Growth in India's States in the First Decade of the 21st Century: Four Facts

UTSAV KUMAR, ARVIND SUBRAMANIAN

This paper is the first attempt at examining the growth performance across Indian states during 2001-09, a period also marked by the global financial crisis. We report four key findings. First, consistent with the fact that the decade was the best one for Indian macroeconomic performance, growth increased across almost all major states in 2001-09 compared to 1993-2001. Second, nevertheless, we continue to see the phenomenon of divergence or rising inequality across states: on average the richer states in 2001 grew faster in 2001-09. Third, during the crisis years of 2008 and 2009, states with the highest growth in 2001-07 suffered the largest deceleration. Since high growing states were also the most open, it seems that openness creates dynamism and vulnerability. Finally, although the demographic dividend – a young population boosting economic dynamism – was evident before 2000, there is little evidence that there was any dividend in the 2000s. Demography alone cannot be counted on for future economic growth.

Utsav Kumar (*kumarutsav@gmail.com*) is an economist and Arvind Subramanian (*asubramanian@piie.com*) is at the Peterson Institute for International Economics and Center for Global Development, Washington DC, the United States.

1 Introduction and Literature Review

Posting a growth of income per capita of 6.1% per annum during the first decade of this millennium (2001-09, hereafter the "noughties"), India seems to have put even more distance from its "Hindu" growth past – a reference to the anaemic growth seen from Independence in 1947 to the late 1970s. The growth rate of income per capita almost tripled from 1.5% during 1951-81 to 4.2% during 1981-2009.[1, 2] Within the latter period, growth accelerated from 2.8% in the 1980s to 4.2% in the 1990s and then surged to 6.1% in the noughties. India now has three decades of respectable growth performance behind it, a point that is often obscured by the near-universal tendency to equate India's growth turnaround with the policy turnaround that occurred in 1991.

Despite this performance and despite starting ahead of China in the late 1970s in terms of per capita GDP (measured in purchasing power parity terms), India's per capita GDP was still only half that of China in 2009. China's GDP per capita grew almost twice as fast as India's (8.2% versus 4%) between 1979 and 2009.

India's growth performance, especially across the states within the country, since the take-off in the late 1970s/early 1980s has been the subject of considerable research interest, including by Ahluwalia (2000), Besley and Burgess (2004), DeLong (2004), Williamson and Zagha (2002), Rodrik and Subramanian (2005), Kochhar et al (2006), Aghion et al (2008), Amin and Mattoo (2008), Panagariya (2008), Ghani (2010), Kumar (2010), Aiyar and Mody (2011). Different authors emphasise different aspects of growth performance.

DeLong (2004) and Rodrik and Subramanian (2005) emphasise the fact that growth took off a decade before policy reforms were seriously initiated in 1991; Amin and Mattoo (2008) stress the role of human capital and institutions in explaining services sector performance. Besley and Burgess (2004) argue that differential labour market regulation was a driver of interstate growth performance.[3] Aghion et al (2008) find that the effects of delicensing were unequal across states – industries in states with employer-friendly labour regulations grew faster than those in states with pro-worker labour regulations. Kumar (2010) and Aiyar and Mody (2011) highlight the role of demographic change in explaining the differential performance of states while Kochhar et al (2006) draw attention to the initial conditions and diversification achieved in manufacturing in explaining interstate differentials. Ghani (2010) focuses on the dynamism of the service sector. Lahiri and Yi (2009) compare the economic performance of two states – Maharashtra and West Bengal – and provide evidence that suggests a worsening of business climate in West Bengal between 1960 and 1993.

But all these papers cover the period until 2000. This paper, to the best of our knowledge, represents the first attempt to compare growth performance across states during the most recent decade, the first of this millennium. We present below some key stylised facts about interstate growth performance and establish their robustness with supporting evidence. In particular we establish four facts which are then discussed in detail in Section 2.

(a) Growth in the main states, except three, increased in 2001-09 compared to 1993-2001.

(b) Despite the strong performance of the hitherto laggard states, we do not find any convergence across states. On the contrary, we find that divergence in the growth performance across states continues.

(c) States with the highest growth in the pre-crisis years, 2001-07, suffered the largest deceleration during the crisis years (2008 and 2009).

(d) For the period 2001-09 we do not find any positive effect of the so-called demographic dividend, namely, that the growth in the share of the working-age group in total population boosts growth of per capita income.

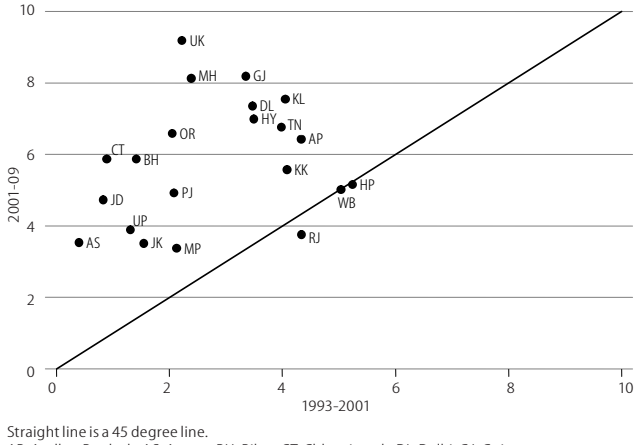
2 Growth in the 2000s: Stylised Facts

Using data on the 21 largest Indian states, we summarise growth patterns across the states during the period 1993-2009. During the period under study, three new states were carved out of three existing states in 2000. These are Jharkhand (out of Bihar), Chhattisgarh (out of Madhya Pradesh) and Uttarakhand (out of Uttar Pradesh). State-level domestic product data for the new states prior to 2000 is available only till 1993. The choice of the time period under study in this paper is therefore dictated by the availability of data. In those instances when we take the analysis further back than 1993, we use data for the old (and larger) states.

Stylised Fact 1: Growth Increased in Most States

Chart 1 plots the income per capita growth rate for the 21 largest states for two time periods – between 1993 and 2001 (on the horizontal axis, this period will hereafter also be referred to as the "nineties") and during 2001 and 2009 (on the vertical axis). The chart shows that all the states, with the exception of Himachal Pradesh, Rajasthan, and West Bengal, lie above the 45 degree line, i e, their growth in the 2000s was substantially greater than in the 1990s. Indeed, average growth across the 21 states doubled from 2.8% in the 1990s to 5.8% in the 2000s. Table 1 shows the growth rate in the 21 states for the period 1993 to 2009 and the sub-periods. The largest improvements were posted by Uttarakhand (7.0 percentage points), Maharashtra (5.8 percentage points) and Chhattisgarh (5 percentage points) with Gujarat, Orissa and Bihar not far behind. The figure provides a clue both to the long-standing success of the Left Front in West Bengal and its unseating in the 2011 elections: West Bengal was one of the strongest performers in the 1990s but was one of the few states whose growth remained unaffected in the 2000s while others surged.[4]

Chart 1: Average Growth of Net State Domestic Product Per Capita (NSDPpc)
(in %, 1993-2001 and 2001-09)



Straight line is a 45 degree line.
AP-Andhra Pradesh, AS-Assam, BH-Bihar, CT-Chhattisgarh, DL-Delhi, GJ-Gujarat, HP-Himachal Pradesh, HY-Haryana, JD-Jharkhand, JK-Jammu & Kashmir, KK-Karnataka, KL-Kerala, MH-Maharashtra, MP-Madhya Pradesh, OR-Orissa, PJ-Punjab, RJ-Rajasthan, TN-Tamil Nadu, UK-Uttarakhand, UP-Uttar Pradesh, WB-West Bengal.
Source: CSO and authors' calculations.

Table 1: Net State Domestic Product Per Capita Growth Rates in States (%)

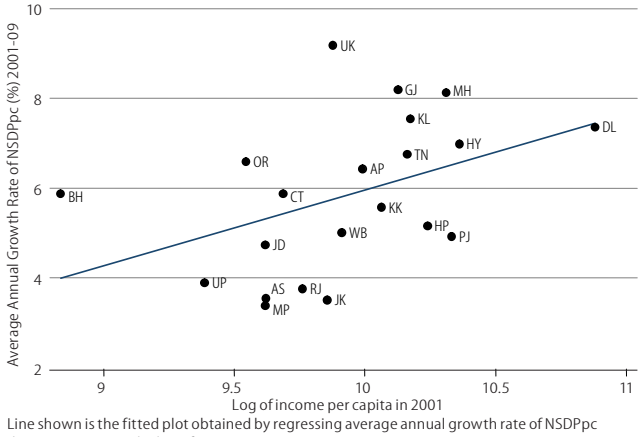
State	1993-2001	2001-09	1993-2009	2001-07 Pre-crisis	2007-09 Crisis Years
Main states					
Andhra Pradesh	4.33	6.43	5.38	7.11	4.38
Assam	0.40	3.53	1.97	2.90	5.42
Bihar	1.41	5.86	3.64	5.01	8.43
Chhattisgarh	0.89	5.87	3.38	5.89	5.80
Delhi	3.47	7.35	5.41	7.29	7.53
Gujarat	3.36	8.19	5.77	8.65	6.81
Haryana	3.50	6.98	5.24	6.84	7.43
Himachal Pradesh	5.24	5.15	5.20	5.82	3.14
Jammu and Kashmir	1.55	3.50	2.52	3.29	4.12
Jharkhand	0.83	4.73	2.78	5.15	3.46
Karnataka	4.09	5.57	4.83	6.69	2.20
Kerala	4.05	7.54	5.80	7.57	7.48
Madhya Pradesh	2.13	3.37	2.75	2.61	5.63
Maharashtra	2.38	8.13	5.26	8.71	6.39
Orissa	2.05	6.58	4.32	6.98	5.39
Punjab	2.09	4.92	3.50	4.67	5.67
Rajasthan	4.34	3.75	4.04	3.80	3.60
Tamil Nadu	3.99	6.75	5.37	7.03	5.92
Uttar Pradesh	1.31	3.88	2.59	3.64	4.58
Uttarakhand	2.23	9.18	5.71	9.94	6.93
West Bengal	5.04	5.00	5.02	4.78	5.67
Average growth of main states	2.79	5.82	4.31	5.92	5.52
Other states					
A & N Islands	1.10	8.15	4.62	8.59	6.83
Arunachal Pradesh	2.46	5.34	3.90	3.79	10.00
Chandigarh	5.67	8.49	7.08	9.13	6.57
Goa	4.40	7.28	5.84	6.61	9.29
Meghalaya	4.22	3.01	3.61	2.97	3.13
Pondicherry	10.56	3.13	6.85	2.99	3.58
Sikkim	2.88	6.19	4.53	6.05	6.60
Tripura	6.81	5.85	6.33	5.47	6.98
Average growth of all states	3.34	5.85	4.59	5.86	5.83

Source: CSO and authors' calculations.

Stylised Fact 2: Divergence across States Continues

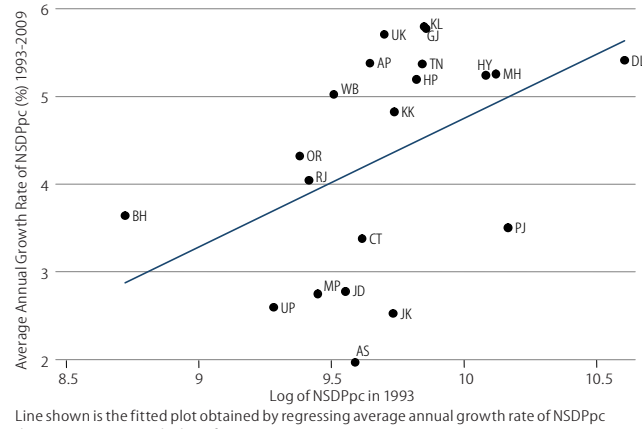
A remarkable feature of the growth performance during the 2000s was the strong performance of the hitherto laggard states. Bihar, Chhattisgarh, Orissa and Uttarakhand recorded some of the highest improvements between 2001 and 2009 vis-à-vis the

Chart 2: Growth during 2001-09 and Income in 2001



Line shown is the fitted plot obtained by regressing average annual growth rate of NSDPpc during 2001-09 on the log of NSDPpc in 2001.
Source: CSO and authors' calculations.

Chart 3: Growth during 1993-2009 and Income in 1993



Line shown is the fitted plot obtained by regressing average annual growth rate of NSDPpc during 1993-2009 on the log of NSDPpc in 1993.
Source: CSO and authors' calculations.

previous eight year period 1993-2001. So did the "gale winds of divergence" noted by Rodrik and Subramanian (2005) and Kochhar et al (2006) change direction and become forces for convergence during the 2000s?

Chart 2 provides initial evidence on this question. It plots the growth rate of the states for the period 2001-09 against the income per capita in 2001. If there is convergence with the income level of the richer states, the relationship should be downward sloping. But, as Chart 2 shows, richer states on average grew faster so that the inequality across states is actually increasing. We find that far from changing directions the forces of divergence continue. The strong growth performance of the laggard states should not obscure the more general pattern that across the Indian states, we still do not see the phenomenon of convergence, whereby the poorer states, by virtue of growing faster than the richer states, start catching up with the latters' level of income.

What happens if we change the time period to 1993-2009 to see if there is convergence over a longer period of time? Chart 3 shows us the results. We find that states with a higher per capita income in 1993 grew faster over the next 16 years. In other words, we do not find any evidence of convergence over a shorter or a longer period.

We formally investigate the question of convergence and divergence in cross-state growth performance by estimating a standard growth convergence regression equation using state-level data. In this framework, average annual growth rate of income per capita over the period 2001-09 is regressed on the logarithm of initial income per capita in 2001. Results from the estimation exercise are shown in Table 2. Column 1 shows the results for the period 2001-09. We find that the coefficient on the log of initial income

Table 2: Unconditional Convergence Regressions for Main States (1993-2009)

	Dependent Variable Is Growth Rate of Income Per Capita during					
	2001-09	1993-2009	1993-2001	2001-09	1993-2009	1993-2001
	New States			Old States		
	(1)	(2)	(3)	(4)	(5)	(6)
Log of initial income per capita	1.69** (0.75)	1.47*** (0.47)	1.13** (0.47)	2.02*** (0.68)	1.60*** (0.46)	1.07 (0.71)
Constant	-10.94 (7.51)	-9.92** (4.60)	-8.13* (4.60)	-14.43* (6.88)	-11.18** (4.43)	-7.41 (6.99)
Observations	21	21	21	18	18	18
R-squared	0.18	0.20	0.09	0.29	0.23	0.08
States	Main	Main	Main	Main	Main	Main

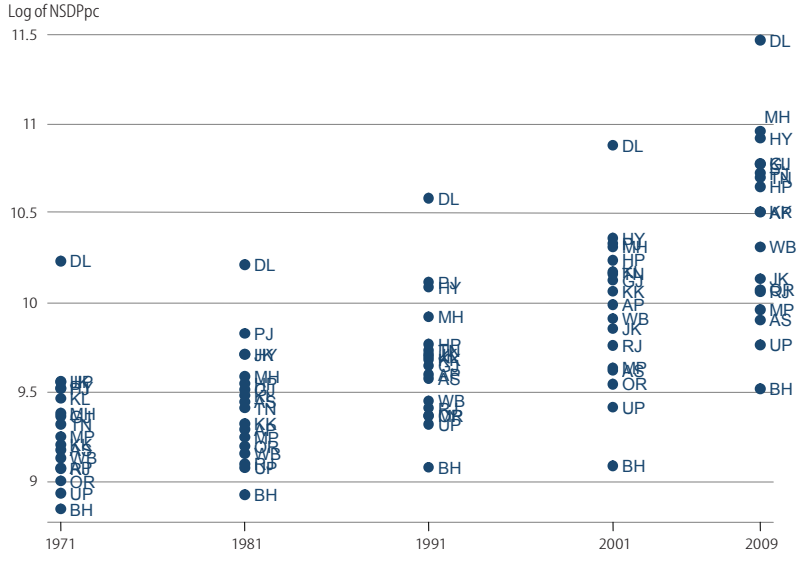
Robust standard errors in parentheses.
*, **, *** denotes statistical significance at 10%, 5%, and 1% respectively.
Source: Authors' calculations.

Table 3: Convergence and Divergence (1971-2009)

	OLS			Difference GMM		System GMM	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log of initial GDP per capita	2.910*** (0.634)	-0.669 (0.683)	-4.102* (2.161)	-8.613 (9.475)	-4.602 (6.243)	-0.773 (0.522)	-0.797 (0.591)
Log of initial GDP per capita* dummy for the 1980s		1.342 (1.182)	1.166 (1.092)	1.191 (0.880)	1.518 (1.086)	2.400** (0.967)	2.099* (1.039)
Log of initial GDP per capita* dummy for the 1990s		1.878* (1.055)	1.678 (1.313)	1.737 (1.047)	1.729 (1.037)	2.348** (0.870)	2.215** (0.995)
Log of initial GDP per capita* dummy for the 2000s		2.691** (1.028)	2.830** (1.097)	3.101* (1.506)	2.751*** (0.877)	1.931*** (0.598)	2.491** (0.888)
State FE	No	No	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	72	72	72	54	54	72	72
Number of groups				18	18	18	18
No of instruments				9	8	14	11
Lag length				All	Two	All	One
Collapsed instruments				No	No	No	No
Arellano-Bond test for AR(2) in first differences (p value)				0.76		0.17	0.11
Hansen test of joint validity of instruments (p value)				0.16	0.09	0.30	0.40
Difference-in-Hansen tests All-system GMM instruments (p value)						0.32	\
Those based on lagged growth only (p value)						0.80	0.94
Total effect for the 2000s: Log of Initial GDP per capita+ (Log of Initial GDP per capita* Dummy for the 2000s)=0 (p value)		0.01	0.46	0.51	0.75	0.02	0.02

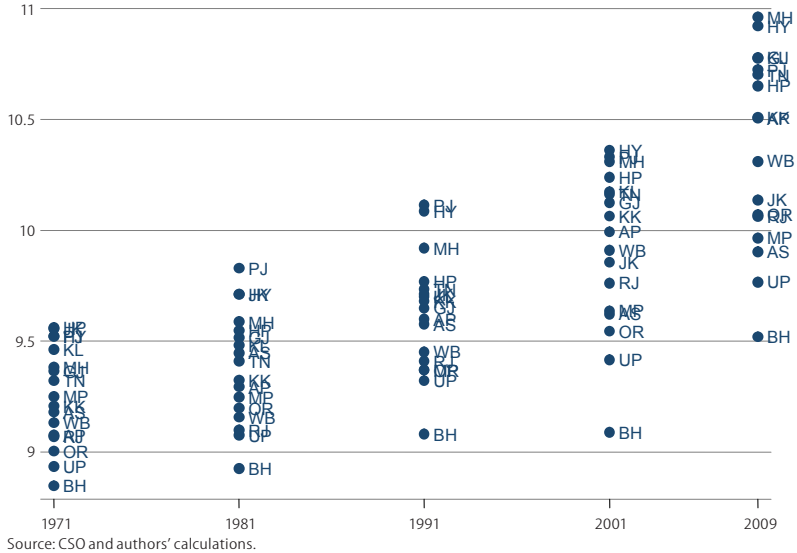
Robust standard errors reported in parentheses.
*, **, *** denotes statistical significance at 10%, 5%, and 1%, respectively. Only the main states are used. New states are combined with the respective state they were created from for the period 2001-09, i e, the old definition of states is used.
Source: Authors' calculations.

Chart 4A: Real Net State Domestic Product Per Capita (1993-2009) (2004-05 prices)



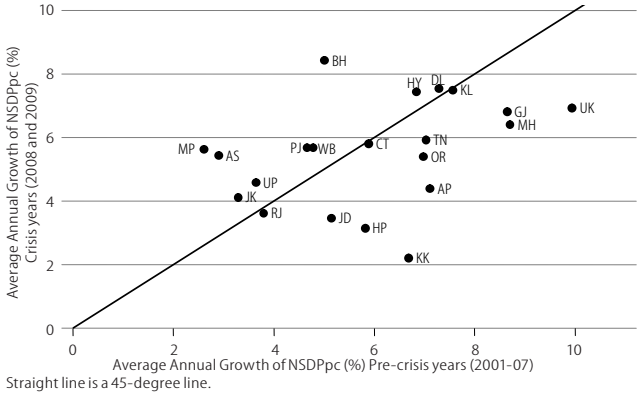
Source: CSO and authors' calculations.

Chart 4B: Real Net State Domestic Product Per Capita (1993-2009) (2004-05 prices)



Source: CSO and authors' calculations.

Chart 5: Growth before and during the Crisis



Straight line is a 45-degree line.

Source: CSO and authors' calculations.

per capita is positive and statistically significant, indicating divergence across states over the period 2001-09. This corroborates the result shown in Chart 2. In column 2, we repeat the exercise for growth over the period 1993-2009 and find that the coefficient on the log of initial income per capita is positive and statistically significant. If we repeat the estimation for the period 1993-2001, we again find that the coefficient on the log of initial income per capita is positive and statistically significant (column 3).

Note that the magnitude of divergence has also increased in the noughties relative to the 1990s. The convergence coefficient was 1.1% for the latter and 1.7 for the former, a difference of almost 55%. For two states, whose levels of per capita income are different by 1 log point in 2009 such as Haryana and Assam; the richer state, Haryana, will grow faster on average by 1.7% per year. That is a truly striking magnitude of difference.

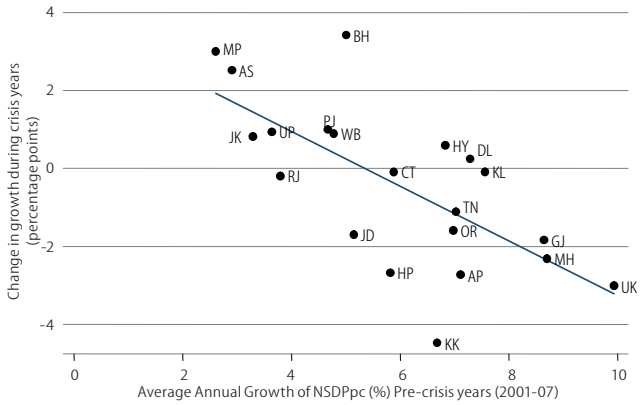
Estimates shown in columns 1-3 are based on 21 states which include the newly formed states in 2000 as well. Since the new states were formed only in 2000, a relevant question is: how do the above results change if the definition of the old states were used for the post-2000 period? In other words, the new states are considered together with their respective parent state.[5] This leaves us with only 18 main states. We find that the initial income per capita is positive and statistically significant for 2001-09 (column 4) and 1993-2009 (column 5) but is positive and insignificant for the period 1993-2001. Appendix Table 1 shows the results for all the states. We find that broadly our results continue to hold.

We also check if the divergence result that we find in the 2000s is due to the time period chosen, i e, 2001-09. We repeat the regression in Table 2 for growth during the period 2004-09. Results from this regression are shown in Appendix Table 2. We find that the coefficient on the log of initial income in 2004 is even more positive for comparable samples.

Kochhar et al (2006) find that divergence accelerated in the 1990s. In this paper, we present evidence that the pattern of divergence continued to intensify in the 2000s. We have already shown that, using cross-sectional unconditional convergence regressions, the pattern of states growing far apart continued in the 2000s. Next we examine whether this pattern of divergence is a new phenomenon or holds over a longer period of time as well. To do so we construct a 10-year panel from 1971-2009 (the last time period is 2001-09) for 18 states (old states used because there is no data for new states prior to 1993). We then estimate unconditional convergence regressions using OLS and conditional convergence regressions using both OLS and GMM. Results from this estimation are shown in Table 3 (p 50).

In column 1, we regress the average annual growth rate of income per capita on the log of initial income per capita at the beginning of each period without any state or time fixed effects and find that the coefficient on the log of initial income per capita is positive and statistically significant showing unconditional

Chart 6: Pre-crisis Growth and Change in Growth during the Crisis Years



Straight line is fitted line obtained by regressing change in average annual growth during crisis years on average growth during pre-crisis years.
Change in growth during crisis years is the percentage point change in average growth during crisis years (2008 and 2009) minus average growth during pre-crisis years (2001-07).
Source: CSO and authors' calculations.

Change in Growth during Crisis Years and Share of Manufacturing in NSDP

Chart 7A

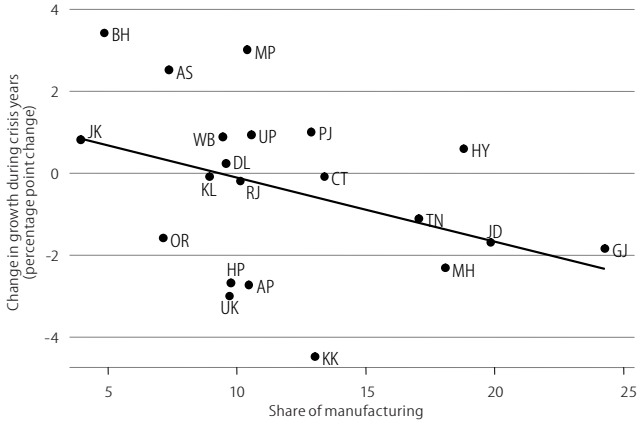
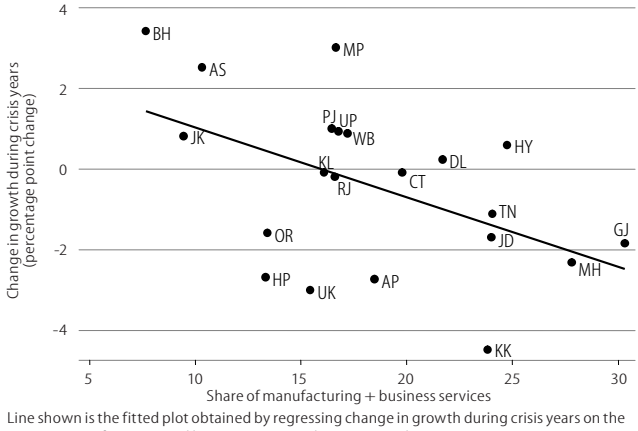


Chart 7B



Line shown is the fitted plot obtained by regressing change in growth during crisis years on the average manufacturing and business services share in NSDP during 1998-2002.
Source: CSO and authors' calculations.

divergence on average for the whole period of 1971-2009. In columns 2 and 3, we examine if there is any difference in the strength of divergence in each successive decade. To do so, the log of initial income per capita is interacted with the respective decadal dummy. In column 2 we have only time fixed effects and in column 3 we have both time and state fixed effects. The coefficient on the log of initial income per capita is negative – statistically insignificant in column 2 and significant in column 3. Coefficients on the interaction of the log of initial income per capita with the period dummies (columns 2 and 3) show that the interaction term has a higher coefficient in each successive period implying that the pattern of divergence has accelerated in each successive decade, showing that richer states continue to grow faster.

In columns 4 to 7, we report estimates obtained using difference GMM and system GMM approaches.[6] The significance of the coefficient on the log of income per capita varies with the estimation method used (Table 3 and Appendix Table 3, p 56). Once again what we are most interested in is the coefficient on the interaction of the log of income per capita for each successive period and how it evolves over time. Except column 6, the coefficient on the interaction of the log of initial income per capita with the decadal dummies is the highest for the most recent period (2001-09) showing that divergence gained further momentum in the 2000s.[7,8]

Another way of looking at the divergence across states is to plot the distribution of per capita income over time. Chart 4A (p 51) shows the distribution at different times during 1971-2009. Chart 4B (p 51) shows the distribution without Delhi. The plot confirms that per capita incomes have increased in all states, including the laggard ones. See for example, Bihar (BH) whose per capita income is trending up but is still at the bottom of the distribution. On the other hand states like Delhi (DL), Haryana (HY) and Maharashtra (MH) continue to be at the top of the income distribution. This conforms to the divergent nature of growth during 2000s. Punjab (PJ) which was among the top states in 1991 was overtaken by other states during 1991-2009.

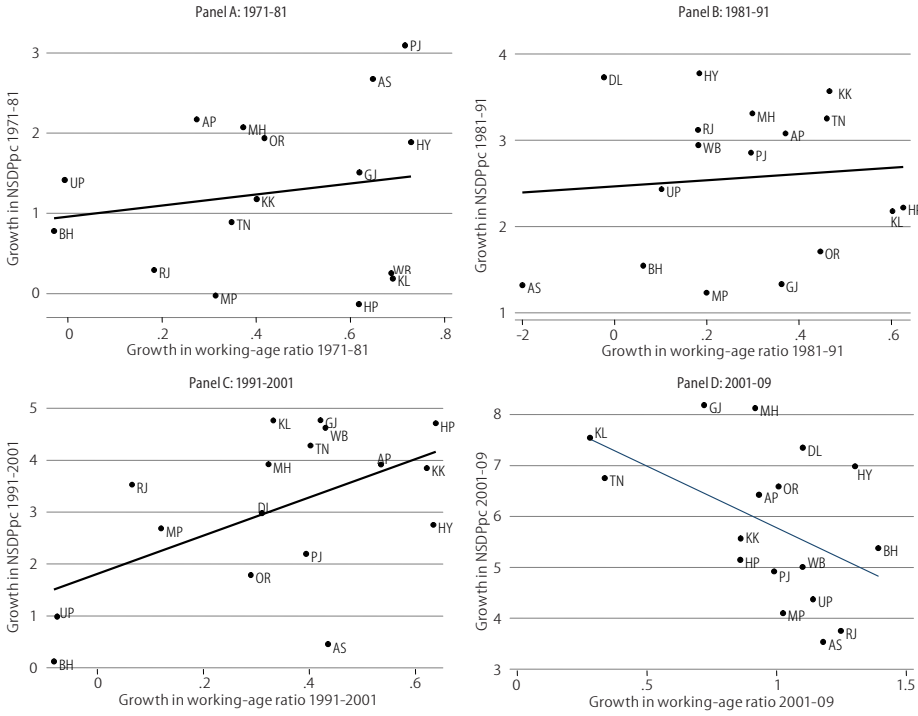
Stylised Fact 3: Faster Growing and More Globalised States Took a Bigger Hit during the Crisis

Since the major policy turnaround in 1991, Indian economy has become increasingly integrated with the global markets through the trade and the finance channels. India's trade-to-GDP ratio, a measure of trade openness, increased from 20% in 1993 to 45% in 2007 (*World Development Indicators*). The ratio of foreign assets and liabilities to GDP, a measure of financial integration with the global economy, increased from 43% in 1993-94 to 85% in 2007-08 (Lane and Milesi-Ferretti 2007). The crisis of 2008-10 highlighted the vulnerability that is the flip side of the dynamism that globalisation has engendered: growth declined in, and capital fled from, India, as in most other countries, albeit to a lesser extent. But the question remained as to which states were more dependent on foreign markets and hence more susceptible to a downturn as conditions abroad faltered.

Average growth across the main states slowed down from 5.92% (Table 1) during the pre-crisis years (2001-07) to 5.52% during the crisis years (2008 and 2009). Average across all the states shows that growth during the pre-crisis and the crisis years were essentially the same. But the question remains if there was any differential in the growth performance across states during the crisis years and which states took a bigger hit.

Chart 5 (p 51) shows that out of 21 states, nine states experienced a slowdown during the crisis years compared to the pre-crisis years, eight states had a higher growth during the crisis years, and the remaining four had nearly the same performance in the

Chart 8: Growth in the Share of the Working Age Population and Growth of Income Per Capita



Source: CSO, Census of India, and authors' calculations. Line shown is the fitted plot obtained by regressing average annual growth of NSDPpc during a decade on the average annual growth in the working-age ratio during the same decade.

crisis years as in the pre-crisis period. Further, we find that states with the highest growth during the pre-crisis years were the ones which registered greater decline in growth during the crisis years (Chart 6, p 52). Our analysis shows, unsurprisingly, that Karnataka, with Bangalore as the globalised IT-hub of India fared the worst with a dramatic growth drop of about 4.4 percentage points during the crisis. Andhra Pradesh and Maharashtra also saw a decline in growth of about 2-3 percentage points. Gujarat and Tamil Nadu experienced smaller declines.

Could it be the case that states that were the most open or globalised before the crisis were affected the most during the crisis? We cannot easily measure the degree to which each state trades internationally but we can estimate crudely how tradable is the economic profile of each state. Since manufacturing and business services tend to be highly tradable, we use these – specifically, the share of manufacturing and the share of manufacturing and business services in total state output – as proxies for the openness of each state.[9] We then plot this share against the change in growth during the crisis. These plots are shown in Charts 7A (p 52) (where manufacturing share in output is the proxy for openness of a state) and 7B (p 52) (where the share of manufacturing and business services combined is the proxy for openness). They show a clear negative correlation. Karnataka, Maharashtra, Tamil Nadu and Gujarat are among the most open states and they also experienced the greatest growth declines. In contrast, Bihar, Jammu and Kashmir and Assam, which produce relatively few tradable goods were the most resilient during the crisis.[10]

Of course, there are likely to be a multiplicity of factors at work which precludes drawing any clear causal conclusions, but the simple correlations seem to be consistent with globalisation conferring dynamism and stoking growth but at the same time inducing vulnerability.

Stylised Fact 4: Demographic Dividend Seems To Be Disappearing

Bloom and Williamson (1998) argue that different age groups have different economic behaviour and that any discussion of the impact of population growth on economic growth should take into account the changing age structure. According to one estimate, demographic dividend accounted for one-third of the growth in east Asia during 1965-90 (Bloom et al 2000). Using provincial level data for 1989-2004, Wei and Hao (2010) show that changes in the demographic structure have helped fuel China's economic growth since 1989.

Demographics affect growth because different age groups exhibit different economic behaviour. A higher share of the working-age population has a positive effect on growth through various channels – a higher labour supply on account of an increase in the population as well as behavioural changes such as increased female labour participation, higher savings as working-age groups tend to save more than the young and the old, and greater investment in education and health as number of children being raised decline and the lifetime over which the investment can be recouped becomes longer. Thus, a favourable change in the age structure, i e, an increase in the share of the working-age population, as captured by the growth

Table 4: Demographic Dividend and Growth: By Decade

	Dependent Variable Is the Growth Rate of Income Per Capita during							
	2001-09		2001-09		1991-2001		1981-91	
	New States				Old States			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log of initial share of working-age population	0.53	10.59	5.83	13.70**	15.78***	13.77**	-0.22	4.67
	(13.33)	(6.93)	(10.19)	(4.94)	(5.13)	(5.18)	(5.73)	(4.75)
Growth in the share of the working-age population	-2.13	-1.22	-0.92	-0.18	2.85**	2.38*	0.40	0.29
	(1.81)	(1.50)	(1.44)	(1.21)	(1.27)	(1.14)	(1.05)	(1.07)
Log of initial income	1.36		1.07		-0.81		1.19	
	(1.50)		(1.31)		(0.69)		(0.73)	
Constant	-5.54	12.61***	-0.80	13.44***	18.99**	10.16***	-8.85	5.30*
	(19.95)	(2.84)	(16.98)	(2.05)	(7.83)	(3.00)	(9.79)	(2.87)
Observations	21	21	17	17	17	17	17	17
R-squared	0.26	0.22	0.41	0.38	0.50	0.47	0.18	0.06
States	Main	Main	Main	Main	Main	Main	Main	Main

Robust standard errors in parentheses. *, **, *** denotes statistical significance at 10%, 5%, and 1% respectively. For 1991-2001 and 1981-91, main states do not include Jammu and Kashmir.
Source: Authors' calculations.

Table 5: Demographic Dividend and Growth: Panel Regressions with Decadal Interactions

	OLS	Difference GMM		System GMM	
	(1)	(2)	(3)	(4)	(5)
Log of initial GDP per capita	-5.164***	-9.925	-7.941	-0.110	-0.005
	(1.652)	(9.594)	(19.001)	(1.480)	(6.329)
Log of initial share of working-age population	34.429**	54.033	40.959**	22.611	8.713
	(13.015)	(31.912)	(6.021)	(16.551)	(0.828)
Growth in the share of working-age population	3.992	6.312	4.694	2.191	0.985
	(2.647)	(4.333)	(2.720)	(1.908)	(1.263)
Growth in the share of working-age pop*1980s dummy	-2.801	-3.006	-3.346	-2.541	-1.233
	(2.171)	(3.571)	(2.832)	(2.513)	(1.571)
Growth in the share of working-age pop*1990s dummy	-0.970	-1.939	-1.109	0.166	2.649
	(2.967)	(3.854)	(3.393)	(4.280)	(3.021)
Growth in the share of working-age pop*2000s dummy	-5.676*	-9.754	-7.547*	-0.590	-1.800*
	(2.720)	(7.427)	(3.786)	(1.276)	(0.880)
State FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Observations	67	50	50	67	67
Number of groups		17	17	17	17
No of instruments		20	17	29	21
Lag length		All	Two	All	One
Collapsed instruments		No	No	No	No
Arellano-Bond test for AR(2) in first differences (p value)		0.79		0.08	0.03
Hansen test of overriding restrictions (p value)		0.28	0.21	0.98	0.96
Difference in Hansen tests All- System GMM Instruments (p value)				1.00	1.00
Those based on lagged growth only (p value)				1.00	1.00
Total effect for 2000s: Growth in the share of working age pop +(Growth in the share of working age pop* Dummy for 2000s)=0 (p value)	0.12	0.44	0.24	0.44	0.55

Robust standard errors reported in parentheses.*,**,*** denotes statistical significance at 10%, 5%, and 1% respectively. Only the main states are used. New states are combined with the respective state they were created from for the period 2001-09, i e, the old definition of states is used.
Source: Authors' calculations.

in the share of the working-age population, has the potential to positively influence growth.

Hope in India's future growth is founded on the demographic dividend: a rapidly expanding young population will save more and inject entrepreneurial vigour that will lift the country to a faster growth trajectory. The demographic dividend is routinely touted by analysts and forecasters as one basis for optimism for India's economic future. And corroborative evidence was provided in two recent papers by Kumar (2010) and Aiyar and Mody (2011). But the pattern of growth in the 2000s appears to muddy the waters.

The share of the working-age (defined as ages 15 to 59) population in the total population in India has been increasing since the late 1970s. This share is projected to increase from 58.6% in 2000 to 63.9% in 2035 before it starts trending down.[11] India is, thus, undergoing changes in the age composition of the population that can help contribute to its growth. Kumar (2010) and Aiyar and Mody (2011), using state-level data for India till 2001, show that there is a positive and a statistically significant impact of growth in the share of the working-age in total population on growth. Aiyar and Modi (2011) estimate that the demographic divided could add up to 2 percentage points to per capita GDP growth during the next two decades.

Chart 8 (p 53) (Panels A-D) shows a scatter plot of the growth of income per capita for each decade from 1971 to 2009 and the growth in the share of the working-age population in the corresponding decade.[12] For the first three decades, 1971-81, 1981-91, and 1991-2001, there is a positive correlation between the two variables (Chart 8, Panel A-C). However, for the latest period, 2001-09, the two are negatively correlated (Chart 8, Panel D). Is it the case that the demographic dividend has vanished in the 2000s?

To test this, we estimate a growth convergence regression augmented with the standard demographic variables (the initial share of the working-age population in total population and the growth in the share of the working-age population).[13] We find that growth in the share of the working-age population is not positively correlated with income growth after controlling for initial income per capita for the period 2001-09 (columns 1 and 3, Table 4, p 53). The coefficient on the growth of the share of the working-age population is negative and statistically insignificant after 2001.

However, for the decade of 1990s, the relationship between the two variables is positive and statistically significant (columns 5 and 6). For the 1980s also we do not find a significant relationship between growth in the share of the working-age population – the key demographic dividend variable – and income per capita growth. The estimated coefficient on the growth in the share of the working-age population for the decade of 1990s (from column 5), 2.85 is comparable to that estimated (2.53) by Kumar (2010) using a pooled OLS for 1971-2001 and to that estimated (2.49) by Aiyar and Modi (2011) also using a pooled OLS for 1961-2001. In both cases, the coefficient is found to be statistically significant.

This simple analysis suggests that the so-called demographic dividend was only really strong during the 1990s and in fact in the 2000s the relationship has the wrong sign even though it is insignificant. Table 5 shows the estimates obtained by pooling the data for 1971-2009 and including interactions of growth in the share of the working-age population with each decade. We report results obtained using OLS, difference GMM, and system GMM. In 3 cases (columns 1, 3, and 5) the coefficient on the interaction with the latest decade is negative and statistically significant. In the other two cases, the coefficient is negative though statistically insignificant. (Appendix Table 4 (p 57) shows the estimates with collapsed instruments.) This too suggests that the impact of demography in the 2000s was different from that in previous decades.[14]

Table 6: Average Annual Growth Rate (%) of the Share of the Working-Age Population

State	1991-2001	2001-11
Andhra Pradesh	0.54	0.89
Assam	0.44	1.14
Bihar	-0.08	1.37
Delhi	0.31	1.03
Gujarat	0.42	0.69
Haryana	0.64	1.24
Himachal Pradesh	0.64	0.81
Karnataka	0.62	0.80
Kerala	0.33	0.24
Madhya Pradesh	0.12	0.99
Maharashtra	0.32	0.86
Orissa	0.29	0.97
Punjab	0.39	0.92
Rajasthan	0.07	1.22
Tamil Nadu	0.40	0.31
Uttar Pradesh	-0.08	1.09
West Bengal	0.43	1.06

Data for share of the working-age population for 1991 and 2001 is from respective censuses. For 2011, projections of age-specific distributions based on the 2001 Census are used. The age-specific distribution from the latest 2011 Census was not available at the time of the writing of this paper.
Source: Census of India and authors' calculations.

This could be due to the fact that there are significant differences before and after 2001 in the states which see a favourable demographic structure (Table 6). Post-2001, based on the population

projections from the 2001 Census, Kumar (2010) shows that the growth in the working-age population is likely to have been concentrated in four states, the so-called BIMARU states.[15] Close to 49% of the increase in India's working-age population during 2001-11 was likely to have been contributed by these four states. Growth in the share of the working-age population in the four states was amongst the highest. Now, while the BIMARU states, especially Bihar, did perform better in the 2000s than in the 1990s, they still lagged behind the other states. That might explain why we find here that the growth in the share of the working-age population is not positively correlated with economic growth in the 2000s. At least so far, these states have not been able to utilise fully the young population to their advantage. But this might change in the future.

In any event, it seems premature to tout the benefits of the demographic dividend.

3 Conclusions

India's growth has been distinctive in many ways, what one of us has dubbed the "Precocious India" phenomenon (Subramanian 2007). It has relied on services rather than on manufacturing as an engine of growth; growth has been skill-intensive rather than intensive in the use of India's abundant factor; India despite being poor is exporting skills and technology in the form of FDI and that too to countries much richer than itself.

The analysis of growth in the 2000s throws up one more quirk, relating to Kerala. The conventional wisdom is of a state that is Scandinavian in its social achievements but sclerotic in its growth performance because of investment-chilling labour laws and strong trade unions, and reflected in a labour force that has voted with its feet by emigrating to west Asia. Well, the data suggest that the conventional wisdom is dead wrong. Kerala posted amongst the highest rates of growth in the 1990s (4% per capita), continued its stellar performance in the go-go 2000s (7.5%), and exhibited great resilience during the crisis, experiencing virtually no decline in growth.

India, evidently, is capacious enough to allow both, reforming Gujarat and, reform-resistant Kerala to flourish. Or, to put it more honestly, the Indian growth miracle, including the experience of the 2000s, continues to confound.

NOTES

1 Source: *Handbook of Statistics on Indian Economy*, Reserve Bank of India and CSO Press Release, April 2011.

2 Throughout this paper, year refers to India's fiscal year, i e, 1951 refers to 1951-52.

3 See, however, Bhattacharjea (2006) for a strong critique of this study.

4 Among the other smaller states, three – Meghalaya, Pondicherry and Sikkim – did experience slowdowns in the 2000s compared with the 1990s.

5 In short, divided Bihar and Jharkhand are considered together as an undivided state of Bihar, similarly Madhya Pradesh and Chhattisgarh are jointly considered as Madhya Pradesh, and Uttar Pradesh and Uttarakhand are considered together as Uttar Pradesh.

6 We estimate different specifications for difference and system GMM by using all the lag lengths and the minimum possible lag lengths for instrumenting endogenous variables as well as by collapsing the instrument set and combinations of both. Table 3 reports estimates using different lag lengths (Roodman 2007). Appendix Table 3 shows estimates obtained by collapsing the instrument (for all the available lag lengths) and the estimates obtained by reducing the lag length and collapsing the instrument set. The two approaches allow controlling for instrument proliferation which overfit the endogenous variables as well as weaken the Hansen test of the joint validity of instruments. The difference GMM specification using only one lag length is not reported as the equation is under-identified. Estimates obtained from difference GMM by collapsing the instrument sets are the same as those without collapsing but are reported in any case.

7 The coefficient on the interaction of initial income with decadal dummies indicate how much more or less divergence there was in any particular decade over and above the average captured in the uninteracted initial income term. So, a positive coefficient on a decadal dummy does not mean that there was divergence in that decade. To ascertain the absolute performance in any decade, we need to add the coefficient on the decadal interaction with the coefficient on the uninteracted income term. When we do this for the 2000s, we see that in columns 2, 6 and 7 of Table 3 that the total effect in the 2000s was indeed one of divergence. The last row of Table 3 and Appendix Table 3 reports the p-value for the total effect for the 2000s; it is positive and statistically significant in column 2 of Table 3 and all the system GMM estimates.

8 In a few cases, our specifications under difference GMM and system GMM do not pass the standard specification tests related to no autocorrelation (Arellano-Bond test for AR(2) in first differences) and the joint validity of instruments (Hansen test and the Difference-in-Hansen tests).

9 Business services as defined in the state national accounts include real estate, ownership of dwellings, and business services. Of these, business services includes IT (information technology) and IT enabled services and is probably the only tradable component. However, due to lack of data at the state level we are unable to use a more disaggregated classification that excludes these potentially non-tradable components.

10 Of course, tradability in this context could refer to domestic or external trade and therefore the drop in growth could be due to fall in either external or domestic demand which we do not distinguish.

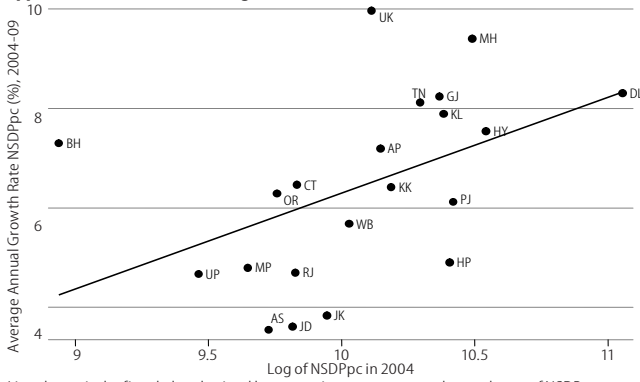
11 Source: *World Population Prospects* (2010 revision), United Nations. Available at http://esa.un.org/unpd/wpp/index.htm.

12 Growth in the share of the working-age population in total population for 2001-09 is calculated using projections of state-level populations by age-group based on the 2001 Census.

Data Appendix

Variable	Source
Income per capita is measured as net state domestic product (NSDP) per capita in 2004-05 prices.	Data on NSDP in 2004-05 prices is from Central Statistical Organisation (CSO), Government of India. Data for years prior to 2004-05 is in different base years A time series is constructed by using growth rates of NSDP in constant prices for years before 2004-05. Data on NSDP for new states created in 2000 for 1993-2000 is from CSO. Population for the years 2001-02 and before is from CSO but for years after 2001-02 population is estimated using decadal growth rates obtained from the provisional figures of Census 2011 released in April 2011. NSDP per capita is then obtained by dividing NSDP by population.
Ratio of working-age population to total population.	Working-age is defined as age groups 15-59. State-specific data on the age-distribution is obtained from various censuses. The latest census for which age-specific distribution is available for states is 2001. For 2009, we use Census of India projections of age-distribution at the state level. These projections were released in 2006 and are based on the 2001 Census. To obtain the share of the working-age population in 2009, average annual growth rate of the working-age population during 2001-06 and 2006-11 was used.
Growth of income per capita	Growth of income per capita is the average annual growth over the period concerned. It is calculated as the differential of the logs of income per capita in the two periods divided by the time elapsed between the two periods multiplied by 100. Since we use different numbers for population, growth rates reported here are likely to differ from officially reported growth rates of per capita income and also because growth rates are calculated as log differentials.
Growth in the share of the working-age population to total population	Growth in the share of the working-age population to total population is the average annual growth over the period concerned.It is calculated as the differential of the logs of ratio of the working-age population to total population in the two periods divided by the time elapsed between the two periods multiplied by 100.

Appendix Chart 1: Growth during 2004-09 and Income in 2004



Line shown is the fitted plot obtained by regressing average annual growth rate of NSDPpc during 2004-09 on the log of NSDPpc in 2004.
Source: CSO and authors' calculations.

Appendix Table 1: Unconditional Convergence Regressions for All States (1993-2009)

	Dependent Variable Is Growth Rate of Income Per Capita during					
	2001-09	1993-2009	1993-2001	2001-09	1993-2009	1993-2001
	New States			Old States		
	(1)	(2)	(3)	(4)	(5)	(6)
Log of initial	1.37*	1.53***	1.13	1.61**	1.57***	0.93
income per capita	(0.67)	(0.43)	(0.73)	(0.68)	(0.46)	(0.87)
Constant	-7.94	-10.40**	-7.68	-10.47	-10.79**	-5.60
	(6.76)	(4.29)	(7.13)	(6.83)	(4.53)	(8.50)
Observations	29	29	29	26	26	26
R-squared	0.14	0.24	0.05	0.21	0.25	0.03
States	All	All	All	All	All	All

Robust standard errors in parentheses.
*, **, *** denotes statistical significance at 10%, 5%, and 1% respectively.
Source: Authors' calculations.

13 The relationship between growth in per capita income and growth in the share of the working-age population and initial share of the working-age population can be derived using the conditional convergence equation specified for example, in Bloom and Canning (2004).

14 The interaction of the growth in the share of the working-age population with decadal dummies tell us how much more or less was the influence of the changing-age structure in each decade over and above the average captured by the uninteracted growth in the share of the working-age population. A negative coefficient on the interaction does not mean that there was a negative impact in that decade; it only tells us the difference in that decade relative to the average. To obtain the overall impact of the growth in the working-age ratio in any decade, we need to add the coefficient on the interaction for that decade with the coefficient on the uninteracted term. When we do this for the 2000s, we see that in columns 1, 3, and 5, the total effect of the growth in the share of the working-age population is negative. However, in all cases the total effect is statistically insignificant as shown in the last row of Table 5 and Appendix Table 4.

15 BIMARU refers to the states of Bihar (undivided), Madhya Pradesh (undivided), Rajasthan, and Uttar Pradesh (undivided).

Appendix Table 2: Unconditional Convergence Regressions (2004-09)

	Dependent Variable Is the Growth Rate of Income Per Capita during			
	2004-09	2004-09	2004-09	2004-09
	New States		Old States	
	(1)	(2)	(3)	(4)
Log of initial income per capita	1.93* (0.99)	1.74*** (0.62)	2.44*** (0.66)	2.09*** (0.42
Constant	-12.98 (10.10)	-11.26* (6.51)	-18.33** (6.66)	-14.94*** (4.34)
Observations	21	29	18	26
R-squared	0.22	0.25	0.42	0.40
States	Main	All	Main	All

Robust standard errors in parentheses. *, **, *** denotes statistical significance at 10%, 5%, and 1%, respectively.
Source: Authors' calculations.

Appendix Table 3: Convergence and Divergence (1971-2009)

	Difference GMM		System GMM			
	(1)	(2)	(3)	(4)	(5)	(6)
Log of initial GDP per capita	-8.613	-4.602	-0.827	-1.089**	-1.054**	-0.766
	(9.475)	(6.243)	(0.535)	(0.440)	(0.433)	(0.627)
Log of initial GDP per capita*	1.191	1.518	2.439**	2.548***	2.456***	2.040**
Dummy for 1980s	(0.880)	(1.086)	(0.881)	(0.852)	(0.648)	(0.896)
Log of initial GDP per capita*	1.737	1.729	2.359**	2.519***	2.471**	2.155**
Dummy for 1990s	(1.047)	(1.037)	(0.972)	(0.831)	(0.936)	(1.018)
Log of initial GDP per capita*	3.101*	2.751***	2.111***	2.673***	2.624***	2.438**
Dummy for 2000s	(1.506)	(0.877)	(0.579)	(0.660)	(0.704)	(0.916)
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	54	54	72	72	72	72
Number of groups	18	18	18	18	18	18
No of instruments	9	8	12	13	11	9
Lag length	All	Two	All	Two	Two	One
Collapsed instruments	Yes	Yes	Yes	No	Yes	Yes
Arellano-Bond test for AR(2) in first differences (p value)	0.76		0.17	0.14	0.14	0.10
Hansen test of joint validity of instruments (p value)	0.16	0.09	0.14	0.43	0.15	0.09
Difference-in-Hansen tests All- System GMM Instruments (p value)			0.11	0.65	0.26	
Those based on lagged growth only (p value)			0.09	0.96	0.14	0.09
Total effect for 2000s: Log of Initial GDP per capita+ Log of Initial GDP per capita* Dummy for 2000s)=0 (p value)	0.51	0.75	0.02	0.01	0.01	0.02

Robust standard errors reported in parentheses. *, **, *** denote statistical significance at 10%, 5%, and 1%, respectively.
Only the main states are used. New states are combined with the respective state they were created from for the period 2001-09, i e, the old definition of states is used.
Source: Authors' calculations.

REFERENCES

Aghion, P, R Burgess, S Redding and F Zilibotti (2008): "The Unequal Effects of Liberalisation: Evidence from Dismantling the License Raj in India", *American Economic Review*, 98(4): 1397-1412.

Ahluwalia, M (2000): "Economic Performance of States in the Post Reforms Period", *Economic & Political Weekly*, 6 May, 1637-48.

Aiyar, S and A Mody (2011): "The Demographic Dividend: Evidence from the Indian States", Working Paper No WP/11/38 (Washington DC: IMF).

Amin, M and A Mattoo (2008): "Human Capital and the Changing Structure of the Indian Economy", Policy Research Working Paper Series 4576, The World Bank, Washington DC.

Besley, T and R Burgess (2004): "Can Regulation Hinder Economic Performance? Evidence from India", *Quarterly Journal of Economics*, 119(1): 91-134.

Bhattacharjea, A (2006): "Labour Market Regulation and Industrial Performance in India: A Critical Review of the Empirical Evidence", *The Indian Journal of Labour Economics*, 49(2): 211-32.

Bloom, D E and D Canning (2004): "Global Demographic Change: Dimensions and Economic Significance", NBER WP # 10817 (MA: Cambridge).

Bloom, D E and J G Williamson (1998): "Demographic Transitions and Economic Miracles in Emerging Asia", *World Bank Economic Review*, 12 (3): 419-55.

Bloom, D E, D Canning, P N Malaney (2000): "Population Dynamics and Economic Growth in Asia", *Population and Development Review*, Vol 26: 257-90.

DeLong, J B (2004): "India Since Independence: An Analytic Growth Narrative" in Dani Rodrik (ed.), *Modern Economic Growth: Analytical Country Studies* http://www.j-bradford-delong.net/Econ_Articles/India/India_Rodrik_DeLong.PDF.

Ghani, E, ed. (2010): *The Service Revloution in India* (India: Oxford University Press).

Kochhar, K, U Kumar, R Rajan, A Subramanian and I Tokatlidis (2006): "India's Pattern of Development: What Happened, What Follows?", *Journal of Monetary Economics*, Vol 53: 981-1019.

Kumar, U (2010): "India's Demographic Transition: Boon or Bane? A State-Level Perspective", Economics Program Working Paper # EPWP 10-03 (New York: The Conference Board).

Lahiri, A and K Yi (2009): "A Tale of Two States: Maharashtra and West Bengal", *Review of Economic Dynamics*, 12(3): 523-42.

Lane, P R and G M Milesi-Ferretti (2007): "The External Wealth of Nations Mark II: Revised and Extended Estimates of Foreign Assets and Liabilities, 1970-2004", *Journal of International Economics*, 73, November, 223-50.

Panagariya, A (2008): *India: The Emerging Giant* (New York: Oxford University Press).

Rodrik, D and A Subramanian (2005): "From 'Hindu Growth' to Productivity Surge: The Mystery of the Indian Growth Transition", *IMF Staff Papers*, Vol 52(2): 193-228.

Roodman, D (2007): "A Note on Theme of Too Many Instruments", Working Paper No 125 (Washington DC: Center for Global Development).

Subramanian (2007): "Precocious India", *Business Standard*, 14 August.

Wei, Z and R Hao (2010): "Demographic Structure and Economic Growth: Evidence from China", *Journal of Comparative Economics*, Vol 38: 472-91.

Williamson, J and R Zagha (2002): "From Slow Growth to Slow Reform", Institute for International Economics, Washington.

Appendix Table 4: Demographic Dividend and Growth: Panel Regressions with Decadal Interactions

	Difference GMM		System GMM			
	(1)	(2)	(3)	(4)	(5)	(6)
Log of initial GDP per capita	1.518	0.916	0.098	-1.146	0.355	0.159
	(37.010)	(4.876)	(0.895)	(1.645)	(0.715)	(0.745)
Log of initial share of working-age population	15.802	8.950	11.913	27.081*	10.472*	11.005
	(5.786)	(24.383)	(7.660)	(14.583)	(5.880)	(7.488)
Growth in the share of working-age pop	2.157	1.029	1.448	2.676	0.688	0.936
	(4.324)	(3.180)	(1.261)	(1.866)	(1.232)	(1.141)
Growth in the share of working-age pop*1980s dummy	-3.020	-2.645	-1.938	-3.452	-1.954	-1.977*
	(3.354)	(2.373)	(1.511)	(2.481)	(1.231)	(0.973)
Growth in the share of working-age pop*1990s dummy	1.127	2.008	1.408	0.125	2.753	3.254
	(4.720)	(3.295)	(2.057)	(3.804)	(1.991)	(2.065)
Growth in the share of working-age pop*2000s dummy	-1.329	-1.164	-1.589	-1.096	-1.061	-1.236
	(6.966)	(4.283)	(1.110)	(1.157)	(1.073)	(1.118)
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	50	50	67	67	67	67
Number of groups	17	17	17	17	17	17
No of instruments	15	12	21	27	18	14
Lag length	All	Two	All	Two	Two	One
Collapsed instruments	Yes	Yes	Yes	No	Yes	Yes
Arellano-Bond test for AR(2) in first differences (p value)	0.10		0.03	0.08	0.03	0.03
Hansen test of overid restrictions (p value)	0.21	0.26	0.92	1.00	0.83	0.81
Difference in Hansen tests All-system GMM instruments (p value)			1.00	1.00	0.99	0.80
Those based on lagged growth only (p value)			0.85	1.00	1.00	0.71
Total effect for 2000s: Growth in the share of working-age pop +(Growth in the share of working-age pop*Dummy for 2000s)=0 (p value)	0.81	0.95	0.90	0.25	0.66	0.83

Robust standard errors reported in parentheses. *, **, *** denotes statistical significance at 10%, 5%, and 1% respectively. Only the main states are used. New states are combined with the respective state they were created from for the period 2001-09, i e, the old definition of states is used.
Source: Authors' calculations.