Economic Growth and Regional Divergence in India, 1960 to 1995

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The current literature on regional convergence has centred on the empirical relationship between initial income and its long run growth rate found among the regions in the developed countries. The fundamental basis of the 'converging' outcome is the neo-classical assumption of the law of diminishing returns to capital. In contrast to the conventional results of the developed countries, the present paper has found that Indian states have been diverging over the period of last 35 years. Moreover, this result does not nullify the role of planning through disbursement of development funds across the states. The Indian scenario exhibits interesting relationship between private and public capital in the regional context. Later a simple model is developed to highlight the relationship between growth and public investment.

I
Introduction

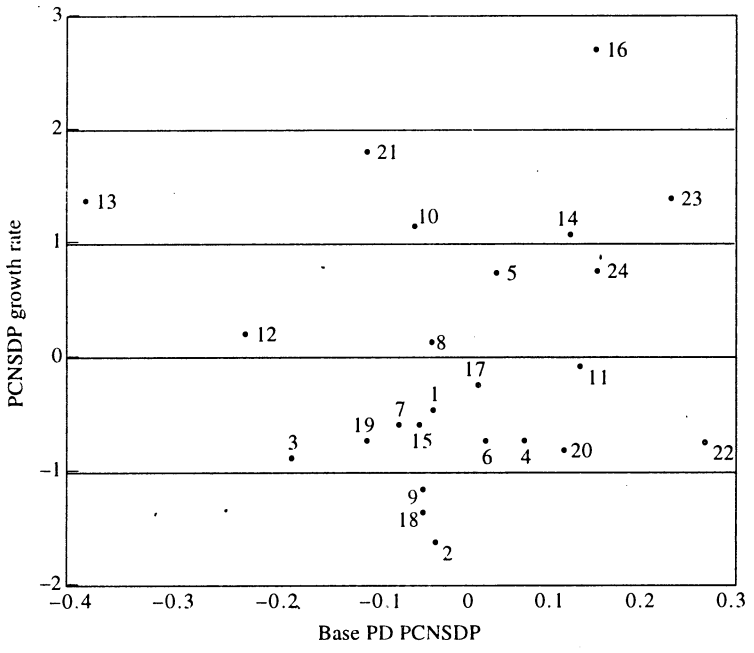
REGIONAL growth and disparity have been topics of significance for the researchers working on Indian economy since independence. In fact, a major thrust of the economic policy, since the initiation of the planning process way back in the 1950s was to foster 'balanced' regional development with active support for industrialisation in backward regions as well as through minimising inter-regional disparities in costs and prices. The well known policy of 'freight-equalisation' and subsidies to industries in backward regions, point towards the commitments of the planners towards harmonious progress of the nation.

Theoretical research on regional economic growth and convergence had to wait for about four decades after the pioneering work of Harrod-Domar and Solow came into force. Of course, it must be mentioned that the classic works of Myrdal (1958) and Hirschman (1958) dealt in quite detail about the causes of concentration of economic activities in a particular location or region. According to Myrdal(1958), although, in the long run, the 'crowding out' effects may exert negative impact on further development, given the phenomenon of 'historical accidents' and 'cumulative causation hypothesis', the play of market 'forces normally tends to increase rather than decrease the inequalities between the competing regions. These favoured localities and regions, if happen to coincide with natural geographic scopes for ports, roads, good soil conditions and proximity to raw materials, may gain a 'competitive advantage' [Porter 1990]. Even the movements of labour, capital, goods and other services generate ever-incresing internal and external economies in the preferred regions which have very strong 'backwash effects' on the unlucky regions [Myrdal 1958]. Thus, 'backwash effects' exert a retarding pull on other regions. There are diseconomies of agglomeration also, as well as 'spread effects' to other regions. But it is not possible to predict at any particular point of time which effects will dominate. Hirschman (1958) strongly propagated the case for governmental intervention to counteract the 'polarisation effects' of free market forces. The most obvious and less 'risky' approach is to endow the backward regions with a good system of transportation, effective power stations, and other SOC facilities as are available in the developed regions [Ghosh and De 1998 and Ghosh and Chattopadhyay 1997, for India].

With the advent of the endogenous growth theory, convergence in per capita income of the nations and then for the regions infused renewed interest among the theoreticians to try out empirical vindication of theoretical judgments. Following Barro and Sala-i-Martin (1992, 1995), several authors such as Bishop, Formby and Thistle (1994), Quah (1993, 1996), Coulombe and Lee (1993), Shioji (1992), Sala-i-Martin (1996) have extensively dealt with the issue of regional growth and convergence for different countries. Sala-i-Martin (1996) nicely surveys the literature and its current standing in terms of the empirical results obtained so far. The major finding is : the simple Solovian idea that a region with lower per capita income should grow faster tends to be hold for almost all countries experimented so far. The US, Canada, Japan and Europe clearly show the required 'negative' relationship between initial 'per capita income' and annual average growth rate over a long period of time. If one believes in the data set, no one can deny both the visible scatter as well as the statistical relationship hidden therein. The point that within a national boundary, the poorer region has grown faster than the richer ones, is well taken. However, this does not resolve entirely the statistical controversies raised by Quah (1993) who concludes that the constant estimates of "2 per cent per year" convergence could just be a statistical illusion since a collection of random walks estimated in a cross section could deliver such an outcome. Also, Quah (1993) argues that Barro-regressions suffer from 'Galton' fallacy. It is quite possible that the negative relationship between per capita and growth rate just depict the stationary distribution and there may not be any 'long run' tendency of convergence. Sala-i-Martin (1996) partially agrees with it [Quah 1996], though not fully. A theoretical problem with the so-called 'convergence' hypothesis is that, on the one hand, such models depend on a neoclassical specification of the growth process but fail to justify the restricted mobility of resources which leads to protracted convergence. With perfect or extensive resource mobility, 'convergence' should have been instantaneous. This problem has been mentioned in Marjit and Mitra (1996), and Sala-i-Martin (1996). Barro et al (1995) analyse a model of partial mobility of capital and convergence across countries. However, within a national boundary and particularly in the context of the developed country markets, it is rather peculiar to assume imperfect mobility of factors.

The main observation of the empirical research is that there have been evidences of 'convergence' in Europe, USA, Canada and in Japan. This also had reinforced the strength of 'Solow' model *vis-a-vis* endogenous growth models. Theoretically, the role of diminishing returns has assumed a central position in this debate. It is quite

FIGURE 1: ANNUAL GROWTH (1961-62 TO 1989-90) OF PCNSDP



Andhra Pradesh (1), Assam (2), Bihar (3), Gujarat (4), Haryana (5), Himachal Pradesh (6), Jammu and Kashmir (7), Karnataka (8), Kerala (9), Madhya Pradesh (10), Maharashtra (11), Manipur (12), Orissa (13), Punjab (14), Rajasthan (15), Sikkim (16), Tamil Nadu (17), Tripura (18), Uttar Pradesh (19), West Bengal (20), Arunachal Pradesh (21), Delhi (22), Goa, Daman, Diu (23), Pondicherry (24). PCNSDP stands for per capita net state domestic product.
Source: Marjit and Mitra (1996)

natural that some effort would be spent on studying the convergence problem of states within India.

India and China seem to be the most appropriate examples for studying regional growth and convergence given their geographic size, population and regional diversity. Regional divergence seems to be the outcome that should excite the researchers not 'convergence' because in the developed countries, one does not observe cut-throat regional conflicts except in Spain and Italy and may be in the new 'Germany'. To the best of our knowledge three papers have addressed the issue of regional convergence in India, namely, Cashin and Sahay (1995), Marjit and Mitra (1996) and Nagaraj, Varaudakis and Veganzones (1997).

In Marjit and Mitra (1996), the scatter between base period per capita net state domestic product (PCNSDP) and the annual average growth rates of the same across the states do not show any 'negative' relationship, and there is a considerable stretch of 'upward trend' denoting divergence (Figure 1). Cashin and Salary (1995)'s scatter look almost the same (Figures 2), but in the abstract, they claim that they have evidence of 'absolute' convergence, i e, initially poor states did indeed grow faster than their initially rich counterparts. In the body of the paper the coefficient of convergence is not statistically different from zero. Interestingly, in Cashin and Sahay (1995), the fitted negatively sloped line has only two points on it. Marjit and Mitra (1996) and Cashin and Sahay (1995) have used same deflator for different time periods to compute real PCNSDP. Figure 1 is taken from Marjit and Mitra (1996) (corrected a bit because some numerical errors were found in the published paper, but there is not much of a difference from the original one). However, Cashin and Sahay (1995) provide an extensive survey of regional economic disparity in India and is a useful reference on that count. The problem is that the claim they make in the abstract is simply not borne out by the statistics they have provided. Nagaraj, Varoudakis and Veganzones (1997) have examined the growth performance of Indian states taking into account differential availability of physical, social and economic infrastructures during different time points between 1970 to 1994. Although there is evidence of conditional convergence across the state, the authors have admitted persistent income disparity over the same period.

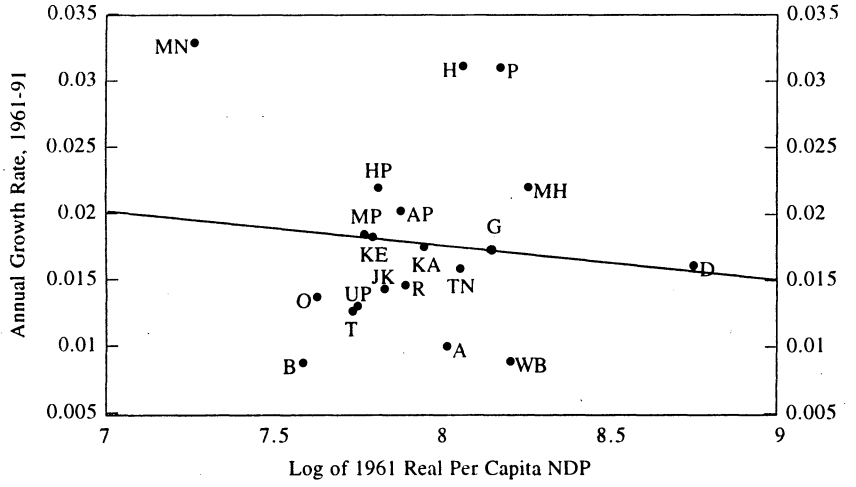
One major problem in evaluating regional real per capita income, apart from the typical Indian problem of having to work with a data set which never reveals 'income' figures, is that often 'deflators' are not available at the regional levels. This has not only bothered Cashin and Sahay (1995) and Marjit and Mitra (1996) but also Sala-i-Martin (1996, p 1332, 2nd para). The findings of inter-regional convergence in levels of output could be explained by inter-regional convergence in price levels with no real convergence. This was somehow satisfactorily resolved for Japan [Shioji 1992] and Canada [Coulombe and Lee 1993]. The preliminary finding in Marjit and Mitra (1996) was also marked by the non-availability of regional level deflators.

In this paper we first construct a measure of real PCNSDP by deflating the nominal figures with 'regional' prices. In this regard we make use of a data set hitherto unutilised in the discussion on regional convergence in India – the consumer price index for agricultural labourer (CPIAL). Also, we want to see how the Indian states have been affected by the allocation of planned expenditure. We have also tried to test whether the centralised planning process did help through judicious distribution of funds (for practical expediency what is known as plan outlay) among the states in removing regional disparity. Even if we find some degree of divergence across the states, there is not much justification in blaming the planning process. In fact, there are reasons to believe that private capital accumulation have outweighed the efforts of planning, and have ultimately resulted in rising regional imbalance. Our impression is that the evolution of such an outcome might have been strengthend by the states' own policies for development. Finally, we have suggested a simple structure for capturing the relationship between public and private capital in the regional growth process.

II
Data and Methodology

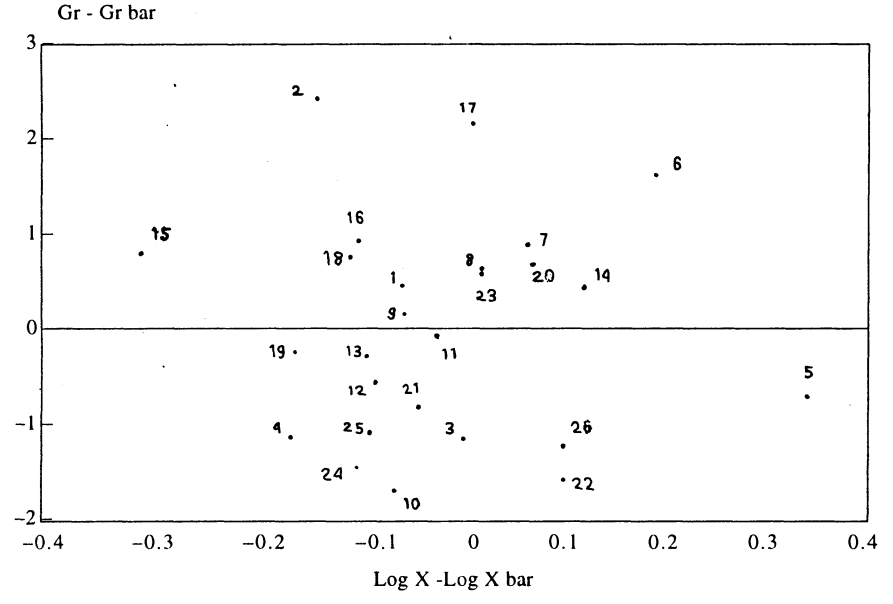
One of the most serious problems of studying the issue of inter-state convergence in the context of an LDC like India is the non-availability of a consistent set of data for a reasonably long period for the variables under considerations. The general convention is to deflate the nominal Per Capita Net State Domestic Product (PCNSDP) by some all-India level deflator. Although consistent data sets like as deflators Wholesale Prices in India (WPI) and Consumer Prices in India (CPI) are available at the all-India level, statewise data for these prices are absolutely lacking. Moreover, there are so much variations of actual prices, whether WPI or CPI types, across the states that use of a single price for all the states cannot be justified on any ground whatsoever. The problem of using such deflator is that they are available only at the all-India level, and hence fail to capture inter-state variations in prices. It is naive not to incorporate inter-state price differentials in deriving statewise real income, because it can have substantial impact on the results of convergence. In the available literature on Indian studies we do not find any such attempt. We think Consumer Price

FIGURE 2: CONVERGENCE OF REAL PER CAPITA NDP ACROSS 20 INDIAN STATES: 1961 NDP AND 1961-91 NDP GROWTH



Source: Cashin and Sahay (1995)

FIGURE 3: SCATTER OF PCNSDP (x) AND GROWTH OF x



Notes: Numbers corresponding to scatter points represent state sl. no. as in Table 1.

Index Number for Agricultural Labourers(CPIAL) is the only and most suitable statewise data available for deflating the nominal PCNSDP to get the real income. We have preferred CPIAL especially because (i) agriculture alone still accounts for a significant proportion of income, and (ii) there is no other acceptable regional deflator from government sources.

In order to test the growth hypothesis, the concept of public investment has been derived from the per capita plan outlay (PCPO) as disbursed by the union government (primarily on the basis of Gadgil formula during the later period) across the states over different plan periods. A plan is generally supposed to spread over a period of five years. But under various exceptional economic exigencies, there are variations over the duration of a plan. For example, (1) between Third and Fourth Five-Year Plans, there were three annual plans, covering the period from 1966-67 to 1968-69, and (2) between Fifth and Sixth Five-Year Plans, there was one annual plan in the year 1979-80. Uptil now, there are on the whole 10 plan outlay figures including these annual plans for each of the states. As desired by our formulation of the model, we have converted the PCPO per plan period into yearwise values dividing each figure by the corresponding time span of the plan (i e, by the number of years). Moreover, public capital stock at the state level is derived from the cumulative figures of PCPO. As plan outlay can be assumed to be spent for development purposes, capital formation deflator is the most appropriate price index for converting the nominal PCPO into real terms. Thus, yearwise PCPO figures are deflated by capital formation deflator. Growth rates of PCPO (i e, g_{ipo} of PCPO) for each state is calculated by taking the average of the growth rates between each pair of successive plans. $\bar{g}$ of PCPO is the average of g_{ipo}s across 26 states, and $g_{ipo}-\bar{g}_{ipo}$ of PCPO is calculated separately for each state. As will be required in subsequent sections State-wise investment at any point of time is defined by the corresponding real PCPO.

The data on PCNSDP at current prices have been collected from the *India Data Base : The Economy* by Chandhok and The Policy Group, *Estimates of State Domestic Product* (government of India) and supplemented by various issues of *Economic Survey*, government of India. The CPIAL series are taken from *India Data Base, Statistical Abstract* (government of India) and *Agricultural Prices in India* (government of India). Data on Per Capita Plan Outlay (PCPO) have been collected from various issues of Centre for Monitoring the Indian Economy (CMIE) and plan documents. This data represent per capita disbursement of funds by government of India for development purpose for the states over the plan period.

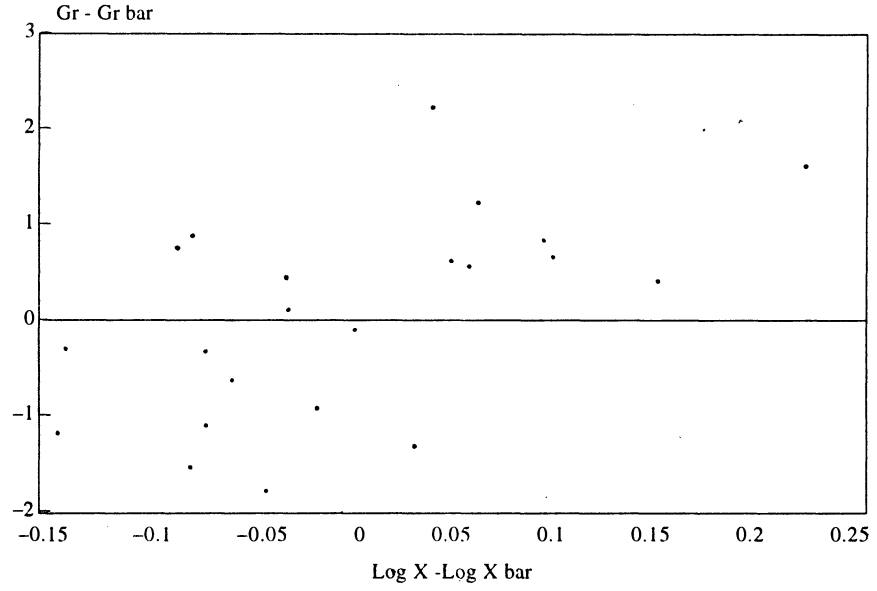
III
Hypothesis of Divergence

The standard practice to get a preliminary idea about the convergence/divergence hypothesis is to establish a relationship between $g_i - \bar{g}$ and $\{\log(x_i) - \log(\bar{x})\}$, where g_i and x_i are average annual growth rate of PCNSDP and the base-period value of the same respectively; and $\bar{g}$ and $\bar{x}$ are their respective means. Barro and Sala-i-Martin (1995) and Sala-i-Martin (1996) talk about different types of convergence and testing procedures. Since the prima facie evidence in Indian context is that of divergence, we abstain from highlighting those.

We have constructed the series of statewise real PCNSDP by dividing the nominal PCNSDP with the CPIAL (base : 1960-61 = 100) as the deflator which, we think, is the best available representative of inter-state variations in prices.

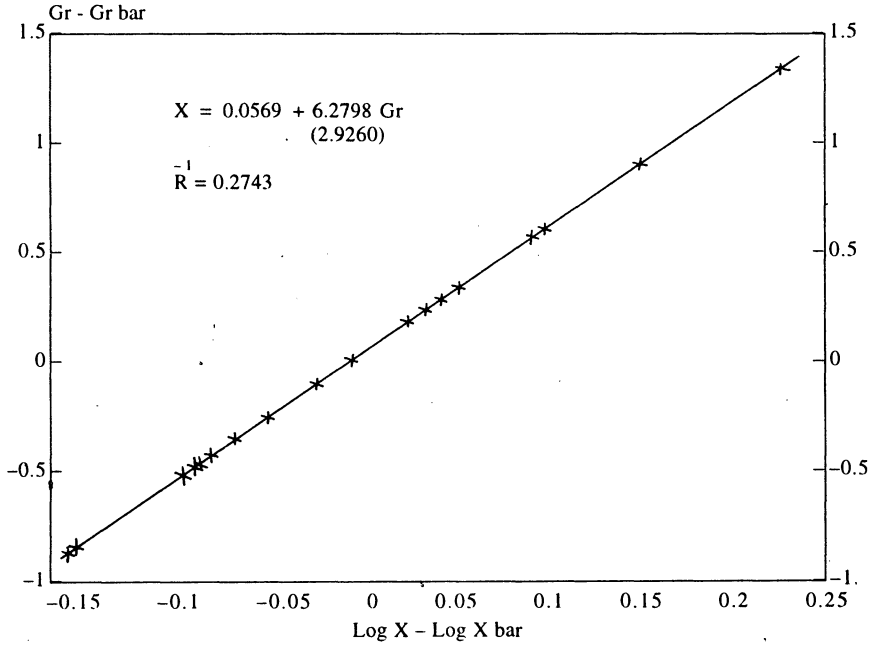
In a detailed analysis on inter-state variations in living standard, Dutta Chowdhury (1993) argues that variations in 'rural income' or standard of living across the states tend to explain most of the variations in rural plus urban categories. It may be mentioned here that the CPIAL is originally available for 15 states. But as we are working with 26 states, we have to represent the adjacent state figures as proxy for those states for which CPIAL data are not available.

FIGURE 4(a): SCATTER OF PCNSDP (X) AND GROWTH OF X



Notes: (1) Same as Figure 1.
(2) Omitting 5 states as outliers, namely Ar P(2), D(5), Man (15), Sik(22), WB(26).

FIGURE 4(b): FITTED CURVE OF PCNSDP(X) AND GR



Notes: (1) Same as Figure 1.
(2) Omitting five states as outliers.

The average annual growth rates of PCNSDP over the entire period from 1960-61 to 1994-95 for each of the 26 states have been calculated from the yearwise growth rates of PCNSDP.[1] Table 1 involves deflated PCNSDP by CPIAL. Column 3 gives the value of base year real PCNSDP (x_i) and column 4 gives the average annual growth rate of the same for each of the states. Columns 5 and 6 represent the value of ($\log x_i - \log \bar{x}$) and ($g_i - \bar{g}$), respectively.

Figure 3 depicts the scatter diagram of the points representing the combination of the proportion $\log (x_i/\bar{x})$ and the deviations of growth rates from the mean ($g_i - \bar{g}$) corresponding to columns (5) and (6) of Table 1. It suggests some preliminary features regarding the issue of convergence.

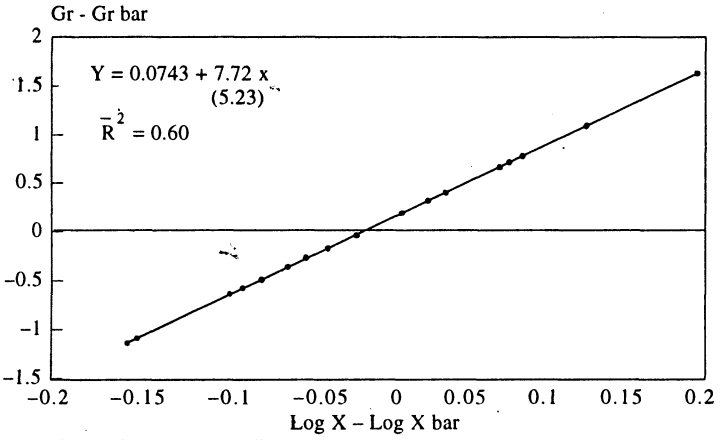
First, the scatter points are spread in such a fashion as not to suggest any 'negative association' between the variables. It is interesting to note that Arunachal Pradesh (2) and Manipur (15) both starting from a very low initial income have grown faster than their base period counterparts, while Delhi (5), Sikkim (22) and West Bengal (26) all starting with high income have lagged behind others. Excepting these five states, the rest of the states form a block in which those with almost similar initial income have grown at lower rates (below the diving lines) and vice versa. In other words, had the 'convergence' results been true, the scatter points would have to cluster on the top left and the bottom right blocks. In fact the reverse has occurred: the points are stretched along the bottom left and top right corners. This is clearly an indication in favour of divergence, although the cohesiveness of the top right points are slightly dispersed.

A strong positive relationship between the two variables is noteworthy, if one omits only five points as outlines (Table 2). This picture emboldened us to test the fitted relationship between the two variables. For this purpose, we have again calculated the two series ($\log x_i - \log \bar{x}$) and ($g_i - \bar{g}$) for 21 states, omitting five states as outliers, namely, Arunachal Pradesh (2), Delhi (5), Manipur (15), Sikkim (22) and West Bengal (26). The share of total NSDP of these states is small enough to cause any major harm on the statistical results. The corresponding scatter diagram is represented in Figure 4(a) from which an upward drift is obvious. The fitted curve given in the Figure 4(b) shows a strong positive relationship between base period income and growth rate with a$\bar{R}^2$ = 0.2743 and a highly significant t-statistics (2.9260), where the estimated equation for the period 1960-61 to 1994-95 is as follows

$$(g_i - \bar{g}) = 0.0569 + 6.2796\ (\log x_i - \log \bar{x})$$
$$(0.3036)\quad (2.9260)$$
$$\bar{R}^2 = 0.2743$$

This highly significant positive coefficient of ($\log x_i - \log x$) suggests that initially poor states have failed to pace up their growth rates and initially well-to-do states have grown richer. This observation helps us to reiterate two distinct challanges to the validity of the theory of convergence for the LDCs. First, if we assume that each state is approaching its own 'steady state' (maybe in view of their own intra-regional, e g, districts, diversity), then clearly these 'steady states' do not seem to fall on the same line. Even at the regional level we observe a feature that endogenous growth theorists believe a typical 'cross country' experience, that is, the poorer countries growing at lower rates than their richer counterparts. Second, the simple 'solow type' conclusion whereby the 'regional convergence' follows from the basic law of diminishing returns, cannot be taken for granted for the LDCs. Hence, it

FIGURE 5: FITTED CURVE OF PCNSDP (CPIAL) AND GR 1960-61 TO 1990-91



Notes: Omitting six states as outliners.

is compelling to check whether regional disparity has increased for all practical purposes. One way of further conceptualising the idea of 'divergence' is to treat each state as different 'countries', control for state-specific parameters and then focus on the diverging impact of capital accumulation. This is related to the concept of 'conditional' convergence which usually features in the debate on cross-country convergence. But if one follows the tradition of analyses on 'regional' convergence, it is enough to look at the above regression as the states within a geo-political boundary do share common characteristics. Interesting point is how 'divergence' appears in such homogeneous environment.

We have found relatively stronger results for the period 1960-61 to 1990-91. For comparison, the estimaed equation (see also Figure 5) with the corresponding t-statistics and R^2 is given below.

$$(g_i - \bar{g}) = 0.0743 + 7.7200\ (\log x_i - \log \bar{x}) \quad (5.23)$$

$$R^2 = 0.60$$

The aforesaid observation is further substantiated from the movement of the coefficient of variation (CV) across the states over the period from 1960 to 1995. It is clear from Figure 6 that the coefficient of variation has been rising at faster rate since the late 1970s thereby strengthening the hypothesis of rising regional disparity much more in the post-liberalisation period. The value of CV has recorded a slowly declining trend up to 1981-82 (31.80) from 1961-62 (33.88). Since then it has been rising steadily reaching the maximum of 43.44 in 1993-94. The high value of $\bar{R}^2$ (0.77) as revealed from three alternative polynomial fits confirms that there is an exponentially rising tendency towards income disparity across the states even in foreseeable future.

Having established a really strong case against the conventional result of convergence, let us now concentrate on the five exceptional states which are omitted from the final fit. Interestingly, three of these states lie in the north-eastern frontier, namely, Arunachal Pradesh (2), Manipur (15), and Sikkim (22). These states started with moderately low base year income but grew at very fast rates. There is no denying the fact that their weights are not significant in the all-India picture. Moreover, centre-state grants in favour of these states are indeed substantial relative to other states. The other two states, Delhi (5) and West Bengal (26), although started with very high level of base period income have performed poorly in terms of income growth over the period of last 35 years.

IV
Planning and Regional Disparity of Income

The issue of distribution of resources among the states has always been a serious subject of debate. Given the nature and intensity of heterogeneity of what India is, we believe there can hardly be any foolproof method of resource distribution across the states under the present Constitution. Article 246 in seventh schedule defines the authority of the union and the state governments. The latter's responsibility is concerned mainly with the agricultural sector (in particular, taxation and land reforms), power generation, education, health, sanitation, small industries and road transport (other than the national highways). On the other hand, Article 280(3) (a) and (b) of the Constitution mandates the Finance Commission (which is being set up every five years) to correct the imbalances in resources and expenditures between the centre and the state (vertical imbalance) and the disparity in income levels and development across the states (horizontal imbalance). But over the years, the Planning Commission has emerged as a significant institution for the transfer of resources to the states, and this has come about by taking recourse to Article 282 under which increasing channelisation of resources has restricted the scope of Finance Commission to non-plan revenue expenditure [Chakraborty 1998; Vithal 1997 and Gulati 1987]. It should be mentioned here that we are concerned with the development funds as distributed by the Planning Commission in the name of Per Capita Plan Outlay (PCPO).

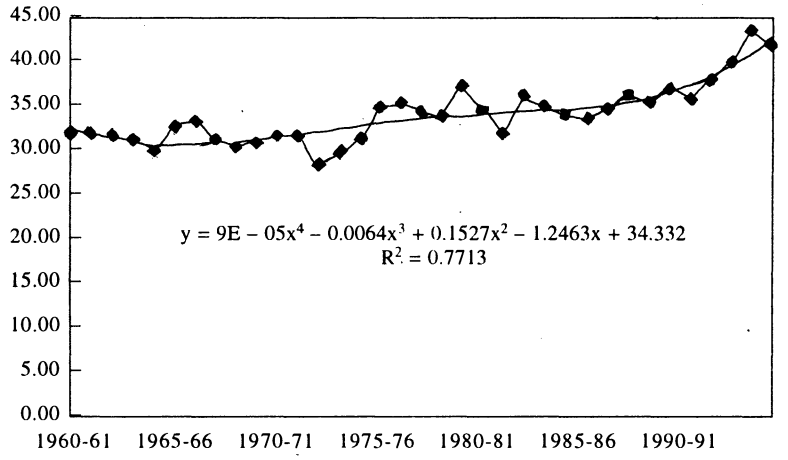
In order to study the responsibility of the government (where the decision-making is ultimately supposed to be guided by the need and performance rather than optimality, if there is no political intervention) in eradicating regional disparity in income across the states, we have found out the relationship between the growth rate of PCPO and the average level of income (PCNSDP) for each of the states corresponding to each plan, whether five-year or annual. The results of the regressions are presented in Table 3. The coefficient of PCNSDP shows significant (at 1 per cent level) negative value of –21.0991 with the t-statistics of (–2.9279), $\bar{R}^2$ being 0.2335. The negative coefficient proves the fact that the disbursement/distribution of plan funds has been made in accordance with the level of income across the states, i e, the poorer states have been receiving proportionately larger amount of funds for developmental purpose relative to their richer counterparts (Figure 7). Therefore, it appears that the planners have done their duty in fostering balanced regional development so far as distribution of funds are concerned. Hence, there may be other reasons for the observed regional divergence across the states of India over the entire plan period.

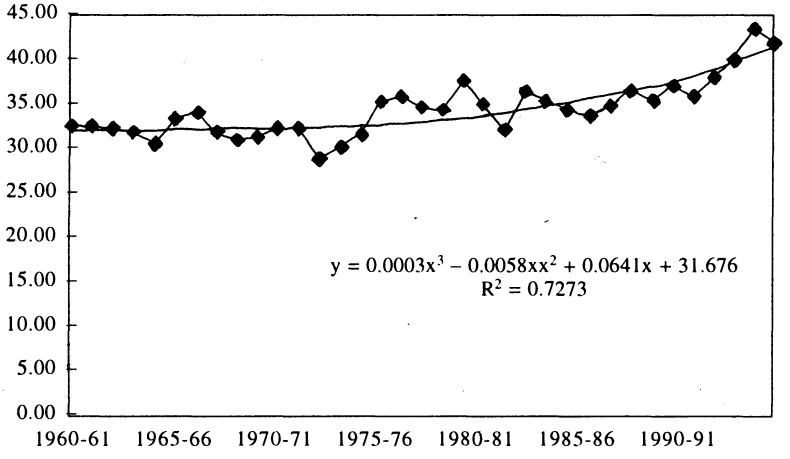
A simple way of capturing the role of factor accumulation and technical change on the state level growth in per capita real output is to invoke the well known growth accounting relationship. Growth rate in per capita income essentially depends on savings ratios, incremental capital output ratio and growth in population. Since all these information are not available for each of the states over a long period of time, and there may be methodological problems in comparing state level estimates, we adopt a particular strategy. We approximate state level 'public savings ratio' by the ratio of PCPO to PCNSDP (I/Y) and the 'incremental public output capital ratio' by the ratio of changes in PCNSDP and changes in capital stock measured from the PCPO series ($\Delta Y/\Delta K$). If we denote the first by x and the second by z, then g_i, the per capita income growth of the i-th state is captured by the following simple growth equation

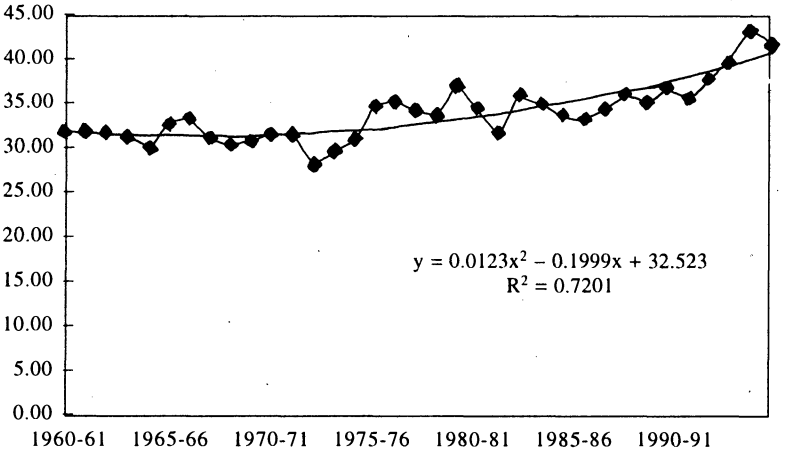
$$g_i = a + bx_i + c\ z_i + \varepsilon_i \qquad (1)$$

where ε_i captures the corresponding variables for private capital, population growth, etc.

FIGURE 6: TRENDS OF CV OF PCNSDP WITH ALTERNATIVE FITS: 1960-61 TO 1994-95







Note that if we run a regression based on equation (1) and find the estimates of b and c to be highly significant and a small estimated residual (that is, a high $\bar{R}^2$) we shall be in trouble because we have already argued that 'public help' has not been able to nullify 'divergence'. Hence, x_i must not be able to 'explain' a lot about g_i. Intuition tells us that x_i or z_i may explain part of g_i but the main force behind the evolution should be hidden in ε_i. Fortunately, this is borne out by the regression analysis. x_i has a significant impact on g_i, z_i does not have much of an impact. Goodness of fit for the regression is extremely poor ($\bar{R}^2 = 0.0597$). This is summarised in Table 4.

As Table 3 shows growth of PCPO has been biased towards the 'poorer' states which in turn grew slower than the 'richer' ones. Hence, the relatively poor states must have been greatly affected by the 'factors' lumped in ε_i. our future task is to disentangle 'ε_i' further to properly specify the growth accounting relationship. It is possible that ε_i also contains non-plan expenditure on which we are yet to obtain systematic time series data. What our analysis points out is that private capital accumulation may have an inertia which is not entirely explained by the redistributive thrust of the planning process. In other words, poorer states might have generally been helped by the central government but that has not dictated the pattern of private capital accumulation and growth.

Before we conclude it is instructive to capture the relationship between public and private capital in the regional growth process in terms of a simple structure. This exercise is suggestive to the extent it can generate outcomes which are consistent with our empirical findings so far.

We consider a set up where two states share the stocks of public capital as well as private capital. The allocation of public capital is determined by the planners whereas the private capital is getting allocated to equalise the marginal productivities across two states. We postulate the following production function for real per capita output. We ignore labour and focus only on the accumulation of capital. The production function is

$$y_i = k_{gi}^{\alpha i}\, k_{pi}^{\beta} \qquad (2)$$

where Y_i is the real output for the i-th state; k_{gi} and k_{pi} are respectively public and private capital used in the process of production; α_i and β are productivity parameters such that $0 < (\alpha_i, \beta) < 1$. We intentionally keep a_s different across regions ('regions' and 'states' are used interchangeably). Let λ be the share of public capital allocated to region 1 and '$(1 - \lambda)$' to region 2. Given the above assumptions, it is straightforward to get

$$y_1 = k_{g1}^{\alpha 1}\, k_{p1}^{\beta} \qquad (3)$$

From the first order condition,

$$\frac{\partial y_1}{\partial k_{p1}} = \beta k_{g1}^{\alpha 1} \cdot k_{p1}^{\beta-1} \qquad (4)$$

and

$$\frac{\partial y_2}{\partial k_{p2}} = \beta k_{g2}^{\alpha 2} \cdot k_{p2}^{\beta-1} \qquad (5)$$

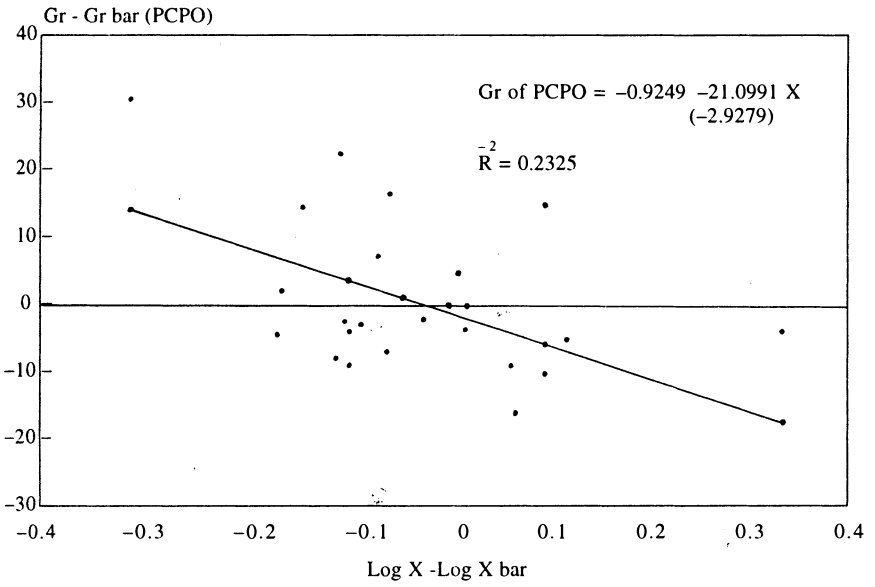
Given the above equations, (6) is derived by equating the marginal productivities of private capital across two regions

$$k_{p1} = \left[k_g^{\frac{(\alpha 1-\alpha_2)}{1-\beta}}\right]\left[\frac{(1-\lambda)^{\alpha 2}}{\lambda^{\alpha 1}}\right]^{\frac{1}{\beta-1}} .(k_p - k_{p1}) \qquad (6)$$

where $\bar{k}_g$ and $\bar{k}_p$ are given stocks of public and private capital. Solving for k_{p1} and k_{p2} in terms of k_g, we get

$$\frac{y_{1t}}{y_{2t}} = \left[\frac{\lambda^{\frac{\alpha 1}{(1-\beta)}}}{(1-\lambda)^{\frac{\alpha 2}{(1-\beta)}}}\right] .k_{gt}^{\frac{(\alpha_1-\alpha_2)}{(1-\beta)}} \qquad (7)$$

FIGURE 7: SCATTER OF PCNSDP AND GROWTH OF PCPO



Note: Number corresponding to scatter points represent state sl. no. as in Table 1.

We introduce the time dimension to highlight the evolution of the regional per capita income overtime. Several observations are in order.

First, if $\alpha_1 = \alpha_2$, $\frac{y_{1t}}{y_{2t}}$ remains constant over time and is directly proportional to 'λ', the share of allocation. Let k_{gt} be represented by,

$$k_{gt} = k_{g0}\,(1 + z)^t,\ z > 0 \qquad (8)$$

Then,

$$\frac{y_{1t}}{y_{2t}} = \frac{\lambda^{\frac{\alpha_1}{(1-\beta)}}}{(1-\lambda)^{\frac{\alpha_2}{1-\beta}}} \cdot k_{g0}(1+z)^{\frac{(\alpha 1-\alpha 2)t}{(1-\beta)}} \qquad (9)$$

If $\alpha_1 < \alpha_2$, then $\frac{y_{1t}}{y_{2t}}$ will decline as t goes up, notwithstanding a significant growth in public capital. A lower α implies that region 1 is characterised by inferior productivity of public capital which in turn leads to greater allocation of private capital in the other region leading to increasing regional disparity over time. One way of mending this is to continuously adjust λ to favour region 1. But such adjustment may not be feasible. A high λ may boost up y_{1t} for a while but as time goes by, the productivity differential $(\alpha_2 - \alpha_1)$ will lead to a continuous decline in the relative per capita income of region 1. However, we do not provide the clue as to how the poorer region also has a lower α. But we show that larger public capital in one region may not allure private capital because of lower efficiency with which public capital is utilised in that region. Hence, greater capital expenditure in a particular state may still lead to subsequent worsening of the relative position of the state.

V
Concluding Remarks

In a way it is interesting to note that this paper has obtained a relationship between initial PCNSDP and its growth rate over 35 years across Indian states which looks very different from the ones we usually experience in the literature on convergence. This in fact gives us something different and therefore should invoke further responses from

TABLE 2: REGRESSION BETWEEN INITIAL LEVEL OF PCNSDP AND ITS GROWTH

Dependent Variable in Growth of PCNSDP $(g_i - \bar{g})$			
Independent Variable	Coefficient	T Ratio	$\bar{R}^2$
Constant	0.0569	0.3036	0.2743
PCNSDP $(\log(x_i) - \log(\bar{x}))$	6.2796**	2.9260	

Notes: (i) Omitting five observations as outliners.
(ii) ** Significant at 1 per cent level.

TABLE 3: REGRESSION BETWEEN GROWTH OF PCPO AND INITIAL LEVEL OF PCNSDP

Dependent Variable in Growth of PCPO			
Independent Variable	Coefficient	T Ratio	$\bar{R}^2$
Constant	-0.9249	-0.4406	0.2325
PCNSDP $(\log(x_i) - \log(\bar{x}))$	-21.0991**	-2.9279	

Notes: (i) With all observations (26).
(ii) ** Significant at 1 per cent level

TABLE 4: RELATION OF GROWTH OF INCOME WITH RATE OF INCOME WITH RATE OF INVESTMENT AND INCREMENTAL CAPITAL OUTPUT RATIO

Dependent Variable in Growth of PCNSDP			
Independent Variable	Coefficient	T Ratio	$\bar{R}^2$
Constant	1.8909	3.8239	0.0597
AV1 = I/Y	3.40161	1.8716*	
AV3 = Δ = ΔY/ΔK	0.4625	0.6999	

TABLE 1: PER CAPITA NET STATE DOMESTIC PRODUCT AND ITS GROWTH

Sr No (1)	States (2)	All States				Omitting Five States	
		x_i at 1960-61 (3)	g_i (4)	$\log x_i - \log x$ (5)	$g_i - g$ (6)	$\log x_i - \log x$ (7)	$g_i - g$ (8)
1	Andhra Pradesh	275.00	3.07	-0.0532	0.4272	-0.0343	0.4104
2	Arunachal Pradesh	228.00	5.01	-0.1346	2.3675	–	–
3	Assam	315.00	1.47	0.0058	-0.1684	0.0247	-1.1851
4	Bihar	215.00	1.50	-0.1601	-1.1421	-0.1412	-1.1589
5	Delhi	668.00	1.94	0.3322	-0.7005	–	–
6	Goa, Daman and Diu	479.06	4.20	0.1878	1.5580	0.2067	1.5412
7	Gujarat	362.00	3.48	0.0662	0.8458	0.0851	0.8290
8	Haryana	327.00	3.23	0.0220	0.5967	0.0409	0.5800
9	Himachal Pradesh	275.65	2.76	-0.0487	0.1208	-0.0333	0.1041
10	Jammu and Kashmir	269.00	0.96	-0.0627	-1.6736	-0.0439	-1.6903
11	Karnataka	296.00	2.57	-0.0212	-0.0708	-0.0024	-0.0876
12	Kerala	259.00	2.08	-0.0792	-0.5621	-0.0603	-0.5788
13	Madhya Pradesh	252.00	2.34	-0.0911	-0.2943	-0.0722	-0.3110
14	Maharashtra	409.00	3.07	0.1192	0.4277	0.1381	-0.4110
15	Manipur	154.00	3.40	-0.3050	0.7587	–	–
16	Meghalaya	249.17	3.51	-0.0960	0.8706	-0.0772	0.8539
17	Mizoram	321.45	4.74	0.0146	2.0980	0.0335	2.0812
18	Nagaland	244.50	3.35	-0.1042	0.7138	-0.0854	0.6971
19	Orissa	217.00	2.38	-0.1561	-0.2580	-0.1372	-0.2748
20	Punjab	366.00	3.28	0.0709	0.6437	0.0898	0.6270
21	Rajasthan	284.00	1.82	-0.0392	-0.8168	-0.0203	-0.8334
22	Sikkim	372.00	1.08	0.1005	-1.5595	–	–
23	Tamil Nadu	334.00	3.18	0.0318	0.5466	0.0501	0.5298
24	Tripura	248.00	1.19	-0.0981	-1.4459	-0.0792	-1.4627
25	Uttar Pradesh	252.00	1.57	-0.0911	-1.0653	-0.0722	-1.0821
26	West Bengal	390.00	1.42	0.0985	-1.2180	–	–

Notes: (i) x_i represents statewise PCNSDP deflated by CPITAL (1960-61=100).
(ii) g_i represents statewise growth rate of real PCNSDP.

theoretical and empirical researchers. The debate on the 'rate-of-convergence' or for that matter whether there is a statistical convergence or not gains impetus when the initial observation cannot on a priori ground rule out the possibility of convergence. In this case the states seem to have drifted apart relative to their initial position. This is an exercise on economic growth, and ignores variations in per capita consumption expenditure, which if properly measured show lesser variation than SDP [Dutta Chowdhury 1993]. Notwithstanding such problems, we argue that properly measured real PCNSDP does not show any sign of convergence.

Theoretically, there are many interesting questions one may ask. Since it is more or less accepted that 'diminishing returns' somewhere is the main factor behind 'convergence' i e, over accumulation eats into the incentive to investing into the accumulated regions. Such a theory can hardly be applied to India where 'public' intervention plays major role and incentives for investment are likely to be guided by non-market factors. A strait-jacket explanation of 'divergence' is to recognise the role of 'increasing returns' which generally leads to corner solutions [see Krugman 1979, 1991a, 1991b]. Higher capital/labour ratio will attract more capital and will generate higher return drawing all capital away from the 'smaller' size region.

It is quite possible that the regions or states have different 'steady state' levels of per capita real income determined by fundamental long run parameters of saving rate and productivity. If the behavioural parameters are different across states, it may generate 'divergence'. We are seriously constrained by the non-availability of such data set.

However, given the usual limitations of the present set-up, the results of this paper are very interesting and at the same time suggestive of some further extensions. First, there is strong statistical evidence in favour of 'divergence' across Indian states over the period from 1960-61 to 1994-95. Although the coefficient of determination has been slightly weakened compared to the 30-year period ending in 1990-91, the coefficient of variation (meaning regional disparity) has recorded a strong exponential trend over last 35 years. Second, the allocation of Plan funds across the states has been made in accordance with the level of income of the states, that is, the poorer states have been receiving proportionately larger amount of development funds relative to their richer counterparts all through these years. Given such type of positive discrimination, rising regional disparity may be the outcome of lower efficiency with which public capital is utilised and also of infrastructural disparity across the states. In this context, Ghosh and De (1998) has developed a physical infrastructure development indicators for the states taking into account transport (rail and road), irrigation, spread of electricity, per capita consumption of electricity and telephones for different time points from 1971 to 1995 on the basis of principal component analysis. According to them, regional imbalance in physical infrastructure has been strongly responsible for rising income disparity across the states [see also Ghosh and Chattopadhyay 1997].

On the basis of the aforesaid findings relating to the issue of divergence across Indian states over 1960 to 1995, it becomes imperative for us to digress into the following areas: (1) to try to build up some sort of a private capital formation indicator at the state-level, (2) to study statewise productivity differentials for the organised manufacturing industries as a proxy for the industrial capital formation, and (3) to evaluate the process of development of some of the outlier states like West Bengal for which the issue of flight of industrial capital has generated renewed interest in very recent period.

Note

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1 It should be mentioned that all these 26 states have not been existing right from 1960-61. It is true that most of the major states did exist prior to 1960-61. But on the basis of the States Reorganisation Act, 1956, some of the states have been further recognised during the later period. Also, a few states were either formed or reorganised much later with the implementation of the North-Eastern Reorganisation Act in 1972, and as a result, data for Meghalaya, Mizoram and Sikkim are available only from the early 70s. For those states, we have treated the first available PCNSDP figures as the base year income. As the share of these states in India's total income is very low, it does not do any harm. (For reorganisations of the states, see *India 1996*, Government of India.)

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