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Regional Disparities in Per Capita Income in India: Convergence or Divergence?

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August 2013

KDPE 1313

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Abstract

The paper looks at the latest evidence of what has been happening to regional disparities in per capita income (measured as Gross State Domestic Product per capita) in India over the first decade of the twenty first century (1999/00 to 2010/11) by estimating cross section equations for unconditional and conditional beta (β) convergence and sigma (σ) convergence across thirty two regions (twenty-eight States and four Union Territories). There is no evidence of unconditional convergence, but weak evidence of conditional convergence controlling for population growth; credit growth; male literacy; the share of agriculture in State GDP, and State expenditure as a share of State GDP. Sigma divergence has increased continuously, except among the poorest States.

Key Words : Regional Growth; India; Convergence/Divergence.

JEL Codes : O47, O53, R11

Introduction

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There are huge differences in living standards, measured by per capita incomes, across the States of India ranging from 12,000 rupees per head in Bihar to nearly 100,000 rupees per head in Goa.[1] They are the product of history and past growth experience. There are also other related disparities in levels of education, literacy, health, infrastructure, population growth, investment expenditure and the structure of regions.

Regional differences in the standard of living can have serious implications for the economic and political functioning of national economies. This is true of both developed and developing countries. Regional economic disparities can lead to undesirable labour and capital migration between depressed and prosperous regions, and to the spread of inflation from prosperous to depressed regions worsening the aggregate trade-off between inflation and unemployment. Disparities can be a cause of political resentment in less prosperous regions and disillusion with the political process, leading to social unrest. There is a strong case on economic, social and political grounds for a greater degree of economic balance between the regions of countries, and many countries implement regional policies to address imbalances. Indeed, ever since India's independence in 1947, one of the major policy objectives of government has been to reduce regional disparities in living standards; to promote national unity, and to foster growth with equity. Articles 280 (a) and (b) of the Indian constitution give considerable power to the central government to allocate financial resources to less prosperous regions in three forms : first, statutory transfers (tax sharing); second, grants in aid, and third, Plan and discretionary grants (which usually support central government projects in the States). The Indian Financial Commission decides how funds are allocated every five years. The Financial Commission has responsibility for tax sharing and grants in aid, while the Planning Commission determines Plan grants. In addition, Central Ministries may make discretionary grants to States. Indirect resource transfers may also be made through loans from central government and public financial institutions such as Development Banks. As a background to these resource transfers to poorer States, all State governments draw up State Plans specifying their needs and their own financial resources. A good deal of bargaining goes on between Central Ministries and States, with the Planning Commission used as an arbiter when necessary. The theme of the Eleventh Five-Year Plan

[1] Measured by Gross State Domestic product (GSDP) divided by population.

2007-2012 was 'faster and more inclusive growth', recognising that regional disparities have widened considerably in recent years.[2]

The purpose of this paper is to portray and analyse these differences over the period 1999/00 to 2010/11, testing for unconditional beta (β) convergence of gross State domestic product (GSDP) per capita; testing for conditional β convergence, and testing for sigma (σ) convergence, measured by the standard deviation (SD) and coefficient of variation (CV) of State per capita incomes. There have been a number of other studies of this nature over the last fifteen years or so, sometimes with different conclusions (see Table 1 below, p. 7). The novelty of this study is that it takes the most recent time period of the first decade of the twenty-first century; it takes more regions than previous studies covering virtually 100 per cent of the total population; it takes a cross-section approach to pick-up long term relationships, avoiding some of the complexities of panel-data analysis, and it takes some of the same control variables as other studies when testing for conditional convergence and, using cross-section, supports their significance, particularly the negative impact of population growth, the positive impact of credit to the private sector as a proxy for the dynamism of investment, and the negative impact on living standards of agricultural-based regions.

Economic Theory

Orthodox equilibrium theory (e.g. Solow, 1956) predicts that regional differences in income per head should converge on a common level of income per head if tastes and preferences (i.e. savings, investment and population growth) and technology are the same across regions. This is because of the neoclassical assumption of diminishing returns to capital so that the marginal product of capital in poor regions, with little capital per head, should be higher than in richer regions with more capital per head. For the same amount of savings and investment, therefore, the growth of per capita income should be higher in poor regions than rich regions leading to what is called in the literature unconditional beta (β) convergence. This was the neoclassical story until the advent of 'new' (endogenous) growth theory in the 1980s, pioneered by Romer (1986) and Lucas (1988), which questioned the assumption of diminishing returns to capital, arguing that there are forces at work in economic systems, particularly the formation of human capital and research and development (R&D), which prevent the marginal physical product of capital from falling as countries (or regions) get

[2] Cashin and Sahay (1996) find grants to State governments from central government have had a positive impact on reducing regional disparities, but have been offset by other factors.

richer, so that convergence can only be conditional controlling for different levels of education, R&D expenditure and other variables that determine the productivity of capital (e.g. population growth; trade openness; political stability, government expenditure and so on). Each region may converge to its own steady-state, but the steady-state levels of per capita income may persist of even widen due to a widening dispersion of the conditioning variables.

Another strand of orthodox equilibrium theory argues that once differences arise between regions, economic and social forces come into play to narrow differences. For example, the movement of labour from low-wage regions to high wage regions should narrow wage differences by reducing labour supply in the depressed regions and increasing labour supply in more prosperous regions. Likewise the movement of labour from high unemployment regions to low unemployment regions should narrow unemployment differences. The migration of capital should have the same equilibrating tendency, moving to, or locating in, regions where wage rates are low and the rate of profit high, assuming an inverse relation between the wage rate and the profit rate. Trade between regions is a substitute for migration and will lead to factor price equalisation (Samuelson, 1948).

This second strand of orthodoxy equilibrium theory can also be challenged, and was challenged in a serious way by Gunnar Myrdal in his classic book *Economic Theory and Underdeveloped Regions* (1957) in which he puts forward the thesis of circular and cumulative causation which broadly means that economic success breeds economic success, and failure breeds failure. Orthodox equilibrium theory, he argues, is static and ignores the dynamic consequences of factor migration and trade. Labour migration from depressed to prosperous regions does not necessarily equalise wage rates and unemployment because movements in labour supply add to labour demand. Labour migration is also a selective process which may denude a depressed region of its human capital and enhance the productive capacity of the prosperous regions that it moves to. Equally, capital may not locate where wages are lowest if the future prospective yields of capital are lower in depressed regions than in more prosperous regions. Trade may also work to the advantage of more prosperous regions if there exist static and dynamic returns to scale, so that fast growing regions become more and more competitive. This is the essence of Kaldor's (1970) regional growth model incorporating cumulative causation. The model consists of four structural equations: (i) regional output growth as a positive function of export growth as the only true component of autonomous demand; (ii) export growth as a function of competitiveness and

the growth of income outside the region; (iii) a region's competitiveness as a function of its wage growth relative to productivity growth, and (iv) productivity growth as a function of output growth due to static and dynamic returns to scale- otherwise known as Verdoorn's Law.[3] It is the Verdoorn relation that makes the model 'circular and cumulative'. The faster the growth of output, the more competitive regions become, so the faster their export growth, and the faster they grow. It is an interesting question why in the teaching of regional growth and regional disparities, the neoclassical prediction of convergence has always been the initial presumption, rather than the non-orthodox prediction of divergence, but that is a question for historians of thought to answer.[4]

To summarise the theory of regional growth, therefore, we have orthodox neoclassical equilibrium theory predicting unconditional convergence; we have 'new' growth theory predicting conditional convergence, and we have non-orthodox theory of the cumulative causation type associated with Myrdal and Kaldor predicting the possibility of unconditional divergence.[5]

As suggested at the outset, the existence of convergence/divergence is typically measured in two ways. The first is to run a regression of the growth of income per head on the *initial* level of per capita income (measured in logs) to test whether initially poor regions grow faster than initially rich regions first without conditioning variables and then with. This is testing for β convergence – unconditional and conditional. The second measure is to compute the standard deviation (SD) or coefficient of variation (CV) of the log of per capita income over time to see whether the dispersion rises or falls. This is the test for σ convergence. Unconditional β convergence is a necessary condition for σ convergence but not a sufficient condition because of random shocks. Neither is conditional β convergence a sufficient condition for σ convergence because the steady-state levels of regional per capita income may diverge through time through the dispersion of conditioning variables widening. In this paper we test for unconditional and conditional β convergence and sigma convergence across 28 States of India and 4 Union Territories (see Table 2, p.9) over the period 1999/00 to 2010/11, using as conditioning variables : regional differences in population growth; male literacy rates (as a

[3] For a formalisation of the Kaldor model and its dynamic properties, see Dixon and Thirlwall (1975) and Thirlwall (2013).

[4] For an overview of non-orthodox cumulative causation theory, including the theory of externalities, see Toner (1999)

[5] The new economic geography of Krugman (1991, 1995) also predicts divergence if centripetal forces outweigh centrifugal forces.

proxy for levels of education); the growth of outstanding credit to the private sector as a proxy for investment; the structure of regions measured by the share of agricultural output in State GDP, and State expenditure as a proportion of State GDP.[6]

Previous Research

There have been several previous studies of the convergence or otherwise of per capita incomes (measured by GSDP) across the regions of India, but most are now dated, and none take as many regions as the study here. The conclusions of the major studies are given in Table 1 (p.7). The studies differ in the number of regions taken; the time period covered, and the method of estimation, but a broad consensus emerges. First there is no evidence of unconditional β convergence. The only study that reaches a different conclusion for the time period 1961-91 is Cashin and Sahay (1996), but on close inspection their statistics do not support the conclusion (Dasgupta et. al., 2000, and Ghosh, 2010 also mention this). There is unanimity that there has been an increase in σ divergence measured by the standard deviation or coefficient of variation of regional per capita incomes. Where there is disagreement is over conditional β convergence and what the significant steady state (conditioning) variables are. Nagaraj et. al. (1998) use a dynamic panel with fixed effects and find differences in infrastructure, the structure of production and price shocks as significant variables in explaining differences in the growth of regional per capita income (GSDP). Differences in levels of education appear insignificant. Trivedi (2002) also uses panel data with and without fixed effects, using infant mortality, physical infrastructure and education as control variables. Without fixed effects, infant mortality is significantly negative; infrastructure is significantly positive, and education is insignificant. In the fixed effects model, education becomes significant, but infant mortality is only significant at the 90 per cent confidence level. Adabar (2004) uses a dynamic fixed effects panel using per capita investment, population growth and human capital as control variables. The author constructs his own measure of regional investment based on 'outstanding credit extended by All Scheduled Commercial Banks (SCBs) [plus] assistance given by all financial institutions [plus] government capital expenditure'. He also constructs his own index of human capital based on the literacy rate; age specific school enrolment rates; life expectancy, and infant mortality.

[6] For State data on all the conditioning variables and data sources, see Appendices 1 and 2, respectively.

Table 1: Summary of Studies of Regional Convergence / Divergence in India.

Study	Time Period	No. of states	Absolute β Convergence	Conditional β Convergence	Sigma Convergence
Cashin and Sahay (1996)	1961-1991	20	Yes	–	No
Nagaraj et. al. (1998)	1970-1994	17	No	Yes	No
Ghosh et. al. (1998)	1960/61-1994/95	26	No	–	No
Dasgupta et. al. (2000)	1970/71-1995/96	21	No	–	No
Sachs et. al. (2002)	1980-1998	14	No	No	No
Trivedi (2002)	1960-1992	16	No	Yes	No
Adabar (2004)	1976/77-2000/01	14	–	Yes	–
Nayyar (2008)	1978/79-2002/03	16	No	Yes	No
Ghosh (2010)	1960/61-2006/07	15	No	Yes	No
Chikte (2011)	1970-2005	15	–	–	No
Kumar and Subramanian (2012)	2001-2009	21	No	–	–

Source: Authors' Literature Summary.

These three independent variables account for 93 per cent of regional growth rate differences. Nayyar (2008) also uses a dynamic panel, using the literacy rate and public and private investment as control variables. He finds both important, but with private investment tending to flow to the richer regions (as predicted by the theory of cumulative causation) and public investment also tending to favour richer regions because richer States raise more tax revenue. Ghosh (2010) takes a panel with fixed effects and shows inter-State variations in steady-state levels of GSDP per capita are due to variations in human capital, the structure of production and infrastructure, similar to the findings of Nagaraj et. al. (1998) and Trivedi (2002). The only study that does not find evidence of conditional convergence is Sachs et. al. (2002) because 82 per cent of cross-variation in regional growth is explained by the rate of urbanisation. We now turn to our own study.

Regional Disparities in India

Table 2 gives a list of the 28 States and 4 Union Territories (Andaman and Nicobar, Chandigarh, Delhi and Puducherry)[7] – hereafter all referred to as regions – ranked in descending order of their level of real Gross State Domestic Product (GSDP) per head, measured in rupees, in the base year of the study 1999/00. The regions taken account for virtually the whole of the Indian population (99.95 per cent). The level of GSDP per capita in 2010/11, and the average annual growth of real GSDP over the period, is also given. It can be seen from the table that India has a vast array of richer and poorer regions with Goa being the initially richest region and Bihar the poorest. In 2010/11, Chandigarh was the richest, but Bihar remained the poorest.

There are also substantial variations in the average annual growth rate over the period, ranging from an impressive 8.39 per cent in Chandigarh to a sluggish 2.71 per cent in Jammu & Kashmir. What is also apparent is a clear dividing line between the top four richest regions and the others which have high initial levels of GDSP per head and very fast growth over the period. When it comes to statistical analysis of unconditional and conditional β convergence we will examine the extent to which these four regions may be influencing the results and conclusions by running regressions first including these four regions and then excluding them.

[7] Three Union territories are excluded due to lack of data. They are Daman and Diu, Dadra and Nagar Haveli, and Lakshadweep, but they account for only 0.05 per cent of India's population.

Table 2: State Levels of GSDP and Growth 1999/00 to 2010/11.

State\Union Territory* (UT)	1999/00 per capita GSDP (Rs)	2010/11 per capita GSDP (Rs)	average annual growth rate of per capita GSDP (%)
Goa	47343	99703	6.207
Chandigarh*	46722	119956	8.396
Delhi*	40649	88645	6.497
Puducherry*	34045	78640	6.977
Punjab	27933	42798	3.556
Andaman & Nicobar Islands *	26537	49358	5.171
Maharashtra	25969	47221	4.983
Haryana	24758	52045	6.191
Himachal Pradesh	23503	45432	5.492
Gujarat	22071	46199	6.155
Kerala	21826	48143	6.592
Tamil Nadu	21820	37348	4.479
Karnataka	19442	33797	4.608
Mizoram	17813	28942	4.045
West Bengal	17109	30483	4.813
Andhra Pradesh	17080	34435	5.843
Sikkim	16762	41515	7.557
Meghalaya	15823	25991	4.136
Jammu & Kashmir	15777	21862	2.718
Tripura	15426	29400	5.374
Uttarakhand	15134	31316	6.060
Arunachal Pradesh	15032	27118	4.917
Rajasthan	14931	23966	3.943
Manipur	14461	20567	2.935
Nagaland	14063	30321	6.402
Madhya Pradesh	15823	25991	4.136
Chhattisgarh	13354	26147	5.600
Assam	13277	19526	3.214
Jharkhand	13002	18450	2.916
Orissa	11814	23360	5.681
Uttar Pradesh	10737	15933	3.289
Bihar	6185	12098	5.591

Source: Central Statistical Organisation (CSO) and Authors' Calculations.

It is instructive first of all, however, to say a little about the structure of these four regions' economies and the factors driving their growth. Chandigarh is a city and Union Territory in the north, serving as the capital of two States, Haryana and Punjab. It is the home of several central government offices, which makes the government the largest employer. Its developed infrastructure, strategic location and large pool of skilled labour has led to a recent

information technology (IT) boom in the city. Special Economic Zones (SEZs) and trade promotion organisations have also been set up to encourage trade and growth. Industries such as paper manufacturing, pharmaceuticals and banking have grown rapidly in recent years. Delhi is the national capital Territory of India, so the government here is also a significant employer. The tertiary sector, such as IT, tourism, media, banking, hospitality and telecommunications, dominates the economy. This, along with various incentives, makes Delhi very attractive to investors, which has been a major factor in its growth performance. Puducherry is a Union Territory that consists of four districts of the former French India. High government infrastructure investment, good transport links and the establishment of many SEZs has attracted many multinational companies. Tourism, eco-tourism and fisheries also thrive in the region. Goa, on the west coast, is India's smallest State, dominated by the tourist industry. It contains sixteen SEZs and also substantial ore and mineral deposits making mining the second largest activity. All four of these regions have well-developed infrastructure, high literacy rates, favourable industrial structures, and incentives in place which encourage investment and trade. In most previous studies of regional convergence in India, these regions are not included, partly because of their small size, but also because of previous lack of data.

As a preliminary first step in analysing whether there has been convergence or not in the first decade of the twenty-first century, we look at the average growth rate of the richest and poorest regions, and calculate the ratio as shown in Table 3. It can be seen right from the start that the ratio exceeds unity even taking the ratio of the top half of the regions to the bottom half. The ratio of growth of the richest four to the poorest four is 1.61, and 1.21 for the top half of the distribution compared to the bottom half.

Table 3: Ratio of Growth of the Richest to Poorest Regions 1999/00 to 2010/11.

	Ratio
Top 4 richest to bottom 4	1.61
Top 6 richest to bottom 6	1.53
Top 8 richest to bottom 8	1.31
Top 10 richest to bottom 10	1.37
Top 12 richest to bottom 12	1.30
Top 14 richest to bottom 14	1.27
Top 16 (half) richest to bottom 16 (half)	1.21

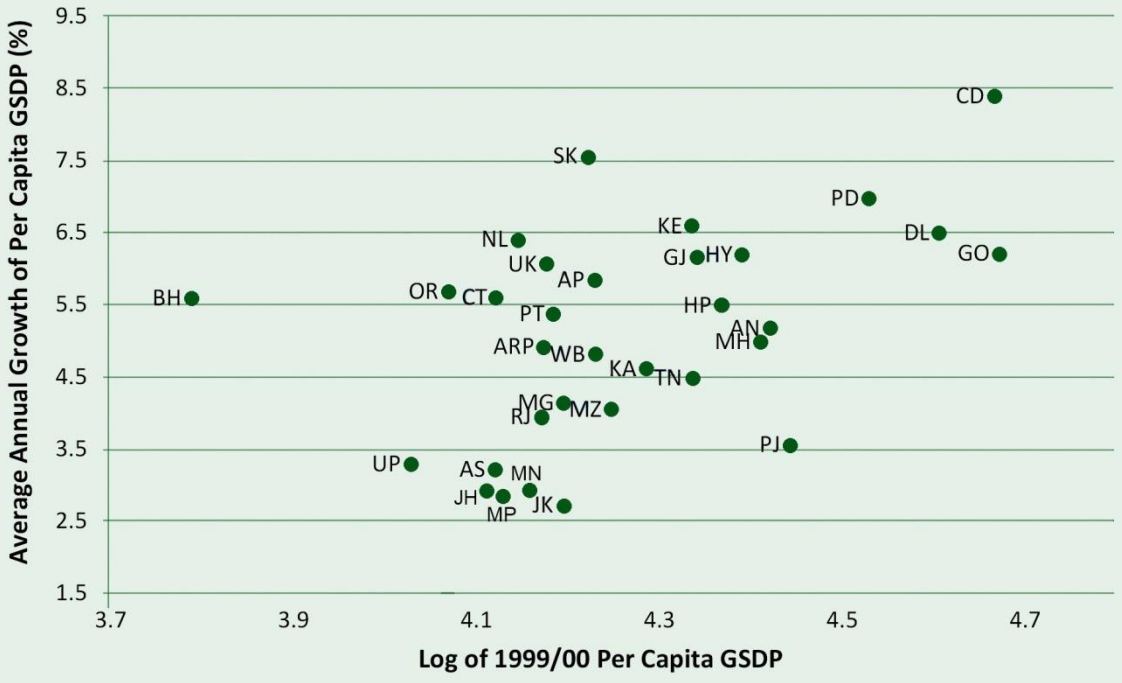
Source: Authors' Calculations.

This is *prima facie* evidence, although not conclusive, that there has been unconditional divergence, not convergence, as other studies have found for previous decades. Whether this result is driven by the fast growth of the four richest regions mentioned above remains to be tested, as does the question of whether unconditional divergence may coincide with conditional convergence. We now look at these questions using parametric tests.

Unconditional Beta (β) Convergence/Divergence

Figure 1 shows a scatter plot of the average annual growth of per capita GSDP against the initial level of GSDP for all the 32 regions over the period 1999/00 to 2010/11.

Figure 1: Growth of GSDP Per Capita 1999/00 to 2010/11 Against Log of 1999/00 (Initial) GSDP Per Capita.



Notes: AN-Andaman & Nicobar Islands, AP-Andhra Pradesh, ARP- Arunachal Pradesh, AS-Assam, BH- Bihar, CD- Chandigarh, CT-Chhattisgarh, DL-Delhi, GO-Goa, GJ-Gujarat, HP-Himachal Pradesh, HY-Haryana, JH-Jharkhand, JK-Jammu & Kashmir, KA-Karnataka, KE-Kerala, MH-Maharashtra, MP-Madhya Pradesh, MN - Manipur, MG - Meghalaya, MZ - Mizoram, NL-Nagaland, OR-Orissa, PD-Puducherry, PJ-Punjab, RJ-Rajasthan, SK-Sikkim, TN-Tamil Nadu, TP-Tripura, UK-Uttarakhand, UP-Uttar Pradesh, WB-West Bangal.

Source: CSO and Authors' Calculations.

It is clear from the scatter that the four regions discussed above are 'outliers' and may well bias the results in testing for regional convergence/divergence. To assess this we first run an ordinary least squares cross section regression taking the whole sample of regions (regression 1) and then the sample excluding the four richest regions (regression 2). The equation to be fitted is:

$$g_{gsdp} = a + \beta(\log \text{initial GSDP}) + \varepsilon_r \qquad (1)$$

where g_{gsdp} is the growth of per capita State gross domestic product; log initial GSDP is the level of GSDP in the base year 1999/00 and ε_r is the error term. For unconditional convergence, β must be significantly negative. The results of fitting equation (1) are shown in Table 4.

Table 4: Tests for Unconditional Convergence.

	Constant	β	r^2	Diagnostic Tests		
				Functional Form	Heterosked-asticity	Normality
Regression 1 (Full Sample)	-10.00 (-1.87)***	+3.54 (2.83)*	0.21	F=1.44 P=0.25	Chi2(1)=1.35 P=0.25	W=0.97 P=0.62
Regression 2 (excluding 4 regions)	-1.54 (-0.20)	+1.51 (0.83)	0.03	F=1.66 P=0.20	Chi2(1)=0.69 P=0.41	W=0.96 P=0.35

Notes: The numbers in parentheses are t-statistics. ***, ** and * represent statistical significance at the 10%, 5% and 1% levels. Functional form is measured by the Ramsey RESET test. Heteroskedasticity is measured by the Breusch-Pagan Test. Normality is measured by Shapiro-Wilk W test. P>0.05 accepts the hypothesis of no omitted variables; no heterosked-asticity and residuals normally distributed.

Regression (1) satisfies all the diagnostic tests for functional form; heteroskedasticity, and normality of the residuals. The β coefficient is significantly positive at the 95 per cent confidence level, which rejects the hypothesis of unconditional convergence. On the contrary, the evidence taking the whole sample of countries is that there has been unconditional divergence. Richer regions have been growing significantly faster than poorer regions. When the four richest regions are excluded from the sample, however, this result changes. In regression 2, there is no correlation between initial GSDP per head and subsequent growth performance. The β coefficient is not significantly different from zero, so there is no evidence of convergence or divergence taking the majority of States. This result contrasts with the conclusion of most of the studies for earlier time periods which find significant unconditional

divergence between a smaller number of States (and excluding Goa and the Union Territory States taken here) (see Table 1, p.7).

Conditional Convergence/Divergence

We now turn to the issue raised in 'new' growth theory that even if there is no unconditional convergence of regional per capita incomes, there may be conditional convergence with each region converging on its own steady-state level of income, holding constant variables that affect the growth of income other than the initial level of per capita income. In their survey of the 'new' growth theory literature, Levine and Renelt (1992) find only four variables robust: the initial level of per capita income; population growth; the ratio of investment to GDP, and the secondary school enrolment rate. Unfortunately, data on the latter two variables at the State level in India are not available, but it is possible to proxy them as other studies have done. Investment performance can be proxied by the growth of outstanding credit by All Scheduled Commercial Banks (SCBs) to the private sector (see also Adabar, 2004). In India, nearly 75 per cent of all financial assets of financial institutions are accounted for by SCBs. The secondary school enrolment rate can be proxied by the male literacy rate (see also Chikte, 2011). As well as these variables, we also believe that the structure of regional economies is likely to be a major determinant of growth performance i.e. whether regions specialise mainly in land-based activities such as mining and agriculture, or whether they specialise more in manufacturing and sophisticated services. The 'new' growth theory literature generally ignores structure, but the reason it matters is that different activities have different production and demand characteristics. Agriculture and mining are diminishing returns activities which slow the growth of labour productivity unless offset by technical progress, while manufacturing and sophisticated services (such as banking and IT) are mainly increasing returns activities which raise labour productivity growth. On the demand side, agriculture and mining products tend to be income inelastic (Engel's Law) while manufactured goods, at least, tend to be income elastic. This makes a difference to the growth of exports from a region (for a fuller discussion, see Thirlwall, 2013). Structure in our model is measured by the average share of agricultural output in State GDP over the period (see also Nagaraj et. al. 1998 and Ghosh, 2010). In line with other investigators (e.g. Chikte, 2011) we also consider the impact of State expenditure as a proportion of State GDP. If the expenditure is on public goods such as health, education and infrastructure, it might be expected to have a positive effect on regional growth performance.

In testing for conditional convergence, therefore, we have six conditioning variables: (i) initial per capita GSDP (initial log GSDP); (ii) population growth (pop); (iii) the growth of bank credit to the private sector (credit); (iv) the male literacy rate (literacy); (v) the share of agriculture in State GDP (% agric), and (vi) State expenditure as a per cent of Sate GDP (% Stateexp) (see Appendix 1 for the data on each of these variables). In equation form:

$$g_{gsdp} = a_0 + \beta(\text{initial log GSDP}) + a_1(\text{pop}) + a_2(\text{credit}) + a_3(\text{literacy}) + a_4(\%\text{agric}) + a_5(\%\text{Stateexp}) + \varepsilon_r \quad (2)$$

The sign on the population variable cannot be determined *a priori*; it depends on whether there are increasing or diminishing returns to population growth. Population pessimists, or neo-Malthusians, would expect a negative sign, while population optimists (e.g. Simon, 1996) would expect a positive sign. The signs on credit, literacy rate and State expenditure are expected to be positive if credit and State expenditure are largely used for investment purposes, and if literacy raises labour productivity. The sign on %agric is expected to be negative if industrial and service activities are more conducive to productivity growth than agriculture. β has to be determined.

The results of fitting equation (2) to the data for the whole sample (regression 1), and the sample excluding the four richest regions (regression 2), are shown in Table 5 (p.15). For the full sample of regions (regression 1) there is no evidence of conditional convergence. The β coefficient is positive and insignificant. Excluding the four rich, fast growing regions, however, (regression 2), there is some weak evidence of conditional convergence. The β coefficient does become negative but is insignificant. Population growth exerts a significant negative effect on State per capita income growth in both samples of regions (see also Adabar, 2004; Nayyar, 2008; Chikte, 2011). The population pessimists seem to be right! The extension of credit to the private sector exerts a significant positive impact in both samples of regions. The male literacy rate seems to have no significant effect, nor does the share of State expenditure in State GDP. Lastly, the economic structure of regions matters. Regions with higher shares of agriculture grow slower which is in accordance with expectations; although the variable is only significantly negative at the 90 per cent confidence level in the sample excluding the four rich States (see also Ghosh, 2010). Overall the regression equations explain a high proportion of the variance in the growth of per capita GSDP of the regions of India, and all the diagnostic tests are met.

Table 5: Tests for Conditional Convergence.

	Constant	B	pop	literacy	credit	%agric	%statexp	r^2
Regression 1 (Full Sample)	4.83	+0.43	-1.08	-0.007	+0.005	-0.083	-0.039	0.51
	(0.58)	(0.25)	(2.11)**	(0.15)	(3.08)*	(2.32)**	(1.43)	
Diagnostic Tests	Functional Form : F = 1.16 : P = 0.35							
	Heteroskedasticity : Chi2(1) = 0.86 : P = 0.35							
	Normality : W = 0.98 : P = 0.81							
Regression 2 (excluding 4 regions)	14.76	-2.30	-1.25	+0.008	+0.005	-0.062	-0.034	0.53
	(1.77)***	(1.23)	(2.46)**	(0.18)	(3.33)*	(1.85)***	(1.38)	
Diagnostic Tests	Functional Form: F = 0.40 : P = 0.76							
	Heteroskedasticity : Chi2(1) = 0.55 : P = 0.45							
	Normality : W = 0.97: P = 0.68							

Notes: The numbers in parentheses are t-statistics. ***, ** and * represent statistical significance at the 10%, 5% and 1% levels. Functional form is measured by the Ramsey RESET test. Heteroskedasticity is measured by the Breusch-Pagan Test. Normality is measured by Shapiro-Wilk W test. P>0.05 accepts the hypothesis of no omitted variables; no heteroskedasticity and residuals normally distributed.

Sigma (σ) Convergence/Divergence

We know that β convergence is not a sufficient condition for the standard deviation (SD) or coefficient of variation (CV) of regional per capita incomes to converge because of random shocks. We also know that conditional β convergence is not a sufficient condition for σ convergence because the steady-state levels of per capita income may diverge through time. We need to estimate directly the evolution of the SD and CV of Gross State Domestic Product per capita across our sample of 32 regions. As well as calculating for the whole sample of regions, we also split the regions into three sub-groups based on their initial GSDP per head to see whether the same trends are apparent in the rich, middle, and poor income groups. Group 1 includes regions with initial per capita income over 25,000 rupees; group 2 includes regions between 15,000 and 25,000 rupees, and group 3, regions with less than 15.000 rupees per head. The evolution of the SD and CV for all four samples are shown in Figures 2 and 3.

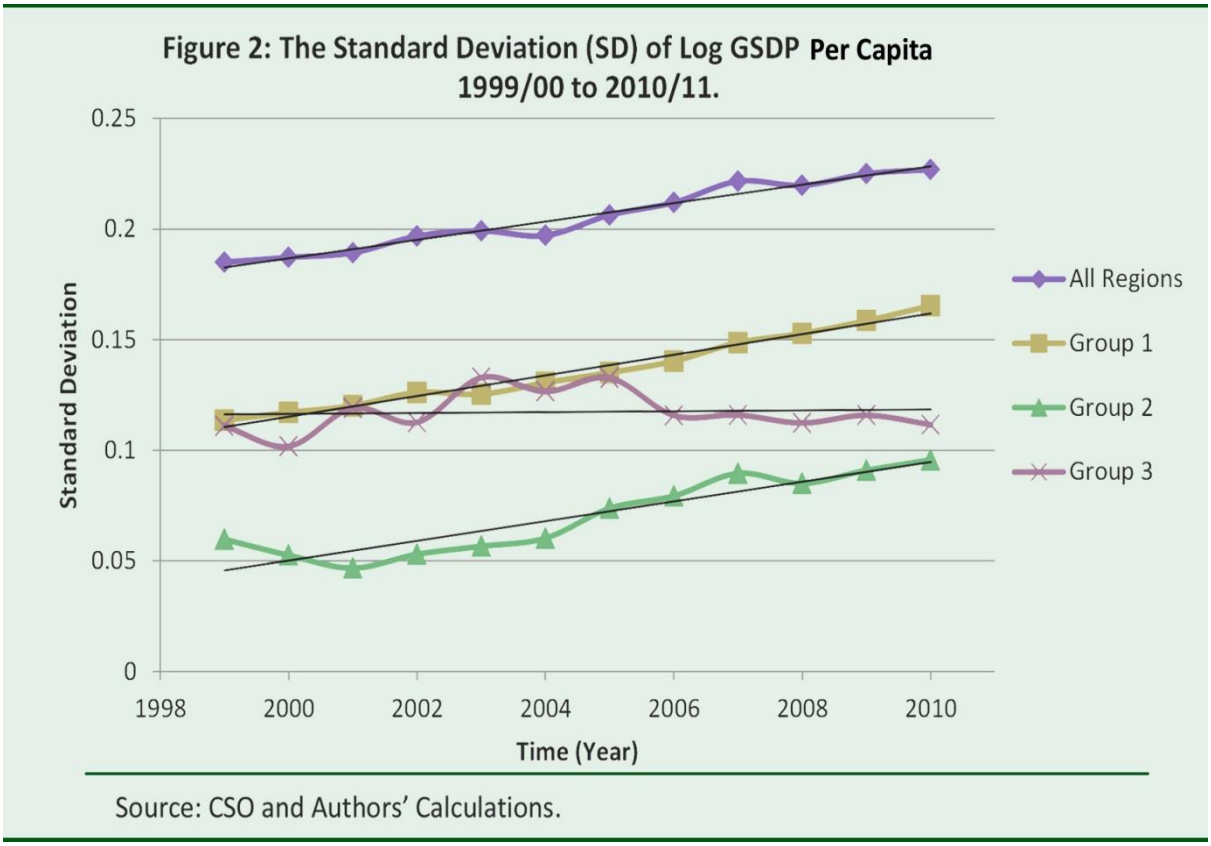
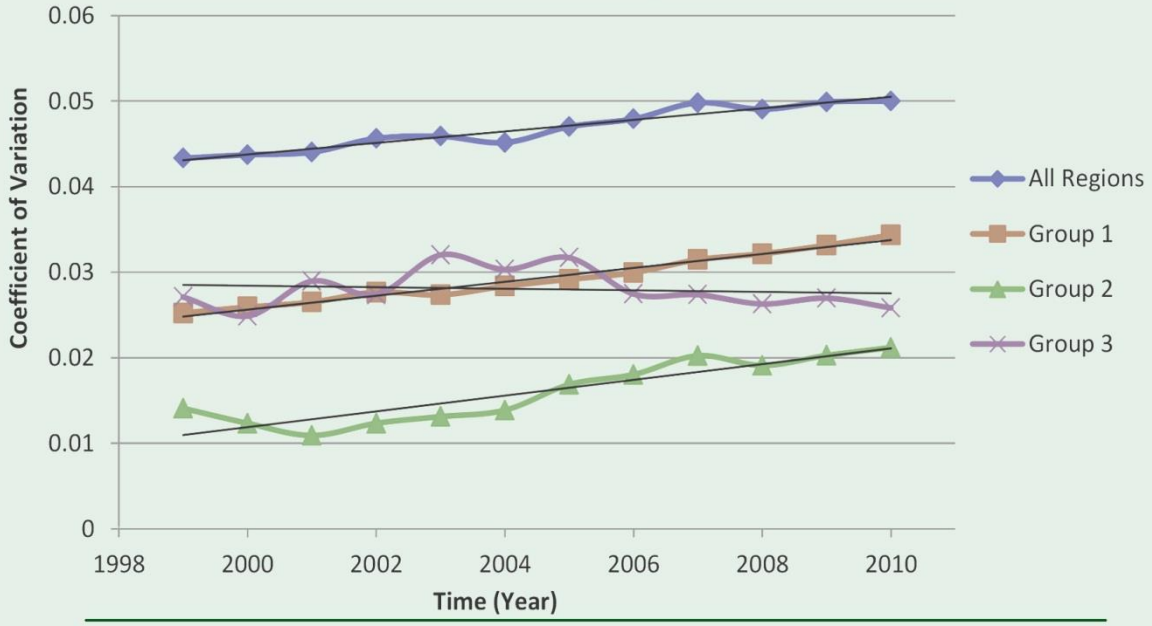


Figure 3: The Coefficient of Variation (CV) of Log GSDP per Capita 1999/00 to 2010/11.



Source: CSO and Authors' Calculations.

The fitted linear time trends to the data in Figures 2 and 3 are shown in Table 6

Table 6: Linear Trends of the Standard Deviation (SD) and Coefficient of Variation (CV) from 1999/00 to 2010/11 for all Regions and Groups of Regions.

	Standard Deviation (SD)		Coefficient of Variation (CV)	
All Regions	$SD = 0.1785 + 0.0041t$ $(97.01)^{*}\ \ (16.58)^{*}$	$R^2 = 0.96$	$CV = 0.0424 + 0.0005t$ $(105.28)^{*}\ (12.31)^{*}$	$R^2 = 0.94$
Group 1	$SD = 0.1058 + 0.0047t$ $(62.27)^{*}\ \ (20.20)^{*}$	$R^2 = 0.98$	$CV = 0.0240 + 0.0008t$ $(82.85)^{*}\ \ (20.68)^{*}$	$R^2 = 0.98$
Group 2	$SD = 0.0143 + 0.0044t$ $(9.62)^{*}\ \ (7.62)^{*}$	$R^2 = 0.85$	$CV = 0.0100 + 0.0009t$ $(10.33)^{*}\ \ (7.00)^{*}$	$R^2 = 0.82$
Group 3	$SD = 0.1160 + 0.0002t$ $(19.56)^{*}\ \ (0.25)$	$R^2 = 0.01$	$CV = 0.0286 - 0.0001t$ $(19.73)^{*}\ (-0.46)$	$R^2 = 0.02$

Notes: The numbers in parentheses are t-statistics. $*$ represents statistical significance at the 1% level.

Source: Authors' Calculations.

For both the SD and CV, the time trend for the whole sample, and for group 1 and 2 regions, is significantly positive, but not for the poorest group of regions. The rise in σ inequality has been driven by the increase in inequality in the middle and rich income regions. The poor regions with GSDP below 15,000 rupees, listed in Table 2 (p.9), seem to be part of a club which has been moving away from the rest of India, but which has not experienced widening differences between them (see also Ghosh, 2010). Bandyopadhay (2011), in his study of

income disparities across States over an earlier period 1965 to 1997, identifies two convergence clubs – one in regions with GSDP per capita at 125 per cent of average income; the other in regions with GSDP per capita at 50 per cent of average income. In our case, the poor regions' club consists of Rajasthan, Manipur, Nagaland, Madhya Pradesh, Chhattisgarth, Assam, Jharkhand, Orissa, Uttar Pradesh and Bihar. Structurally, poor States bear many similarities, particularly a low industrial base, a low productivity agricultural and service sector, and poor health and education.

Conclusion

In this paper we have found that in the first decade of the twenty-first century, regional differences in gross State domestic product per head in India have continued to widen, as they did in previous decades. This is much more supportive of non-orthodox, non-equilibrium models of the growth and development process than neoclassical equilibrium theory. There is no evidence of unconditional beta convergence across the thirty-two States we have taken covering 99.95 per cent of the population; there is weak evidence of conditional beta convergence if the four richest regions are excluded from the sample, and there is no evidence of the dispersion of incomes narrowing except between the poorest regions with an income per head of less than 15,000 rupees. From the conditioning variables we have used here, a necessary condition for regional convergence to take place would be less dependence on agriculture in the poorest States; a lower rate of population growth in poorer regions, and a higher rate of investment in the slow growing regions. No doubt other factors are also important, including more active regional policy by the central government, but without a significant change in policy the process of cumulative causation, as first outlined by Gunnar Myrdal, is likely to continue to widen income disparities across the regions of India. This bodes ill for the large fraction of the Indian population in the poorest States whose wretched quality of life has been graphically illustrated by Jean Dreze and Amartya Sen in their powerful new book *An Uncertain Glory : India and its Contradictions* (2013).

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APPENDIX 1

Data Used in Regressions

State\Union Territory* (UT)	log of 1999/00 per capita GSDP	Population Growth (%)	Average Male Literacy Rate	Average Share of Agriculture	Change in Credit (%)	Average State Expenditure in GSDP
Andaman and Nicobar Islands *	4.68	0.64	88.22	23.15	692.31	42.34
Andhra Pradesh	4.67	1.06	72.94	23.72	713.16	6.20
Arunachal Pradesh	4.61	2.33	68.76	26.73	931.41	30.27
Assam	4.53	1.58	75.05	28.85	484.73	4.72
Bihar	4.45	2.26	66.54	30.87	452.21	6.64
Chandigarh*	4.42	1.59	88.34	0.78	410.89	3.13
Chhattisgarh	4.41	2.06	79.41	20.85	612.06	7.45
Delhi*	4.39	1.92	89.18	0.97	573.18	6.42
Goa	4.37	0.79	90.62	9.13	352.88	6.85
Gujarat	4.34	1.77	83.45	15.90	495.93	5.15
Haryana	4.34	1.83	81.94	24.41	805.42	3.99
Himachal Pradesh	4.34	1.21	88.09	22.08	563.92	8.00
Jammu & Kashmir	4.29	2.15	72.43	28.91	256.99	11.76
Jharkhand	4.25	2.04	72.88	13.86	443.87	5.77
Karnataka	4.23	1.47	79.48	20.56	551.06	8.89
Kerala	4.23	0.48	95.13	17.21	458.88	3.55
Madhya Pradesh	4.22	1.87	78.30	24.96	397.12	10.76
Maharashtra	4.12	1.50	87.90	13.51	487.49	3.29
Manipur	4.20	1.72	83.01	26.36	599.08	16.31
Meghalaya	4.19	2.48	71.30	21.26	552.47	11.74
Mizoram	4.18	2.07	92.22	17.34	803.19	24.13
Nagaland	4.18	-0.05	77.23	58.14	907.88	12.03
Orissa	4.18	1.32	78.88	23.29	561.06	5.36
Puducherry*	4.16	2.48	90.37	5.08	623.90	14.41
Punjab	4.15	1.30	78.36	33.44	455.52	3.47
Rajasthan	4.20	1.96	78.11	27.64	656.36	6.59
Sikkim	4.13	1.17	81.67	19.62	863.64	28.82
Tamil Nadu	4.12	1.46	84.62	13.23	529.72	4.21
Tripura	4.11	1.39	86.60	24.70	569.63	9.60
Uttar Pradesh	4.07	1.85	74.03	30.39	454.65	5.18
Uttarakhand	4.03	1.77	85.81	21.40	528.55	9.89
West Bengal	3.79	1.31	79.85	25.64	468.81	2.79

APPENDIX 2

Data Sources

Variable	Source
Income per capita	Income is measured as gross state domestic product (GSDP) at 1999/00 prices. Data from the Central Statistical Organisation (CSO), Government of India. GSDP per Capita calculated by dividing GSDP by population.
Growth of Income per capita	Growth of Income per capita is the average annual growth of income per capita over the period.
Population Growth	Population data from 2011 Censuses, released April 2011.
Male Literacy Rate	Male literacy rate data from 2011 censuses, released April 2011. An average over the period is used.
Share of agriculture and allied sectors in Gross State Domestic Product	Data on GSDP of agriculture and allied sectors (include Agriculture, Forestry & logging and Fishing) from the CSO, Government of India. Base Year 1990/00. Share calculated by dividing the GSDP of agriculture and allied sectors by GSDP, multiplying by 100. Average over period is used. Data only available from 1999/00 to 2009/2010.
Outstanding credits extended by all Scheduled Commercial Banks (SCBs)	Data From the Reserve Bank of India. Percentage change over period is used.
State government expenditure as a percentage of GSDP	Data From Datebook, Planning Commission, Government of India, 18 May 2011. An average over the period is used.