.7percent respectively in 1986-87. Their values in 2013-14 were 37.2percent and 40.1percent respectively. As the graph indicates, there has been a constant upward trend in the movement of their values supporting the argument of increased non uniformity in income distribution among the states over the time period. Notable is the similar upward and downward movement in their values over the time period.

To test the argument further, the Theil Index (TE) as a measure of regional inequality is estimated. The index was developed by Theil in 1967. It is size

independent and gives the relative position of the region in the sample. It is mathematically expressed as

$$E_{xt} = \sum X_{it} \ln \left(\frac{X_{it}}{P_{it}} \right)$$

X_{it} is the proportionate share of the state in the national income and P_{it} is the proportionate share of the state in total population. The value t varies from 1986-87 to 2013-14 and “ i ” represents the states. A value of 0 indicates perfect equal distribution. An increasing value of the index over time is indicative of increasing inequalities.

Plot of the TE values for the time period is depicted in Figure 3

The increase in the value of the index over the time period supports the inferences derived from the values of t , CV and Wt CV. Thus all the four indicators point to increased inequalities in income during the period.

The estimated coefficients of the regression of t , CV, weighted CV and TE, each independently on time is reported below

	Intercept	Slope	R ²
t ratio	0.51(3.9)	0.004(0.51)	0.009
CV	2.6(44)	0.004(12)	0.85
Weighted CV	0.29(51)	0.004(12.2)	0.94
TE	0.02(13.5)	0.001(13.2)	0.87

Figures in parentheses are the t values of the estimates

Except for the t ratio, the t values of the intercept and slope is significant in all the cases. R^2 is also high in all the regressions except for the t ratio. Thus all the measures of inequality have increased year on year and the change is statistically significant.

Finally, we capture inequalities through the Gini coefficient (G). This coefficient was developed by an Italian statistician, Corrado Gini in 1912. G is a measure of inequality, defined as the mean of absolute differences between all pairs of individuals

for some measure. The minimum value is 0 when all measurements are equal and the theoretical maximum value is 1 for an infinitely large set of observations where all measurements but one has a value of 0, which is the ultimate inequality (Stuart and Ord, 1994).

When G is based on the Lorenz curve of income distribution, it can be interpreted as the expected income gap between two individuals randomly selected from the population (Sen, 1973). Mathematically, it is calculated as

$$G = \frac{\sum_{i=1}^n \sum_{j=1}^n |y_i - y_j|}{n^2 \bar{y}}$$

Here y is the per capita income, \bar{y} is the mean value, n is the number of states, y_i, y_j are the per capita figures of states “ i ” and “ j ” respectively.

If the y values are placed in ascending order such that each y has a rank “ i ”, the calculation is simpler and is mathematically derived from

$$G = \frac{\sum_{i=1}^n (2i - n - 1)y_i}{n \sum_{i=1}^n y_i}$$

The Gini coefficient for the period is plotted in Figure 4

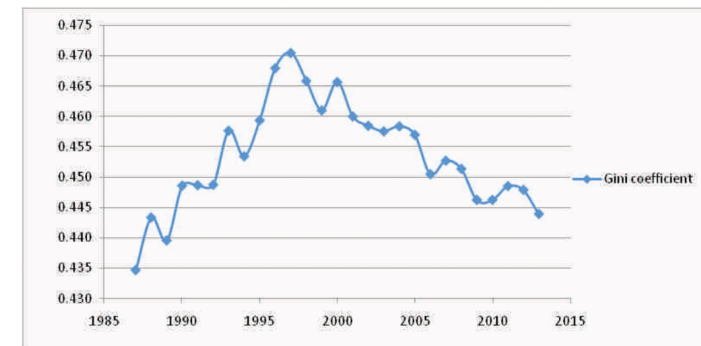


Figure 4: Plot of Gini Coefficients for the Period 1986-87 to 2013-14

As evident from the plot, the Gini coefficient increases from 0.435 in 1986-87 to a high of 0.47 in 1996-97 and has been declining since then to a value of 0.444 in 2013-14. It can be noticed the decline in the value of the index is slightly moderate compared to the sharp rise in its value from 1986-87 to 1996-97. Thus the inference of the Gini index would suggest that the liberalization of the Indian economy has helped in reducing income inequalities among the states.

In the calculation of the Gini index by the above methods, each region/state is considered to be one unit each. But, the states in India are very diverse with respect to size and population. Thus, a better measure of inequality should factor the population of the state in the calculation of the index. The population weighted Gini index does exactly this and is calculated as

$$G_w = \frac{1}{2\bar{y}} \sum_{i=1}^n \sum_{j=1}^n \frac{P_i}{P_T} * \frac{P_j}{P_T} |y_i - y_j|$$

P_i , P_j , P_T are the population of regions/states "i", "j" and total population of the regions/states respectively.

The behavior of the weighted Gini index is quite similar to the unweighted index. The rise in inequalities is sharp from 1986-87 to 1995-96 followed by a sharp fall till 1999-2000 and has been

relatively stable since then. This is again a comforting sign for the propagators of liberalization and open market economy as the reforms in India has certainly helped in reducing income inequalities.

Sigma convergence

For each year, the standard deviation/sigma (σ) of the log of state income is estimated. A decreasing value of sigma over time will indicate convergence while an increasing value will signify divergence.

A plot of σ values during the time period is shown in figure

There is a constant increase in the σ value from 0.289 in 1986-87 to 0.411 in 2013-14 although it remained stable during 1992-93 to 1999-2000. Since then, it has been an upward trend. CAGR for the entire period is 0.8percent with a p value of 2.4E-15. Thus the rate of growth of change in the value of sigma over the time period is significant. This indicator also supports the argument of increased disparities in income distribution.

The regression result of σ values on time is reported below

Intercept	Slope	R ²
0.27(51)	.003(20)	0.94

Figures in parentheses are the t values

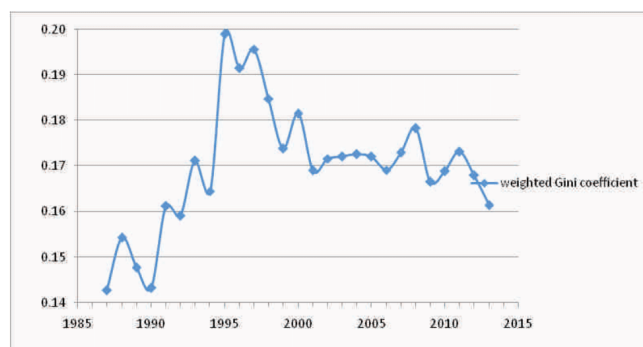


Figure 5: Scatter plot of the Gini Coefficients Weighted by Population from 1986-87 to 2013-14

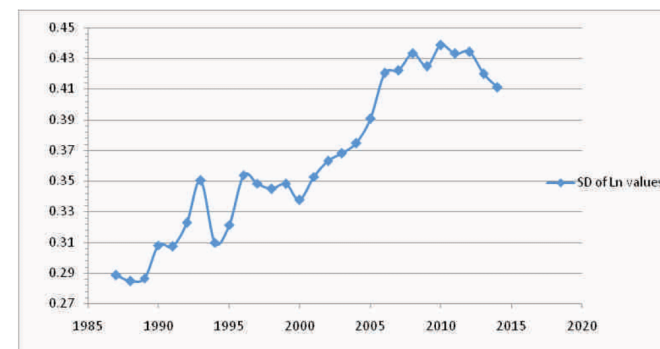


Fig 6: Plot of σ Values over the Period

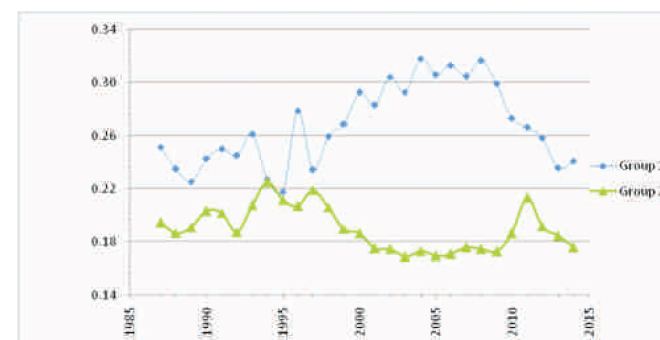


Figure 7: Plot of Sigma Values for Group 1 and Group 2

The t value of the slope being statistically significant, we can infer that value of sigma over the time period has changed significantly. Thus there is evidence of divergence among the states during the time period.

Will the result of sigma convergence vary if we consider more or less homogeneous groups of states? Pritchett and Jones (1997) tested the convergence hypothesis on a selected homogeneous group of countries and found the convergence hypothesis to hold. To test the hypothesis, the states are segregated into two groups - group 1 comprising states with mean per capita below the national

average and group 2 comprising states with mean per capita above the national average. This classification approach is similar to that adopted by Sachs, J.D et al (2001), in their study including the 14 most populous states for the period 1980-98. Basis the classification, group 1 comprises 10 states namely Bihar, Uttarakhand, Jharkhand, Assam, MP, Orissa, J&K, Chhattisgarh, Rajasthan and Meghalaya. Group 2 comprises 11 states namely AP, Gujarat, Haryana, HP, Karnataka, Kerala, Maharashtra, Punjab, Tamil Nadu, Uttarakhand and West Bengal. A scatter plot of the values of σ for the two groups is shown in Figure 7

For group 1, the σ value decreased marginally from 0.251 to 0.241 and for group 2 the value decreased from 0.195 to 0.175.

Group1			Group2		
Intercept	Slope	R2	Intercept	Slope	R2
0.24(22.5)	0.002(2.6)	0.22	0.2(35)	(-0.0009)(-2.6)	0.21

Figures in parentheses are the *t* values

The slope of group 1 is positive and significant while the slope of group 2 is negative and significant. The states with a per capita income lower than the national average had a status quo with marginal convergence while the states with a higher per capita income have also tended to converge to the national average. The important inference here is that there is evidence of convergence in both the groups. Thus, the convergence hypothesis should hold in a group consisting of more or less homogeneous units. The results are similar to the findings of Sachs, J.D et al (2001), who found convergence in the group of states with higher per capita income and divergence in the states with a lower per capita income. Their study covered 14 of the most populous states in India for the period 1980 -1998.

Beta convergence

The seminal work of Barro (1991), on cross sectional data of U.S.A suggested the regression of growth in per capita income on the initial income as a measure of convergence/ divergence in income inequalities.

Thus, the standard measure of beta convergence involves estimating equation

$$\Delta PcStateincome_t = \beta_0 + \beta_1 \ln PcBaseincome_t + U_t \quad (1)$$

$\Delta PcNetIncome_t$ is the vector of compound annual growth rate of income of states, β_0 is a constant term and $PcBaseincome_t$ is the vector of the base year per capita of the states and u is the error term. The compound annual growth of the state is estimated by regressing the log of Pc income during the period on time where the coefficient of the slope gives the compound annual growth rate (β_1 in equation 2).

$$\ln PcStateincome_t = \beta_0 + \beta_1 T + U_t \quad (2)$$

A negative and statistically significant slope of equation (1) indicates an inverse relationship between growth rate and income. Thus, the underlying concept behind beta convergence is that the states with lower per capita income will grow faster than the states with a higher per capita income. It is assumed that low income states will catch up with higher income states. If beta is negative and statistically significant, it signifies beta convergence.

The estimated results for beta convergence is shown below

Intercept	Slope	R ²
0.45(11.4)	1.48E-06(1.1)	0.06

Figures in parentheses are the *t* values

The slope is positive and statistically non significant. This indicates beta divergence. Thus the states with a lower income have not grown faster than the states with a higher income.

Following up on the work of Barro, Sala i-Martin (1996, 1997) observed that in case of convergence, countries generally converge at a rate between 2 to 3 per cent per year. The rate of convergence can be estimated by the following equation

$$\ln \left(\frac{PcStateincome_{2014}}{PcStateincome_{1987}} \right) \beta_0 + \beta_1 \ln PcStateincome_{1987} + u_t$$

The estimated results for beta convergence is shown below

Intercept	Slope	R ²
0.65(0.82)	0.19(0.86)	0.03

The coefficient of slope is positive and non significant. This again reaffirms divergence in income among the states over the time period and the rate of divergence is 0.19percent per year.

Alternative Models for Measuring Convergence/Divergence

Barro model is based on cross sectional analysis of data. The biasness of the model and the validity of the approach have been questioned by a number of authors, prominent among them being Quah (1993), and Evans (1997, 1998). We strongly believe that Barro model treats year on year growth of different units of observations as a function of the corresponding base values of the units. The model is designed to empirically validate the well known base effect; greater the base value, lower tends to be the value of growth rate and vice versa. The model is highly restrictive and cannot be applied to time series data. The base value will remain one for the unit of observation of the time series data of whose per capita income and its growth is examined. Besides, growth is a function of time. In time series analysis the base of year on year growth rate changes on year basis, therefore Barro Model is inappropriate for time series data. In recent years, testing for convergence through time series modeling and use of augmented D-F unit root test on panel data has gained importance. Important contributors in this area have been Levin, Lin and Chu (2002), Im, Pearsen and Shin (2003) and Breitung and Pesaran (2008).

Two Alternative Models for the Test of Convergence are proposed

- The first measure involves estimating the ratio of the maximum and minimum per capita income of states for each year. A decline/increase in the ratio will indicate convergence/divergence.

$$R_t = \frac{PcState_{t,max}}{PcState_{t,min}} \quad (3)$$

t ranges from 1 to 28 for the period 1986-87 to 2013-14, $PcState_{t,max}$ and $PcState_{t,min}$ are the values of the states with maximum and minimum per capita income for year t . The vector of R and $\log R$ values is regressed on time. Thus, if the coefficient of time is negative and statistically significant, convergence is indicated. In case of the log linear function, the coefficient of time measures the rate of change of R over time.

- The second measure captures convergence / divergence of each state over time with respect to the benchmark national average and is estimated from the following equation

$$Z_t = \frac{PcState_{t,t}}{PcIndia_t} \quad (4)$$

Here i is for the states and t is for the time period ranging from 1986-87 to 2013-14. Thus for each state a time series vector of Z_i values is obtained. The time series and its log values are regressed on time. A negative and statistically significant coefficient of time is indicative of convergence.

The slope in both cases is positive and statistically significant. This evidences increased disparity for the time period between the richest and the poorest state of India. The ratio has increased significantly at an annual rate of 1.67 percent.

The estimated coefficients of equation (4) for each state is tabulated in table

The estimated coefficients of equation (3) are reported below

	Intercept	Slope	R ²	F value	Significance F
Pc Max/ Pc Min	3.47(17.7)	0.07(5.8)	0.57	33.7	4.74405E-06
Log values	1.25(26.3)	0.0167(5.6)	0.56	31.8	7.19896E-06

(Figures in parentheses are the *t* values)

Table 2: Convergence/Divergence in Growth of States

State	Normal Function			Log Linear Function			Remarks
	Intercept	Slope	R ²	Intercept	Slope	R ²	
A.P.	0.92(74.6)	0.014(18.1)	0.93	0.08(6.3)	0.013(16.6)	0.92	Divergence
Assam	0.93(42)	-0.01(-7.8)	0.71	-0.07(2.8)	-0.013(8.1)	0.73	Convergence
Bihar	0.52(21.4)	-0.006(-4.2)	0.41	-0.67(-12.8)	-0.014(-4.2)	0.41	Convergence
Chhattisgarh	0.82(29.9)	-0.001(-0.8)	0.03	-0.19(-5.6)	-0.002(-0.8)	0.03	Convergence
Gujarat	1.28(47)	0.008(4.5)	0.45	0.25(12.2)	0.006(4.5)	0.44	Divergence
Haryana	1.38(31.4)	0.023(8.15)	0.73	0.34(13.5)	0.013(8.1)	0.73	Divergence
H.P.	0.98(23.9)	0.02(7.3)	0.68	0.004(0.13)	0.015(7.5)	0.69	Divergence
J & K	0.91(22.5)	-0.008(-3.1)	0.28	-0.11(-2.2)	-0.009(-3.2)	0.28	Convergence
Jharkhand	0.9(46.3)	-0.013(-10)	0.82	-0.088(-3.4)	-0.018(-11)	0.83	Convergence
Karnataka	1.01(56.7)	0.007(6.9)	0.66	0.018(1.2)	0.007(7.1)	0.66	Divergence
Kerala	1.02(56.8)	0.007(6.9)	0.66	0.018(1.2)	0.007(7)	0.66	Divergence
M.P.	1.01(56.8)	0.008(6.9)	0.66	0.018(1.2)	0.007(7.1)	0.66	Divergence
Maharashtra	1.61(57.8)	0.001(0.92)	0.03	0.47(27.8)	0.001(1.01)	0.04	Divergence
Meghalaya	0.91(29.9)	-0.001(-0.7)	0.02	-0.09(-2.6)	-0.002(-0.7)	0.02	Convergence
Orissa	0.73(29.6)	0.0004(0.3)	0.04	0.32(9)	0.007(0.35)	0.05	Divergence
Punjab	1.91(90.4)	-0.013(-9.6)	0.79	-0.65(-52.6)	-0.007(-9.6)	0.79	Convergence
Rajasthan	0.81(41.3)	0.001(1.3)	0.07	0.21(8.9)	0.002(1.3)	0.07	Divergence
Tamil Nadu	1.05(72.1)	0.015(16.6)	0.92	0.056(4.9)	0.012(16.7)	0.92	Divergence
U.P.	0.79(120)	-0.009(-24)	0.96	-0.22(-21.3)	-0.015(-23)	0.96	Convergence
Uttarakhand	1.09(13.4)	0.005(0.9)	0.03	0.08(1.2)	0.003(0.77)	0.02	Divergence
West Bengal	1.03(35.7)	-0.003(-0.1)	0.08	-0.03(0.01)	-0.03(-1.01)	0.01	Convergence

For the period, the per capita income of nine states is converging to the national average. These states are Assam, Bihar, Chhattisgarh, J&K, Jharkhand, Meghalaya, Punjab, UP and West Bengal. For the other states, the per capita income is diverging from the national average. These states are A.P., Gujarat, Haryana, H.P., Karnataka, Kerala, MP, Maharashtra, Orissa, Rajasthan, TN and Uttarakhand.

Performance of States compared to National Average

We analyze the performance of the states with respect to the national average during the time period for which equation (5) is used

$$\sum \frac{\left(\frac{PcNSDP_{i,t}}{PcNGDP_i} \right)}{\text{Number of years}} \quad (5)$$

A score of more than 1 for a state indicates that it has performed better than the national average during the period while a score of less than 1 indicates that it has performed poorly as compared to the national average. Thus, higher the score of a state, better has been its performance on growth front as compared to the national average. Expectedly Punjab, Haryana and Maharashtra had the top scores of 1.73, 1.70 and 1.64 respectively. Thus the per capita of these states on an average was at 1.73, 1.70 and 1.64 times

respectively of the national per capita income during the time period. As expected Bihar, UP and Orissa had the lowest scores of 0.43, 0.65 and 0.73 respectively for the time period. The per capita of these states was on an average at 0.43, 0.65 and 0.73 times respectively of the national per capita income during the time period.

FINDINGS AND CONCLUSION

- For the period, Kerala recorded the highest growth rate of 6.23 percent followed closely by HP and Haryana at 6.12 percent and 5.89 percent respectively. Assam and UP were at the bottom with growth rates of 3.31 percent and 3.43 percent respectively
- Only 9 of the 21 sample states had CAGR in excess of 5 percent during the period.
- Rank correlation matrix and test of concordance point to a near status quo in the rankings of the states during the period. Thus, poor states continued to be poor while the better off states continued to grow at more than the national average
- The t ratios, CV (both un weighted and population weighted) and Theil Index point to increasing regional inequalities during the entire period with the change being statistically significant
- The Gini Index (both un weighted and population weighted) increased during the entire period. The increase was sharp from 1986-87 to 1995-96, and it has been declining since then till 2013-14. This suggests a more uniform distribution of wealth post liberalization as compared to the pre liberalization years
- The divergence in the estimated sigma values over time indicates widening income disparities among the states during the period
- The cross sectional regression of CAGR of the states on their initial per capita income yields a slope which is positive and statistically non

significant. This again is an indication of increased interstate inequalities of income

- Of the 21 states, the income of 12 states is diverging from the national average while for only 9 states the income is converging to the national average.

LIMITATIONS AND FUTURE SCOPE OF STUDY

The study covers the period from 1986-87 to 2013-14. This period may be extended backward and forward in future research in order to examine growth effect on regional inequalities. Secondly, the study can be extended to within region inequalities. This will throw light on within region differences. Certain social groups demarcated on religion or otherwise may also be examined. Within region inequalities are as important as between regions. Limitations also arise from the above. The policy needs focus on regions from the village level onwards.

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