Regional Income Disparities in India and Test for Convergence – 1980 to 2006

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REGIONAL INCOME DISPARITIES IN INDIA AND TEST FOR CONVERGENCE – 1980 TO 2006[1]

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Abstract

We examine trends in regional disparities in India over a period of 26 years (1980 to 2006). There are wide and increasing variations in economic performances of states over time. We have employed panel data estimation method based on the neo-classical framework. The analysis is based on 25 state economies in India. Results of the analysis suggest convergent trend in regional incomes, conditional upon growth rates of inputs, and rate of technological progress. Speed of convergence has been faster during the period 1992-2006, when Indian economy embarked upon detailed structural reforms. Incomes of the special category states have experienced convergence at a higher rate.

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INTRODUCTION

Regional disparities in the level of economic growth experienced in India is a major challenge for policy makers and planners, as it produces serious threat to the socio-political harmony of the country. States have experienced different pace of economic growth, with some states showing fast progress and others languishing behind, although the national growth has been remarkable for the past two decades (Dholakia, 1985; Sachs et al., 2001). Important policy questions that emerge out are - will the national growth lead to further widening disparities, with rich states getting richer and poor states languishing behind even more? Alternatively, will the incomes show economic convergence in the long run? Whether a planned intervention by the government will solve the problem or the normal functioning of the system will resolve the issue of regional disparities overtime? It is in this light that the hypothesis of convergence in regional incomes is tested against the alternative of long – term divergence in state incomes.

Regional equality has been a significant objective of the national plans. Regional backwardness is a main criterion while determining the funds devolution to state governments by the Finance Commission and the Planning Commission. If it is established that national growth will lead to convergence in regional incomes then growth in richer states will trickle down to poorer states in due course of time. In that case, emphasis should be on economic growth rather than regional backwardness while distributing resources to the state governments. However, if the alternate hypothesis of divergence in regional incomes has stronger ground then, some growth may have to be sacrificed in order to achieve balanced regional growth.

There are sharp differences in the theoretical opinions on the issue. A general agreement is for an inverted U shape of regional disparities with growth. This hypothesis has empirical support from Kuznets (1957). The other theoretical framework discussing regional growth is neo-classical growth theory, which predicts convergence in regional incomes due to factor mobility and diminishing factor returns. However, the theory enjoys limited empirical support and is unable to explain the external sources of growth i.e. technical progress (Richardson, 1969). Myrdal (1957) provides the counter argument, in the form of his cumulative causation hypothesis, which postulates that due to industrialization and gain in productivity, rich regions benefit more. Growth spreads to poor regions through access to larger markets and trade opportunities. However, these gains are offset by stronger backwash effects generated by deteriorating terms of trade resulting from high productivity gains in industrialization in rich regions. Therefore, the theory predicts divergence in regional incomes. The new endogenous growth theory takes the argument further and explains the role of growth engines like external economies of scale, agglomeration effects and technological advancements in clustering growth to few highly competitive regions in the economy (Krugman, 1991).

The present study re-examines the issue of convergence/divergence in regional incomes for the period of 1980-2007, a period of rapid growth in Indian economy. The period can be divided into two sub periods, i.e. the pre-reform period (1980-1992), and the post-reform period (1993-2007), based on the changes in the policy regime in India (Dholakia, 2009). India embarked upon the structural adjustment program in 1991-92, and adopted the policies of liberalization, privatization and globalization. The pre-reform saw some deregulation and decontrol in the economy. During this period, industrial expansion was heavily state controlled, with the objective of helping the lagging regions (Sachs et al., 2002). National GDP growth rate for this period on an average was around 5.3%, and the per capita income growth rate was around 3.2%. During the post-reform period, the growth rate of Indian economy has risen to 5.9% and per capita has grown at around 4.1% because of a declining population growth rate (Dholakia, 2009). This study looks at the regional growth disparities across the two sub-periods.

DATA AND ANALYSIS

It can be argued that there are significant differences between regional product and regional income, as the former measures the efficiency in converting inputs into output, whereas, the later is a more appropriate measure of economic well-being of the residents of a state. However, availability of reliable data only on state domestic product limits us to analyze this variable as a proxy for income. We have used state domestic product data provided by Central Statistical Organization (CSO) for the purpose of the analysis.

At present, India is a federation of 29 states and 6 union territories. For the purpose of the analysis, we have left out the state of Delhi[4] and the six union territories, as these are smaller geographical units and therefore do not represent a region. Among the remaining 28 states, three were formed in the year 2000, namely Uttaranchal, Jharkhand, and Chhattisgarh, carved

[4] The reason for leaving out the state of Delhi is that it is a capital state, with very little rural area. The nature and trend of economic variables is expected to be significantly different for the state.

out of the states of Uttar Pradesh, Bihar and Madhya Pradesh respectively. We have combined these newer states with their parent states for the purpose of this analysis[5].

Studies on regional disparities in India often exclude the special category states[6] for their analysis. The ground stated for exclusion is twofold, one; these states represent a very small fraction of total population and income of India, and two, that these states have significantly different economic and geographical conditions. Therefore, these states cannot be compared with the other non – special category states. Rao, Shand, and Kalirajan (1999) in their study of convergence of state incomes in India have used data only for 14 non-special category states. Similarly, Kurian (2000)'s study of regional disparities has included 15 states. However, the studies where these special category states are included provide interesting and significantly different results from the above-mentioned studies. For example, the study of regional disparities in economic and human development by Dholakia (2003), analyzing 20 states, has found that disparities are actually declining. Similarly, Cashin and Sahay (1996) in the study of regional economic growth, including 26 states, have found declining disparities among state economies.

We have included these states in the analysis, and provided separate results for this group, to show that these states do not differ significantly in terms of per capita income and growth, from their non-special counterparts. Since the source of data for both the groups is same, we considered it safe to compare the results for these two groups, and draw insights about their similarities and differences.

TRENDS IN REGIONAL DISPARITIES

Table 1 presents the basic economic data of the 25 states for the years 1980 and 2006. The table reveals the wide differences in state-level economic conditions in India. According to the 1980 data, there are huge disparities among the Indian states. Goa has the highest per capita GSDP, whereas Tripura has the lowest, about one third of Goa's figure. In 2006, Goa continues to be the state with highest per capita GSDP, with five times higher figure than that

[5] The other option to analyze these states would have been to split the data before 2000 between new states and their parent states. For this, data at district level would be needed, which is not available in public domain, for most of the variables.

[6] 10 states, namely Arunachal Pradesh, Assam, Himachal Pradesh, Jammu and Kashmir, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura, are given special category status by Government of India, based on ethnical, cultural, geographical differences, and economic backwardness.

of the state with the lowest, Bihar in this case. This shows that the disparity in per capita GSDP has risen during the period.

Only five states performed better than the national economy, in 1980, namely Goa, Gujarat, Haryana, Maharashtra and Punjab. Rests of the states are below the average national per capita GSDP level. The per capita GSDP of Bihar, Orissa, Rajasthan, Tripura and Uttar Pradesh have a substantially lower than other states. In 2006, the major difference is in the number of states, performing better than the Indian economy as a whole. In terms of per capita GSDP (at 1993-94 prices), 10 states performed better than the nation as a whole. Apart from the five leading states in 1980, Himachal Pradesh, Karnataka, Kerala, Sikkim and Tamilnadu have also shown a positive difference in per capita GSDP as compared to the national GDP.

It is evident from the discussion above that regional disparities in income growth are prevalent in India. The next section presents a detailed statistical account of these disparities during the period 1980-2006.

TESTING FOR CONVERGENCE

Following Barro and Sala-i-Martin (1992), we have used two approaches for testing convergence, namely, (i) the σ convergence measure, which captures the trend in regional disparities, through changes in cross sectional dispersion of per capita product over time; and (ii) the β convergence, an approach based on neo-classical growth model. This approach is based on the measuring the empirical relationship between the initial income level in a region and the subsequent growth rate. A positive association between the two shows high growth in richer states, and therefore divergence in regional incomes.

(i) The σ measure

This measure captures the trend in dispersion in the regional incomes overtime. We have used standard deviation as a measure of dispersion. We have plotted the cross sectional σ values, i.e. the standard deviation of per capita real GSDP (log values) over the years (Figure 1). It is evident from the plot that over all, the disparity has risen, and India has experienced divergence in regional incomes. A closer examination of the plot reveals that there are three distinct phases exhibited by standard deviation. In the first phase, from 1980 to 1990, standard deviation has risen sharply, revealing that growth in Indian economy has been highly unequal. During the second phase, from 1990 to 1999-2000, although the overall increase in standard deviation is not much, but there are high spikes in the figures, showing years with large disparities in growth. The third and the most recent phase exhibits steadily rising disparity. In the second phase, particularly in the year 1992-93, the standard deviation has risen very sharply, which came back to a lower level again in the following year. The reason for this spike could be the sudden impact of structural adjustment program adopted by Indian government in the year 1991-92. Data reveals that states such as Goa and Gujarat, which already had relatively higher per capita GSDP, registered remarkable growth in this year, whereas states with low incomes, such as Orissa and Bihar, registered negative growth in per capita GSDP.

Another reason for a high standard deviation in the year 1992 is a sudden rise in GSDP of states like Goa, Gujarat, Maharashtra, and Rajasthan. Goa experienced a sharp increase in output from electricity, manufacturing and construction sectors, which was sustained in the following years. In Gujarat, output from agriculture and manufacturing sectors registered an unprecedented rise of around 50% in that year. Manufacturing sector sustained the level of output thereafter. In Maharashtra, banking, real estate, and unregistered manufacturing sectors experienced substantial increase in the year 1992. In Rajasthan, the increase in GSDP was due to sharp increase in output of fisheries, mining and electricity sectors.

Interestingly, the sudden drop in standard deviation in the year 1999 is due to a significant increase in GSDP of lagging states such as Bihar and Orissa, and a relatively lower growth in leading states such as Goa and Gujarat. However, it is evident from the figure that disparities in regional growth have increased during the period 1980-2006.

Figure 1 shows that standard deviation is higher among non-special category states. These states therefore have shown a higher divergence over the years. Table 2 presents the results for comparison of means of per capita GSDPs among special and non-special category states. It is evident from the table that the null hypothesis of equal mean per capita GSDP between these two categories of states is not rejected in all the years. Therefore, the perception that non-special category states have higher per capita incomes is not supported by the analysis. Special category states are different only because of their geographical conditions, not based on economic performance. The table also presents results of Levene's test for equal variance in log per capita GSDP between these two categories of states. The results show that for almost all the years except 1986 to 1991, the hypothesis of equal variance is rejected; therefore, special category states show a significantly lower disparity in growth performance than the non-special states.

(ii) The growth model – measuring β convergence

Neoclassical growth theory framework is used to discern the pattern of regional state products in India. Neo classical growth model predicts that regional incomes will overtime converge, to their respective steady states. This steady state depends on savings rate, population growth rate and rate of technological progress in a region, which are assumed exogenous in the model. Therefore, the exogenous rates at which all the factors of production in an economy grow, determine the long run steady state rate of growth of the economy. This model predicts convergence only in the presence of diminishing returns to capital.

Following neo-classical growth framework, since the notion of convergence pertains to steady state, it is worthwhile to test whether the state economies have reached their steady state or not. However, with the limited availability of data, and methodological constraints, it is not easy to be tested. Therefore, the other way out is to test the basic premise of neo-classical growth theory. Neo classical growth predicts convergence in regional income based on the assumption of diminishing factor returns. Therefore, the rich states with high factor stocks and high incomes will experience lower marginal factor returns, as compared to the poorer states. Hence, a negative relationship between the initial level of income and subsequent income growth rate becomes a criterion for testing convergence.

Following Barro and Sala-i-Martin (1992), let the production function of the economy be represented by

$$Y(t) = K(t)^{\alpha} (A(t).L(t))^{1-\alpha} \qquad (1)$$

Where Y is output, K is capital, L is labor and A is the level of technology. α is assumed to be $0<\alpha<1$, depicting decreasing returns to capital. L and A are assumed to grow exogenously at rates n and g respectively.

Representing all the variables per effective unit of labor[7], and reforming the equation (1) to show the dynamics towards steady state, we get the following (See Appendix for detailed derivation):

[7] We have defined effective labor as the population in the working age group, i.e. between 15 -59 years. Data for the years 1980, and 1992 are taken from the 1981 and 1991 censuses respectively. For the year 2006, estimates from the NSSO 62nd round survey – Employment and unemployment in India, 2005-06, are taken.

$$\ln(y(t)) - \ln(y(0)) = [(1-e^{-\lambda t})\frac{\alpha}{1-\alpha}\ln(s)] - [(1-e^{-\lambda t})\frac{\alpha}{1-\alpha}\ln(n+g+\delta)] - [(1-e^{-\lambda t})\ln(y(0))] \quad (2)$$

This equation is used for testing presence of convergence and finding out rate of convergence, conditioned upon rates of savings(s), population growth (n) and technological progress (g). λ is the speed of convergence of the regional economies towards their respective steady state. We have tested two empirical equations based on the above.

Unconditional cross-section regression

Initially, we have assumed that parameters defining steady state, such as savings rate, labor-force growth rate, and rate of technological progress remain same for all the states. Therefore, we have tested a simplified equation given below:

$$\ln(y(t)) - \ln(y(0)) = A + \beta\ln(y(0)) + e \quad (3)$$

where $\beta = -(1-e^{-\lambda t})$; a positive, non zero β indicates divergence in regional incomes, i.e. initially rich states have registered a higher growth as compared to the poorer states. A significant negative β implies convergence in regional incomes overtime. Results of this regression are given in table 3. The analysis presents some interesting results. Assuming that all the states are heading towards a similar steady state, the analysis shows that for all the 25 states, state products have converged during the period 1992-2006. This result also holds for the group of special category states, which show convergence even at a faster rate (0.102). Special category states have shown significant convergence throughout the period of analysis (1980-2006), although at a lower rate (0.077). This result is not surprising, as the geographical and economical conditions of these states are similar, therefore the parameters affecting steady state must also be similar for this group of states.

Another interesting result is that non-special category states have shown significant divergence during the period when reforms in Indian economy were picking up. These states have also shown a pattern of convergence after the reforms were undertaken in full speed in 1991.

Conditional Cross-section regression

It is however, not plausible to assume similar steady states for all the states. Therefore, we tried another version of the equation above, with steady state parameter values varying for different states. However, problem with Indian data is that savings or capital formation data at state level is not available in public domain. Some stand-alone efforts by some state governments have taken place; however, the data is not sufficient to carry out a comprehensive study like this.

Therefore, we have assumed the same savings rate (s in the model) for all the states as for the Indian economy as a whole. However, we have used the growth rate of working age population for each state to define the steady state. We have assumed the national rate of technological progress (estimated by individual researchers, we have used one such reliable estimate) to be applicable to all the states, due to lack of reliable estimates at state level. We have assumed g to be 0.0202 for the years before 1994, and 0.02 for the years after 1994 (Sivasubramaniam, 2004).

We calculated the amount of depreciation for each state in each year, as the difference between gross state domestic product and net state domestic product (source of the data is same as the GSDP data), and represented it as a fraction of GSDP. In order to calculate Depreciation as a percentage of capital stock, we used the national output capital ratio, and multiplied it with the above-mentioned Depreciation to GSDP ratio. Although this method provides only crude estimates of the depreciation of capital stock at state level, it was the best use we could make of the available state level data on amount of depreciation.

We estimated the equation:

$$\begin{aligned} \ln(y(t)) - \ln(y(0)) &= A - [(1-e^{-\lambda t})\frac{\alpha}{1-\alpha}\ln(n+g+\delta)] \\ &-[(1-e^{-\lambda t})\ln(y(0))] \end{aligned} \quad (4)$$

Where $A = (1 - e^{-\lambda t})\dfrac{\alpha}{1-\alpha}\ln(s)$

The table 4 reveals that the size of the coefficient related to initial income has gone down. The significant outcome of the analysis is presence of conditional convergence among the special category states during the over all period, and the period 1992-2006. Even data for all the states show convergence during the later period, i.e. 1992-2006, although at a slower rate.

Panel data regression

The method of estimation used above suffers from omitted variable bias, as it ignores the state specific effects, such as technological and institutional differences. In the above-mentioned framework for measuring conditional convergence, states were to focus only on savings rate and labor -force growth rate in order to increase the steady state level of per capita income. Whereas, if we allow differences in production functions across states, states are to focus on all the tangible and intangible factors that may enter into the list of state specific effects. This framework actually calls for more policy activism. These effects may on one hand significantly affect income growth in the long run, and on the other hand, may affect the steady state parameters such as savings rate and labor force growth rate themselves. We continue from the equation (4) above, and convert it to represent a panel data framework, as below:

$$y_{i,t} - y_{i,t-1} = \beta y_{i,t-1} + \gamma x_{i,t} + \mu_i + \eta_t + e_{i,t} \qquad (5)$$

Where:

$$\beta = -(1 - e^{-\lambda t})$$
$$\gamma = -(1 - e^{-\lambda t})\frac{\alpha}{1-\alpha}$$
$$x_{i,t} = \ln(n + g + \delta)$$
$$\mu_i = (1 - e^{-\lambda t})\ln A(0)$$
$$\eta_t = (1 - e^{-\lambda t})\frac{\alpha}{1-\alpha}\ln(s) + g(t_2 - e^{-\lambda t}t_1)$$

Panel data estimation of this equation now provides the kind of environment necessary for capturing the individual state effects. We measure the equation using least square method with dummy variables for fixed effects. Islam (1995) has shown through a monte-carlo simulation for actual data, that this estimator is robust and consistent.

Here, however, we have defined n as the growth rate of overall state population, and not as the growth rate of working age population, as it is difficult to get time series data for the later. We have continued the assumptions regarding g and δ as before. The switch from cross section estimation to panel data estimation is made possible by dividing the whole period into several shorter time-spans, of 3 years length. The farthest one can go in shortening the span is to take one year as a period. However, following Dholakia (2003), we have safely assumed 3 years time span to control for the measurement errors. All the variables are taken as three years averages. The implied rate of convergence from the above analysis is 0.006, 0.0065 and 0.0047 respectively for all, special category and non-special category states. Special category states have shown the highest speed of convergence, a result also supported by our single cross section regression.

Adoption of panel approach of estimation yields higher rates of conditional convergence. This can be attributed to the omitted variable bias. A(0) term is included in the intercept in single cross section regression, however, it can be safely assumed that it is positively partially correlated with the initial level of income, which is the explanatory variable. Therefore, elimination of A (0) creates an upward bias in the coefficient of initial income measured by single cross section regression, resulting into lower estimates of implied convergence coefficient. Implied elasticity of output with respect to capital (α)[8] is 0.145, 0.022, and 0.272 respectively for the three groups of states. The model yields plausible estimates of elasticity of output with respect to capital, which increases the validity of the model.

Obtaining faster rate of conditional convergence using panel data method throws light on the fact that A (0) is an important determinant of cross-regional growth differentials. If it had been so, the rates of conditional convergence would not have differed so much between the single cross section regression and panel data regression. The fact that, controlling for technological and institutional differences leads to higher rates of conditional convergence, is also evident from higher rates of convergence for special category states, which are similar in these characteristics. We have select special category states as per government of India's classification, which is based on geographical, demographic and economic similarities of these states; therefore, our analysis is free from this bias.

Another benefit of the panel data approach is that estimates of the state specific efficiency parameter (A (0)) can be calculated with the help of estimated coefficients. We have calculated estimates of A (0) for all the 25 states in the analysis. Then, following Islam (1995), an index of efficiency is calculated as the ratio of A (0) for a state with the minimum value of A (0) among states (pertaining to Bihar). States are then classified in five categories based on this efficiency index. The results of this analysis are presented in table 6. It is evident that 17 out of the total 25 states fall in the lowest two categories. This shows the skewness of the distribution of states with respect to efficiency parameter. These state level

[8] We have estimated the elasticity of output with respect to capital (α), with the help of coefficient of steady state parameters (γ). Refer equation (12).

effects are a measure of efficiency with which states convert labor and capital into output. Therefore, in a sense, this index is related to the traditional total factor productivity (TFP). However, TFP is measured with time series data of the same state, whereas, we have measured this efficiency index with the help of cross section of states. This shows that the technological and institutional factors play a major role in determining income level and growth at state level. The list of parameters influencing these factors is very long and includes several qualitative parameters.

CONCLUSION

We have examined the trends in regional disparities in India over a period of 26 years. On the face of it, data of Indian states shows divergence in regional state products. There are wide variations in economic performances of states, and the differences have increased over time. However, a closer statistical analysis reveals that state domestic product has converged for the special category states during the period. The speed of convergence has been even faster during the period 1992-2006, when Indian economy embarked upon detailed structural reforms. Non-special category states have shown divergence in domestic products.

Another interesting finding is that there is no significant difference in the mean per capita real GSDP of special category states and non-special category states. This result contradicts with the very basic criterion of classification of states into special and non-special categories.

We have employed single cross section regression and panel - data estimation methods to test the hypothesis of convergence, based on the neo-classical framework. Panel- data estimation method allows us to separately measure state specific effects representing technological, institutional, climatic and other differences among states. A positive correlation of these effects with state domestic products accentuates the need of a detailed analysis of factors influencing them. In the following chapters, we have analyzed impact of some parameters, such as infrastructure investments, agglomeration economies and structural changes on these state specific effects, leading to disparities in regional economic performance.

Table 1: Indian states: Population and per capita GSDP 1980-2006

		Population (in millions)			Per Capita GSDP (Rs., at 93-94 prices)		
S.N.	**State**	**1980**	**2006**	**CAGR (%) (80-06)**	**1980**	**2006**	**CAGR (%) (80-06)**
1	Andhra Pradesh	53.1	81.2	1.6	5584	16271	4.2
2	Arunachal Pradesh	0.6	1.2	2.5	4569	14658	4.6
3	Assam	17.9	28.9	1.9	4974	10106	2.8
4	Bihar	69.2	121.2	2.2	3513	7309	2.9
5	Goa	1	1.6	1.8	11143	36704	4.7
6	Gujarat	33.8	55.5	1.9	6752	23792	5
7	Haryana	12.8	23.6	2.4	8008	24939	4.5
8	Himachal Pradesh	4.2	6.7	1.8	5568	20075	5.1
9	Jammu & Kashmir	5.9	11.7	2.7	5361	11278	2.9
10	Karnataka	36.8	56.6	1.7	5098	16865	4.7
11	Kerala	25.4	33.8	1.1	5211	18516	5
12	Madhya Pradesh	51.7	90.2	2.2	4728	10982	3.3
13	Maharashtra	62.3	105.7	2.1	7717	23882	4.4
14	Manipur	1.4	2.6	2.3	4900	13826	4.1
15	Meghalaya	1.3	2.5	2.5	5248	14872	4.1
16	Mizoram	0.5	1	2.9	5123	14570	4.1
17	Nagaland	0.8	2.6	4.8	5580	13544	3.5
18	Orissa	26.2	39.2	1.6	4275	10625	3.6
19	Punjab	16.6	27	1.9	9694	22128	3.2
20	Rajasthan	33.8	63	2.4	4140	11827	4.1
21	Sikkim	0.3	0.6	2.5	5244	17310	4.7
22	Tamilnadu	48.2	65.4	1.2	5287	19790	5.2
23	Tripura	2	3.4	2.1	3395	14970	5.9
24	Uttar Pradesh	109.7	194.6	2.2	4190	8528	2.8
25	West Bengal	54.1	85.8	1.8	5016	15320	4.4
	India	**679**	**1122**	**2**	**6162**	**16679**	**3.9**

Figure 2: Standard deviation of log real per capita GSDP for all, special, and non-special category states

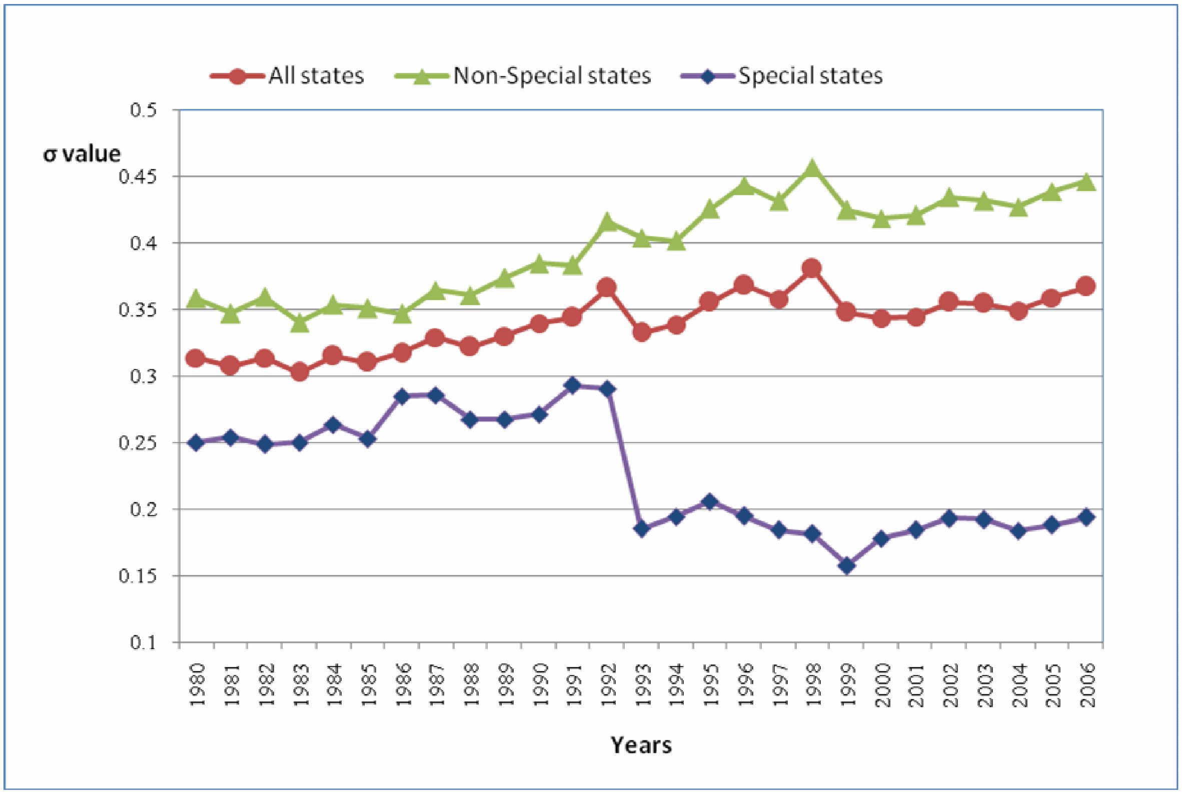

Table 2: Test for difference of means and variance between special and non-special category states

Year	Log per capita real GSDP			Difference of Means		Levene's test for equal variance	
	all states	Non-special States	Special states	t statistic	p value	F statistic	p value
1980	8.59	8.65	8.51	1.44	0.165	7.23	0.013 **
1981	8.62	8.67	8.55	1.18	0.251	7.04	0.014 **
1982	8.64	8.68	8.57	0.99	0.334	7.25	0.013 **
1983	8.67	8.73	8.59	1.38	0.181	6.82	0.016 **
1984	8.68	8.73	8.61	1.17	0.255	5.46	0.029 **
1985	8.72	8.76	8.66	0.89	0.385	4.67	0.041 **
1986	8.74	8.77	8.70	0.55	0.586	2.73	0.112
1987	8.76	8.78	8.74	0.27	0.792	1.10	0.305
1988	8.85	8.89	8.78	0.92	0.368	2.04	0.166
1989	8.87	8.91	8.81	0.85	0.403	2.58	0.122
1990	8.91	8.95	8.84	0.85	0.406	2.93	0.1
1991	8.92	8.95	8.88	0.50	0.625	1.90	0.182
1992	8.96	8.99	8.91	0.54	0.598	1.91	0.18
1993	9.06	9.10	9.00	0.85	0.404	3.97	0.058 *
1994	9.09	9.15	8.99	1.32	0.201	4.10	0.055 *
1995	9.12	9.18	9.04	1.07	0.295	3.15	0.089 *
1996	9.17	9.24	9.08	1.24	0.229	3.91	0.06 *
1997	9.20	9.27	9.10	1.33	0.200	4.35	0.048 **
1998	9.24	9.32	9.12	1.56	0.135	4.48	0.045 **
1999	9.34	9.40	9.25	1.32	0.203	6.11	0.021 **
2000	9.35	9.40	9.28	1.04	0.312	5.63	0.026 **
2001	9.39	9.43	9.33	0.85	0.404	4.60	0.043 **
2002	9.41	9.45	9.35	0.75	0.464	5.78	0.025 **
2003	9.47	9.52	9.40	0.89	0.387	4.50	0.045 **
2004	9.53	9.58	9.47	0.88	0.387	6.34	0.019 **
2005	9.58	9.63	9.51	0.90	0.377	6.82	0.016 **
2006	9.65	9.70	9.57	1.02	0.322	6.35	0.019 **

Note: ** shows significance at 5% and * at 10% level

Table 3: Results of single cross section regression – Unconditional convergence

	Intercept		Coefficient of Initial income		Implied λ (Speed of convergence)	Interpretation	R^2
	estimate	t statistic	β estimate	t statistic			
All States							
(i) 1980-2006	3.172	2.04***	-0.230	-1.37	0.0043	Convergence	0.075
(ii) 1980-1992	1.126	0.74	-0.089	-0.55	0.0033	Convergence	0.013
(iii) 1992-2006	3.144	2.89*	-0.250	-2.21**	0.0089	**Convergence**	0.175
Special States							
(i) 1980-2006	9.641	3.89*	-0.926	-3.47*	0.0434	**Convergence**	0.601
(ii) 1980-1992	6.647	1.84	-0.686	-1.76	0.0419	Convergence	0.279
(iii) 1992-2006	8.035	3.84*	-0.760	-3.48*	0.0442	**Convergence**	0.602
Non-special States							
(i) 1980-2006	0.515	0.32	0.054	0.31	-0.0008	Divergence	0.007
(ii) 1980-1992	-1.116	-1.05	0.152	1.34	-0.0051	Divergence	0.121
(iii) 1992-2006	1.35	1.38	-0.065	-0.64	0.0020	Convergence	0.030

Note: * shows significance at 1% level; ** at 5% and *** at 10% level

Table 4: Results of single cross section regression - Conditional Convergence

	Intercept		Coefficient of steady state parameters		Coefficient of Initial income		Implied λ	Interpretation	R^2
	estimate	t statistic	estimate	t statistic	β estimate	t statistic			
All States									
(i) 80-06	-2.03	-1.07	-0.96	-3.65***	0.054	0.35	-0.0008	Divergence	0.42
(ii) 80-92	0.323	0.16	-0.147	-0.65	-0.045	-0.25	-0.0016	Convergence	0.03
(iii) 92-06	2.121	1.43	-0.331	-1.01	-0.239	-2.10**	0.0084	**Convergence**	0.21
Special States									
(i) 80-06	10.23	2.76**	0.074	0.23	-0.970	-2.82**	0.058	**Convergence**	0.60
(ii) 80-92	8.63	1.55	0.43	0.49	-0.77	-1.73	0.0531	Convergence	0.30
(iii) 92-06	6.76	2.68**	-0.32	-0.91	-0.71	-3.17**	0.0384	**Convergence**	0.64
Non-special States									
(i) 80-06	-2.62	-1.35	-0.73	-2.33**	0.181	1.13	-0.0027	Divergence	0.31
(ii) 80-92	-1.81	-1.07	-0.15	-0.53	0.182	1.40	-0.0060	Divergence	0.14
(iii) 92-06	-1.56	-1.06	-0.98	-2.40**	-0.049	-0.56	-0.0015	Convergence	0.34

Note: * shows significance at 1% level; ** at 5% and *** at 10% level

Table 5: Results of panel data estimation - Conditional convergence

	All states	Special States	Non-special States
Coefficients of steady state parameters			
Estimate	-0.007	-0.001	-0.012
t statistic	-0.64	-0.08	-0.91
Coefficients of initial income			
Estimate	-0.041	-0.044	-0.032
t statistic	-3.61*	-2.39**	-2.01**
implied λ	0.0060	0.0065	0.0047
R^2	0.67	0.58	0.79

Note: * shows significance at 1% level; ** at 5% and *** at 10% level

Table 6: Results of panel data estimation - efficiency parameter A (0)

State	μ_i	$A(0)_i$	$A(0)_i/A(0)_{min}$	Category
Andhra Pradesh	1.212**	277.8	1.90	Low
Arunachal Pradesh	1.26**	347.5	2.37	Low
Assam	1.131**	190.6	1.30	Very low
Bihar	1.074**	146.4	1.00	Very low
Goa	1.416 *	715.3	4.89	Very high
Gujarat	1.317**	451.8	3.09	Medium
Haryana	1.345 *	516.1	3.53	High
Himachal Pradesh	1.268**	360.8	2.47	Low
Jammu and Kashmir	1.198**	261.0	1.78	Low
Karnataka	1.24 **	317.2	2.17	Low
Kerala	1.217**	284.4	1.94	Low
Madhya Pradesh	1.175**	233.7	1.60	Very low
Maharahstra	1.33**	480.2	3.28	Medium
Manipur	1.201**	264.7	1.81	Low
Meghalaya	1.241**	318.8	2.18	Low
Mizoram	1.282**	384.3	2.63	Medium
Nagaland	1.339 *	501.4	3.43	High
Orissa	1.121**	182.6	1.25	Very low
Punjab	1.319**	457.0	3.12	Medium
Rajasthan	1.216**	283.4	1.94	Low
Sikkim	1.295**	408.0	2.79	Medium
Tamilnadu	1.253**	335.5	2.29	Low
Tripura	1.202**	265.7	1.81	Low
Uttar Pradesh	1.125**	185.5	1.27	Very low
West Bengal	1.215**	282.2	1.93	Low

Note: * shows significance at 1% level; ** at 5% and *** at 10% level
Category is defined as 1-1.7 (very low) 1.8-2.5 (low) 2.6-3.3 (medium) 3.4-4.1 (high) 4.2 & above (very high)

APPENDIX

Let the production function of the economy be represented by

$$Y(t) = K(t)^{\alpha}(A(t).L(t))^{1-\alpha} \tag{1}$$

Where Y is output, K is capital, L is labor and A is the level of technology. α is assumed to be $0<\alpha<1$, depicting decreasing returns to capital. L and A are assumed to grow exogenously at rates n and g respectively. The model assumes that a constant fraction of output, i.e. s is invested. Defining capital and output per effective unit of labor (k = K/AL, y = Y/AL), k evolutes as per the following

$$\dot{k}(t) = sy(t) - (n+g+\delta)k(t) \tag{2}$$

Where δ is the rate of depreciation. Equation (2) above implies that k converges to a steady state value k* given by

$$k^{*} = \left[s/(n+g+\delta) \right]^{1/1-\alpha} \tag{3}$$

This implies that the steady state capital labor ratio depends positively on savings rate and negatively on population and technology growth rates.

Substituting k* in the production function (equation 1) and taking logs we have steady state growth of income per effective labor as,

$$\ln\left[Y(t)/L(t) \right] = \ln A(0) + gt + \frac{\alpha}{1-\alpha}\ln(s) - \frac{\alpha}{1-\alpha}\ln(n+g+\delta) \tag{4}$$

Where the term A (0) represents not only technology, but also resource endowments, climate, institutions and other state specific effects. However, we assume here that these state specific effects are independent of the explanatory parameters i.e. savings rate and labor force growth rate.

This growth equation applies when economy is in steady state. However, the dynamics to the steady state can be represented as

$$\frac{d\ \ln(y(t))}{d(t)} = \lambda[\ln(y^{*}) - \ln(y(t))] \tag{5}$$

Where $y(t) = Y(t) \big/ A(t).L(t) = Y(t) \big/ L(t).A(0).e^{gt}$

Also, where λ is the speed of convergence and is given by

$$\lambda = (n + g + \delta)(1 - \alpha)$$

The above equation (5) implies that

$$\ln(y(t)) = (1 - e^{-\lambda t})\ln(y^{*}) + e^{-\lambda t}\ln(y(0)) \tag{6}$$

Where y (0) is the income per capita at some initial date. This equation represents a partial adjustment process. Subtracting ln(y (0)) from both sides and substituting for y*, we have

$$\begin{aligned} &\ln(y(t)) - \ln(y(0)) = [(1 - e^{-\lambda t})\frac{\alpha}{1-\alpha}\ln(s)] - \\ &[(1 - e^{-\lambda t})\frac{\alpha}{1-\alpha}\ln(n + g + \delta)] - [(1 - e^{-\lambda t})\ln(y(0))] \end{aligned} \tag{7}$$

The above equation (7) is same as the equation (4) in the text. In order to convert the equation to a panel data framework, we convert the income as below:

$$\ln\ y'(t) = \ln\frac{Y(t)}{L(t)} - \ln\ A(0) - gt \tag{10}$$

Where ln y' (t) is income per capita. Substituting this into equation (7), we get

$$\begin{aligned} &\ln(y'(t2)) - \ln(y'(t1)) = [(1 - e^{-\lambda t})\frac{\alpha}{1-\alpha}\ln(s)] \\ &-[(1 - e^{-\lambda t})\frac{\alpha}{1-\alpha}\ln(n + g + \delta)] - [(1 - e^{-\lambda t})\ln(y'(t1))] \\ &+(1 - e^{-\lambda t})\ln A(0) + g(t_2 - e^{-\lambda t}t_1) \end{aligned} \tag{11}$$

This equation can be represented in a panel data framework, as below:

$$y_{i,t} - y_{i,t-1} = \beta y_{i,t-1} + \gamma x_{i,t} + \mu_i + \eta_t + e_{i,t} \tag{12}$$

Where:

$$\beta = -(1 - e^{-\lambda t})$$

$$\gamma = -(1 - e^{-\lambda t})\frac{\alpha}{1-\alpha}$$

$$x_{i,t} = \ln(n + g + \delta)$$

$$\mu_i = (1 - e^{-\lambda t})\ln A(0)$$

$$\eta_t = (1 - e^{-\lambda t})\frac{\alpha}{1-\alpha}\ln(s) + g(t_2 - e^{-\lambda t}t_1)$$

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