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"Internal Migration, Center-State Grants and Economic Growth in the States of India"

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Abstract

This paper examines the growth experience of twenty states of India during the period 1961-91, using cross-sectional estimation and the analytical framework of the Solow-Swan neoclassical growth model. We find evidence of absolute convergence--initially-poor states did indeed grow faster than their initially-rich counterparts. There has also been a widening of the dispersion of real per capita state incomes over the period 1961-91. However, relatively more grants were transferred from the central government to the poor states than to their rich counterparts. Significant barriers to population flows also exist, as net migration from poor to rich states responded only weakly to cross-state income differentials.

JEL Classification Numbers:

041, 047, 053, R11

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Contents

Summary

This paper examines the growth experience of twenty state economies of India during 1961-91. The Solow-Swan neoclassical growth model provides the analytical framework, and the implications of this model are tested using cross-sectional techniques.

Across economies with a common steady state, convergence of per capita incomes in the neoclassical growth model is driven by diminishing returns to capital. Each addition to the capital stock of a region generates large (small) increases in output when the regional stock of capital is small (large). Accordingly, if the only difference between regional economies lies in the level of their initial stock of capital, the neoclassical growth model predicts that poor regions will grow faster than rich ones--regions with lower starting values of the capital-labor ratio will have higher per capita income growth rates. Convergence can also occur through the redistribution of incomes from relatively rich regions to relatively poor regions of a federal country by its central government and through flows of labor from poor to rich regions. The paper concentrates on the last two channels.

Have the initially poor states of India grown faster than their initially rich counterparts? A key conclusion of this paper is that real per capita incomes did converge across the states of India during 1961-91. After controlling for the sectoral composition of the states, it is found that the twenty economies converged toward their common steady-state level of per capita income at the relatively slow speed of 1.5 percent a year. That is, 1.5 percent of the gap between per capita incomes in initially poor states and those in initially rich states was closed every year. This implies that, in the Indian context, it would take about 45 years for half the gap between any state's initial per capita income and the steady-state per capita income to be closed.

Also, the dispersion of state real per capita incomes widened during 1961-91. However, because of grants from the central government to the states--with relatively more grants being transferred to poor states than to their rich counterparts--the dispersion of state real per capita disposable incomes was narrower than the dispersion of state real per capita incomes.

In comparison with patterns of regional migration in the United States and Japan, the extent to which population movements occurred in India in response to differential state incomes was relatively weak. In this context, the states of India resemble more closely the regions of Europe, where significant economic, social, and cultural barriers to the free migration of labor continue to exist. Finally, there is little evidence that population movements played an important role in the convergence of state real per capita incomes in India.

I. Introduction

A striking feature of India's economic development since it became independent in 1947 is its low rate of per capita income growth, particularly in comparison to most other Asian countries. This fact is all the more noticeable given the favorable preconditions in the late 1940s of a well-diversified resource base, a large domestic market, the world's fourth largest pool of skilled (scientific and technical) manpower, a sizeable group of entrepreneurs, a long experience with public administration, and a relatively stable political system.

India's growth process since the 1950s has largely been influenced by the economic policies of the Congress Party and the country's first Prime Minister Jawaharlal Nehru. The Congress Party embraced the "socialist pattern of development" whereby central planning guided public and private sector activities, with emphasis placed on import-substitution policies and heavy industry. Industrial licensing was an integral part of government intervention in the economy, as it directed investment flows both across sectors and across states. In addition, the "commanding height" industries (defence, heavy industry, mining, air and rail transport, communications and power) were exclusively the purview of the public sector. Importantly, especially in the context of this paper, India's planners also sought to influence inter-regional investment flows so as to engender balanced regional development. The process of public sector expansion and nationalization continued through the 1970s with several new public financial institutions being set up or nationalized during the period. Thus, until the mid-1980s, India essentially operated as a closed economy, with the public sector dominating economic activity. Macroeconomic crises were typically resolved through the imposition of quantitative and price controls which contributed, in part, to India's relatively low inflation rates, in comparison to other developing countries.

In common with many of the developed world's federal countries (Germany, Switzerland, Australia, Canada, and the United States), there have been concerns within India since independence regarding regional disparities in the context of national economic development. In addition, the efficiency costs of using income-equalizing center-state grants to promote objectives such as national economic equity have been an important related theme in the economics of fiscal federalism. 1/

1/ A key early discussion of the efficiency-equity aspects occurred between Buchanan (1950, 1952) and Scott (1952). The efficiency case against center-state grants is that they result in a misallocation of national resources, because the consequent expansion of state and local public services acts to slow the movement of labor out of regions where it has a low marginal product to regions where it is high. Balogh (1962) and Gupta (1973) make similar points in discussing India's programs designed to reduce disparities in regional incomes.

Early work by Myrdal (1957), Hirschman (1959) and Kaldor (1970) gave rise to the hypothesis of an inverted U-shaped curve between the extent of regional income disparity and a nation's level of income. Some of the first empirical tests of the validity of rising then falling cross-regional disparities in income were conducted by Kuznets (1958) and Williamson (1965) for regions of developed countries. This body of work sparked much interest in India, the developing world's most populous federal country (see Section V).

Whilst there are many studies of the international processes of growth and convergence across countries (see Baumol 1986, DeLong 1988, Dowrick and Nguyen 1989, and Barro 1991, among others), there are relatively few that examine regional growth patterns within any given country. Exceptions have been: Easterlin (1957, 1960), Williamson (1965) and Barro and Sala-i-Martin (1992a) for the states of the United States of America; Williamson (1965) and Barro and Sala-i-Martin (1991) for the regions of Europe; Coulomb and Lee (1993) for the provinces of Canada; Cashin (1995) for the regions of Australasia; De Gregorio (1992) for several South American nations; and Barro and Sala-i-Martin (1992b) and Shioji (1993) for the prefectures of Japan. This paper represents the first formal econometric analysis of the neoclassical growth model's predictions for the process of income growth and convergence across the regions of a developing country.

By undertaking an analysis of the twenty Indian states, we hope to minimize the problems which would arise if the various economies exhibited different steady-state real per capita incomes. 1/ 2/ Assuming that all regions within a given country possess similar levels of technology and similar preferences, and that there are no institutional barriers to the flow of both capital and labor across regional borders, then the neoclassical growth model would predict all regions to have similar levels of real per capita income in the steady state. Accordingly,

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1/ In this paper the term 'state' will be used to describe the twenty regional economies of India, although for the period of analysis Delhi was a union territory and not a state of India. The key difference between a state and a union territory is that the taxing and spending powers of the latter are severely circumscribed; their budget is essentially derived from the central government. The acronyms used for the twenty Indian states we study are: Andhra Pradesh (AP), Assam (A), Bihar (B), Delhi (D), Gujarat (G), Haryana (H), Himachal Pradesh (HP), Jammu and Kashmir (JK), Karnataka (KA), Kerala (KE), Madhya Pradesh (MP), Maharashtra (MH), Manipur (MN), Orissa (O), Punjab (P), Rajasthan (R), Tamil Nadu (TN), Tripura (T), Uttar Pradesh (UP), West Bengal (WB).

2/ In 1991 India comprised 25 states and 7 union territories; in 1961 there were 15 states and 12 union territories. The 20 regions studied in this paper accounted for 93.1 percent of India's net national product (at factor cost) and 99.0 percent of India's population in 1991; the corresponding figures for 1961 were 90.1 and 99.3 percent, respectively (Government of India 1991a, 1995).

absolute convergence should then be closely approximated by conditional convergence. 1/

It is important to note that given the neoclassical growth model's assumption of closed economies, such a model of the convergence process obviously cannot be applied literally to the Indian states because, for given technologies, convergence in both per capita income and capital stocks will occur faster in open than in closed economies. However, as shown by Barro, Mankiw and Sala-i-Martin (1995), in the presence of imperfect capital markets which constrain only a fraction of physical capital to be able to serve as collateral for investment by governments and/or individuals, aggregate income exhibits very similar behavior to that which would be predicted by a closed economy model. That is, partial capital mobility in an open-economy version of the neoclassical growth model can explain the gradual incidence of cross-state income convergence. Undoubtedly, these constraints on the role of capital for collateral were present in India over the 1961-91 period.

Across regions of a given country, which share a common steady state, convergence of per capita incomes in the neoclassical growth model is driven by diminishing returns to capital. Each addition to the capital stock of a region generates large (small) increases in output when the regional stock of capital is small (large). Accordingly, if the only difference between regional economies lies in the level of their initial stock of capital, the neoclassical growth model predicts that poor regions will grow faster than rich ones--regions with lower starting values of the capital-labor ratio will have higher per capita income growth rates. Two other channels by which convergence can occur are: the redistribution of incomes from relatively rich regions to relatively poor regions of a federal country by its central government; and flows of labor from poor to rich regions. We examine the last two channels in this paper. These issues are relevant from a policy perspective in that this study evaluates whether, in the Indian context, fiscal federalism and the flow of labor across states have contributed to the equalization of state per capita incomes.

Accordingly, answers to the following questions will be explored in this paper. First, did the initially-poor states of India subsequently grow faster than the initially-rich states? Second, has the cross-sectional dispersion of per capita incomes across the states widened or narrowed over the period of analysis? Third, did cross-state migration from poor to rich states respond to differentials in per capita incomes across the states? Evidence is found which supports the conjectures of the neoclassical growth model of Solow (1956) and Swan (1956): the relatively poor states did indeed grow faster, with 1.5 percent of the gap between per capita incomes in

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1/ If the states vary in their savings rates and technologies, then the neoclassical growth model predicts conditional convergence--state per capita incomes still converge, but this convergence is conditional on each economy's *own* steady state.

initially-poor and initially-rich states being closed every year. There has also been a widening in the cross-sectional dispersion of real per capita state incomes over the period 1961-91. However, center-state grants ensured that the dispersion of real per capita state disposable incomes remained relatively constant over the period. Finally, net migration across states does not appear to be greatly influenced by differentials in state per capita incomes, which indicates that there are sizeable barriers to labor flows across the states of India. There is also little evidence that cross-state migration is an important cause of the convergence of real state per capita incomes in India.

The structure of the paper is as follows. Section II looks at center-state relations, and discusses several key economic features of the Indian states. Section III sets out the concepts of convergence to be used in this paper, while Section IV discusses the data utilized to test the convergence hypotheses. Section V presents estimates of the speed of convergence of the poor states to the rich, and Section VI calculates the dispersion of per capita incomes across the states. Sections VII and VIII examine the relationship between migration and state per capita incomes, and Section IX offers some concluding comments.

II. Overview of the Indian State Economies

Before rule by the British crown was officially validated in the Indian subcontinent in 1858, it is, perhaps, fair to say that the region as a whole had been united only twice in recorded history. The first unification was by the Mauryan emperor, Ashoka, during the third century B.C., and the second by Akbar during the Mughal empire during the 16th century, A.D. (Wolpert 1993). 1/ Even at the time of India's independence from Britain in 1947, the Indian states remained fairly diverse in their ethnic and linguistic background.

1. Center-state relations

The need to maintain a strong sense of national unity was clearly recognized during 1947-50, when the Indian Constitution was drafted. Consequently, within the confines of a federal system, the Constitution gave strong political and economic powers to the center to impose its own rule on the states, in particular, to allocate financial resources between itself and the states. One of the notable exceptions where the states had primary control was in the area of agriculture; this included the taxation of land and agricultural income and the implementation of land reforms (Joshi and

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1/ An interesting observation is that the capital city of Pataliputra (now Patna) under Ashoka is today the capital of the poorest state, Bihar, while Delhi, the capital city under Akbar and of India today, is the richest (measured in per capita income terms, see Table 2).

Little 1994). 1/ The Constitution also provides for the establishment every five years of a Finance Commission, to review the distribution of tax revenues both between the central and state governments, and across state governments.

The relative financial strength of the center vis-a-vis the states can be ascertained from the following facts: most taxes are levied and accrue to the center (the vast majority accounted by income, excise, and custom taxes); 2/ the relatively elastic sources of tax revenues have also been the purview of the center; and, the center can borrow from domestic and international markets while the states cannot borrow abroad and need the center's permission, de-facto, to borrow domestically. 3/ In case of a conflict on overlapping governmental responsibilities, the center's decision (through legislation) dominates. Broadly speaking, taxes on income and production (with some exceptions) are levied by the center while those on sales and purchases are levied by the states. It is interesting to note that while the states could potentially have tapped their own resources by levying taxes on agriculture and land, they have shown little inclination to raise such taxes. Indeed, the share of such taxes in total state tax revenue has barely been one percent (Sury 1992).

Given the vertical imbalance between the resource raising powers and expenditure needs of the center and the states, the Constitution has provided for a complex mechanism of transfers from the center to the states. 4/ Essentially, there are three direct channels: statutory transfers (comprising tax sharing and grants-in-aid) through the Finance

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1/ Along with agriculture, the responsibilities of state governments extend to power generation, education, health, sanitation, small industries and road transport.

2/ During 1951-85, on average, the center raised more than 70 percent of the total resources raised by the center and the states, of which only 31.4 percent was transferred to the states (Sarkaria Commission 1988).

3/ The center's consent is needed if either a loan from the center to the states remains outstanding or if the center has guaranteed an outstanding loan to the states. Since all states have typically been indebted to the center from the very beginning, the center's permission has de-facto been sought for raising fresh loans.

4/ See Toye (1973) for an early analysis of the structure of both states' receipts (revenues plus transfers) and states' expenditures.

Commission mechanism; 1/ plan grants through the Planning Commission mechanism; and "discretionary" grants through central ministries, primarily for centrally-sponsored schemes. There also exist indirect channels such as loans from the central government and the allocation of credit by financial institutions controlled by the central government. 2/

The purpose of examining transfers in this paper is to determine whether they served their intended purpose of reducing regional income disparities, by the central government allocating relatively greater grants to low-income states. Since not all transfers defined in the Indian context are intended to reduce such disparities, for estimation purposes we use data published in state budgets that can best be singled out as outright intended grants. Specifically, these include: statutory "grants-in-aid", as specified by the Finance Commission; grants for plan purposes as assessed by the Planning Commission; and grants for centrally-sponsored schemes. 3/ Thus we have excluded from the typical Indian definition of transfers those designed for center-state tax-sharing, and indirect transfers through loans. The justification for excluding the tax-sharing transfers is primarily the lack of transparency in determining the magnitude of the income equalizing component. 4/ Loans are clearly distinct from grants in that they have to be repaid. Accordingly, to the extent that we have excluded those center-state tax-sharing transfers designed explicitly to reduce regional disparities, and excluded loans (including external assistance) that may have been subsequently forgiven, 5/ our estimate of what we will

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1/ While the Constitution provides for financial transfers from the center, it does not specify the criteria for dividing the divisible pool of taxes between the center and the states and among the states. Finance Commissions, which determine these shares, have often recommended grants to fill gaps between projected current revenues and expenditures of states. This may have discouraged states from increasing public savings, because of the resultant loss in grants. Although the Finance Commission's recommendations are not binding on the Government of India, the center has generally accepted its major recommendations (Sury 1992).

2/ Of total gross transfers from the center to the states in 1961, some 24 percent comprised the sharing of taxes, 30 percent grants and 46 percent gross loans. The equivalent shares for 1971 were 32, 26 and 42 percent; for 1981 the shares were 39, 29 and 32 percent; and for 1991 the shares were 34, 32 and 34 percent, respectively (Reserve Bank of India 1993, Government of India 1994).

3/ See Bhat (1993) for an analysis of the determinants of the level of grants to Indian states, and Sastry and Nag (1990) for a discussion of the influence of such center-state transfers on states' economic growth.

4/ The formula that determines the states' shares in the center's revenue has, over time, depended to varying degrees on collections by states, state population, and several indicators of per capita income.

5/ The Seventh (1979-84) and Eighth (1984-89) Finance Commissions provided limited amounts of debt relief in the form of debt rescheduling and/or write offs.

henceforth call "grants" understates the role played by the center in reducing regional disparities.

2. Economic features of Indian states and regional disparities

Although the Indian states have long shared common political institutions and national economic policies, the wide diversity in geographic, demographic and economic features is also readily apparent (Tables 1 and 2). While in land area, the states in central India--Madhya Pradesh, Rajasthan, and Maharashtra--are the largest, the eastern states--Uttar Pradesh and Bihar--have the highest population levels. The highest population density (persons per square kilometer) is observed at extreme geographical ends, the highest in Delhi in the north, followed by Kerala in the south and West Bengal in the east. The states which lag far behind the others in literacy rates (total as well as female) and in reducing death rates are Uttar Pradesh, Bihar, Madhya Pradesh, and Rajasthan--these four regions also have the highest birth rates.

Of the six initially-poor states (Manipur, Bihar, Orissa, Tripura, Uttar Pradesh, and Madhya Pradesh) in 1961, five (Bihar, Orissa, Tripura, Uttar Pradesh, and Manipur) remained among the six poorest (in per capita income) in 1991. 1/ The exception was Madhya Pradesh, which had moved up three notches by 1991, and was replaced by Jammu and Kashmir (Table 2). Delhi, the richest region in 1961 as well as in 1991, is clearly an outlier in that its per capita income in both years was more than double the average of the remaining states. Apart from Delhi, six other states (Maharashtra, West Bengal, Punjab, Gujarat, Tamil Nadu and Haryana) had above average per capita income in 1961 and all, with the exception of West Bengal, remained above average in 1991.

While, in general, the richer states in 1991 were more industrialized than others (for example, Tamil Nadu, Maharashtra, Delhi and Gujarat), Punjab and Haryana, primarily agricultural states, had the second and third highest per capita income in 1991 (Table 2). The success story of Punjab and Haryana is mainly accounted by the "green revolution" during the 1960s, when the productivity of agricultural output (mainly wheat) rose sharply and has remained high when compared with other agrarian states. Punjab has also invested heavily in irrigation and flood control measures, both of which have helped to reduce its susceptibility to weather-induced output shocks. West Bengal stands out as one of the most industrialized states that was among the richest in 1961, but fell below average in 1991. Supply shocks in the form of power shortages and labor unrest have frequently beset industry in West Bengal; it also saw a rapid decline in one of its significant export industries--jute, as artificial fibers flooded international markets. In some states (Assam, Bihar, and Manipur) the share

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1/ Unless otherwise denoted, state "income" refers to the value of state net domestic product at factor cost -- see Section IV and the Data Appendix for details.

Table 1. Comparative Demographic and Geographic Indicators 1/

States	Population (millions) 1961	Population (millions) 1991	Annualized 1961-91 Population Growth Rate (Percent)	1991 Land Area ('000 sq.km.)	1991 Density (Persons per sq. km.)	Literacy Rates 2/ 1961	Literacy Rates 2/ 1991	Female Literacy Rates 2/ 1961	Female Literacy Rates 2/ 1991	Vital Rates Avg. 1980-88 (Per 1000 persons) 3/ CBR	Vital Rates Avg. 1980-88 (Per 1000 persons) 3/ CDR	Urban Share of Total Population (Percent) 1961	Urban Share of Total Population (Percent) 1991
Andhra Pradesh (AP)	35.98	66.31	2.04	275	241	246	451	140	337	31.0	11.4	17.4	26.8
Assam (A)	10.84	22.29	2.40	78	284	330	534	196	437	34.7	12.6	7.2	11.1
Bihar (B)	46.45	86.34	2.07	174	497	218	385	82	231	38.3	14.5	8.4	13.2
Delhi (D)	2.66	9.37	4.20	2	6318	620	761	509	680	28.6	7.3	88.8	90.0
Gujarat (G)	20.63	41.17	2.30	196	210	362	609	228	485	34.0	12.1	25.8	34.4
Haryana (H)	7.59	16.32	2.55	44	369	241	553	113	409	37.1	10.5	17.3	24.8
Himachal Pradesh (HP)	2.81	5.11	1.99	56	92	249	635	112	525	32.0	10.1	6.4	8.7
Jammu & Kashmir (JK)	3.56	7.72	2.58	222	35	130	--	51	--	34.3	9.5	16.6	23.8
Karnataka (KA)	23.59	44.81	2.14	192	234	298	560	167	443	29.8	10.1	22.3	30.9
Kerala (KE)	16.90	29.03	1.80	39	747	551	906	456	869	23.7	6.4	15.1	26.5
Madhya Pradesh (MP)	32.37	66.14	2.38	443	149	205	435	81	284	38.9	15.8	14.3	23.2
Maharashtra (MH)	39.55	78.75	2.30	308	256	351	631	198	505	29.9	10.1	28.2	38.7
Manipur (MN)	0.78	1.83	2.84	22	82	360	610	189	486	28.1	6.9	9.0	27.7
Orissa (O)	17.55	31.51	1.95	156	202	252	486	101	344	32.7	13.8	6.3	13.4
Punjab (P)	11.14	20.19	1.98	50	401	315	571	207	497	29.9	6.5	23.1	29.7
Rajasthan (R)	20.16	43.88	2.59	342	128	181	388	70	208	38.7	14.1	16.3	22.9
Tamil Nadu (TN)	33.69	55.64	1.67	130	428	364	637	211	523	26.9	11.9	26.7	34.2
Tripura (T)	1.14	2.74	2.92	10	262	243	604	124	500	27.1	9.0	8.8	15.3
Uttar Pradesh (UP)	73.76	139.03	2.11	294	472	207	417	83	260	39.5	16.6	12.9	19.9
West Bengal (WB)	34.93	67.98	2.22	89	766	345	577	203	472	34.6	11.0	24.5	27.4
All India 4/	439.24	843.93	2.18	3,287	257	283	521	153	394	33.4	12.9	18.0	25.7

Sources: Registrar General and Census Commissioner for India (1991); Government of India (1983); Government of India (1991a, 1991b) and earlier issues.

1/ The 1991 census has not yet been conducted in Jammu and Kashmir; its 1991 population figure is an official projection.

2/ The literacy rates for 1961 exclude that part of each state's population aged 0-4 years; the rates for 1991 are for the number of literates per 1,000 persons aged 7 years and above.

3/ CBR denotes the crude birth rate per 1,000 persons in the rural areas of each state; CDR denotes the crude death rate per 1,000 persons in the rural areas of each state. The all-India figures are weighted averages, with the state/union territory population as weights.

4/ Includes data from states/union territories other than our sample of 20 regions.

Table 2. Comparative Economic Indicators

	Real Per Capita NDP (1990 Rupees)		Annualized Per Capita Real NDP Growth Rate 1961-91	Center-State Grants as Percent of State NDP 1/ (Subperiod average)			Nominal NDP (current prices, Rupees million)		Share of Agriculture in State NDP (Percent)		Share of Manufacturing in State NDP (Percent)	
	1961	1991	(Percent)	1961-65	1971-75	1981-85	1961	1991	1961	1981	1961	1981
Andhra Pradesh (AP)	2567	4728	2.04	1.45	1.80	3.92	9832	311650	58.18	45.59	7.79	11.22
Assam (A)	2941	4014	1.04	4.53	5.40	4.70	3360	89050	55.27	54.01	17.14	6.84
Bihar (B)	2007	2655	0.93	1.18	1.59	2.84	9930	227410	53.58	54.14	9.67	6.40
Delhi (D)	6236	10177	1.63	..	..	..	1746	94280	7.01	4.55	23.30	23.31
Gujarat (G)	3379	5687	1.74	1.04	1.41	1.42	7382	233160	41.59	38.48	20.82	21.92
Haryana (H)	3053	7502	3.00	..	1.16	1.41	2450	122290	62.71	54.23	11.24	14.14
Himachal Pradesh (HP)	2465	4790	2.21	..	9.13	19.08	742	24290	60.59	50.07	5.55	4.38
Jammu & Kashmir (JK)	2511	3872	1.44	6.90	13.77	13.02	940	29510	67.55	50.67	5.78	5.01
Karnataka (KA)	2763	4696	1.77	1.63	1.38	1.56	6916	209900	60.41	42.78	8.96	18.18
Kerala (KE)	2418	4207	1.85	2.11	2.35	1.87	4322	121950	55.63	39.53	12.45	14.05
Madhya Pradesh (MP)	2353	4149	1.89	1.59	1.58	2.53	8073	271710	62.11	49.35	6.92	11.96
Maharashtra (MH)	3818	7316	2.17	0.69	1.33	1.11	15974	571780	41.58	27.79	21.59	27.41
Manipur (MN)	1438	3893	3.32	..	26.66	37.16	119	6940	55.69	48.85	8.34	4.71
Orissa (O)	2026	3077	1.39	3.39	3.93	5.43	3741	96640	61.31	54.94	7.28	7.41
Punjab (P)	3417	8373	2.99	2.39	1.44	0.96	4038	167290	54.00	48.89	10.12	11.97
Rajasthan (R)	2651	4113	1.46	1.69	2.87	3.09	5594	179400	56.21	50.34	10.16	11.08
Tamil Nadu (TN)	3118	5047	1.61	1.08	1.26	1.87	11118	280310	51.88	25.43	15.03	27.42
Tripura (T)	2325	3420	1.29	..	19.63	28.67	284	9310	62.72	57.15	5.71	4.48
Uttar Pradesh (UP)	2353	3516	1.34	1.12	1.40	2.86	18431	484770	60.01	51.68	7.83	10.66
West Bengal (WB)	3641	4753	0.89	0.88	2.05	1.41	13394	320620	40.51	31.88	20.26	24.68
All India 2/	2857	4934	1.82	..	..	..	142420 3/	4139430 3/	48.56 4/	41.23 4/	17.20 4/	22.98 4/

Sources: Authors' calculations, derived from: Reserve Bank of India (1993) and earlier issues; Government of India (1986); Government of India (1995) and earlier issues.

1/ Is the subperiod average of center-state grants, as a percentage of the subperiod average state NDP. Data on transfers from the central government to Delhi are unavailable.

2/ Includes data from states/union territories other than our sample of 20 regions.

3/ The all-India product figures are net national product (at factor cost).

4/ The all-India sectoral composition relate to net domestic product at factor cost (current prices), for agriculture, forestry and fishing; and manufacturing, respectively. The 1981 all-India figures include mining in the share of agriculture, and construction in the share of manufacturing.

of manufacturing in state NDP actually declined substantially between 1961 and 1981.

Figures 1-3 illustrate the variations in per capita output for the 20 states in our sample over the period 1961-91. Among the six initially-poor states in 1961 (Figure 1), Manipur has recorded the highest per capita annual growth rate between 1961-91 at 3.3 percent, despite having the third-highest population growth rate in the whole sample. Both Manipur and Tripura (with the second-highest population growth rate) also clearly benefitted the most from center-state grants in the post-1970 period (Table 2). Several northeastern states, including Tripura, have faced a large influx of refugees from Bangladesh, following its creation in 1971. At the other extreme, Bihar has grown at a very slow pace, recording the second lowest growth in per capita NDP during 1961-91. The dismal performance of Bihar, despite net out-migration over the period of analysis, appears to be closely related to low agricultural productivity in a largely agrarian state, poor infrastructure, and disincentives to invest because of political uncertainty, industrial unrest, and the steady erosion of law and order.

Among the nine initially-middle-income states (Figure 2), Haryana, Himachal Pradesh, Andhra Pradesh and Kerala grew at a faster pace in annual per capita terms during 1961-91 than the all-India average of 1.82 percent per annum (Table 2). Moreover, both Himachal Pradesh and Jammu and Kashmir benefitted greatly from center-state grants (Table 2). Andhra Pradesh and Kerala were among the main exporters of labor to the Middle East during the 1970s and the early 1980s--remittances to these states through the late 1980s may also have been a significant factor contributing to their relatively high rates of income growth during 1961-91.

Of the five initially-rich states (Delhi, Punjab, Maharashtra, Gujarat, and West Bengal), Punjab and Maharashtra have grown at the highest rates (Table 2 and Figure 3) during 1961-91. Punjab's success has already been accounted for above, while Maharashtra appears to have made inroads into expanding industrial production (compare the declining share of agriculture and the rising share of manufacturing in state NDP during 1961-81 in Table 2) and exports.

A common feature shared by virtually all the 20 states is large intertemporal variations in output. The main factors accounting for these variations include terms of trade shocks (particularly movements in the price of oil and other commodities), border conflicts and civil disturbances, variations in weather conditions, and other supply-side constraints. Not only is agricultural output in many states dependent on the timeliness and extent of rainfall (the monsoons), weather conditions also affect agricultural-based industries (such as food and textiles) and infrastructure (water supply and hydro-based power plants). Finally, rigidities in state-based product and factor markets have also precluded more rapid adjustment by states to unforseen macroeconomic shocks.

Figure 1

Real Per Capita NDP (1990 Rupees)
Six Initially-Poor States, 1961-91

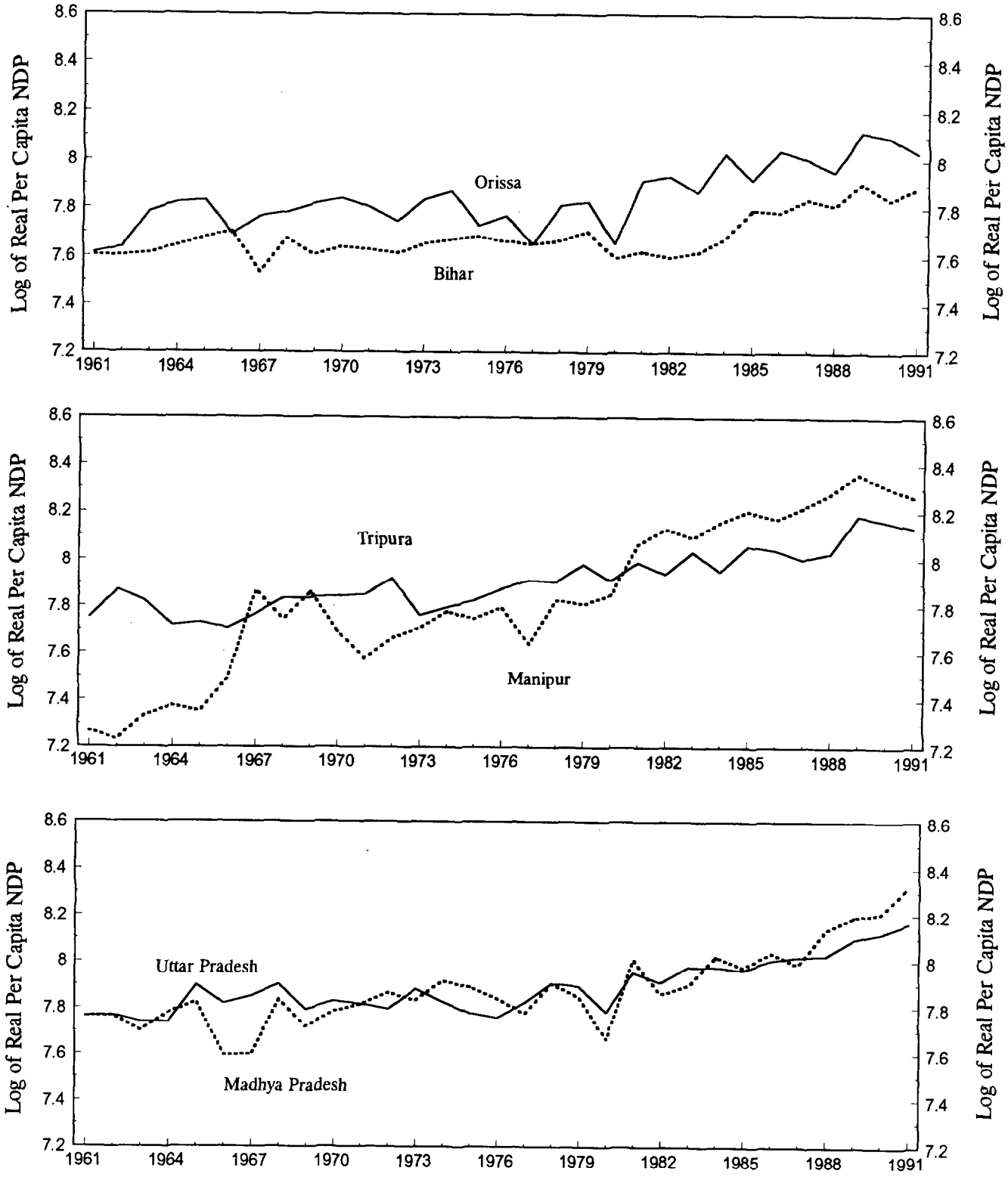


Figure 2

Real Per Capita NDP (1990 Rupees)
Nine Initially-Middle-Income States, 1961-91

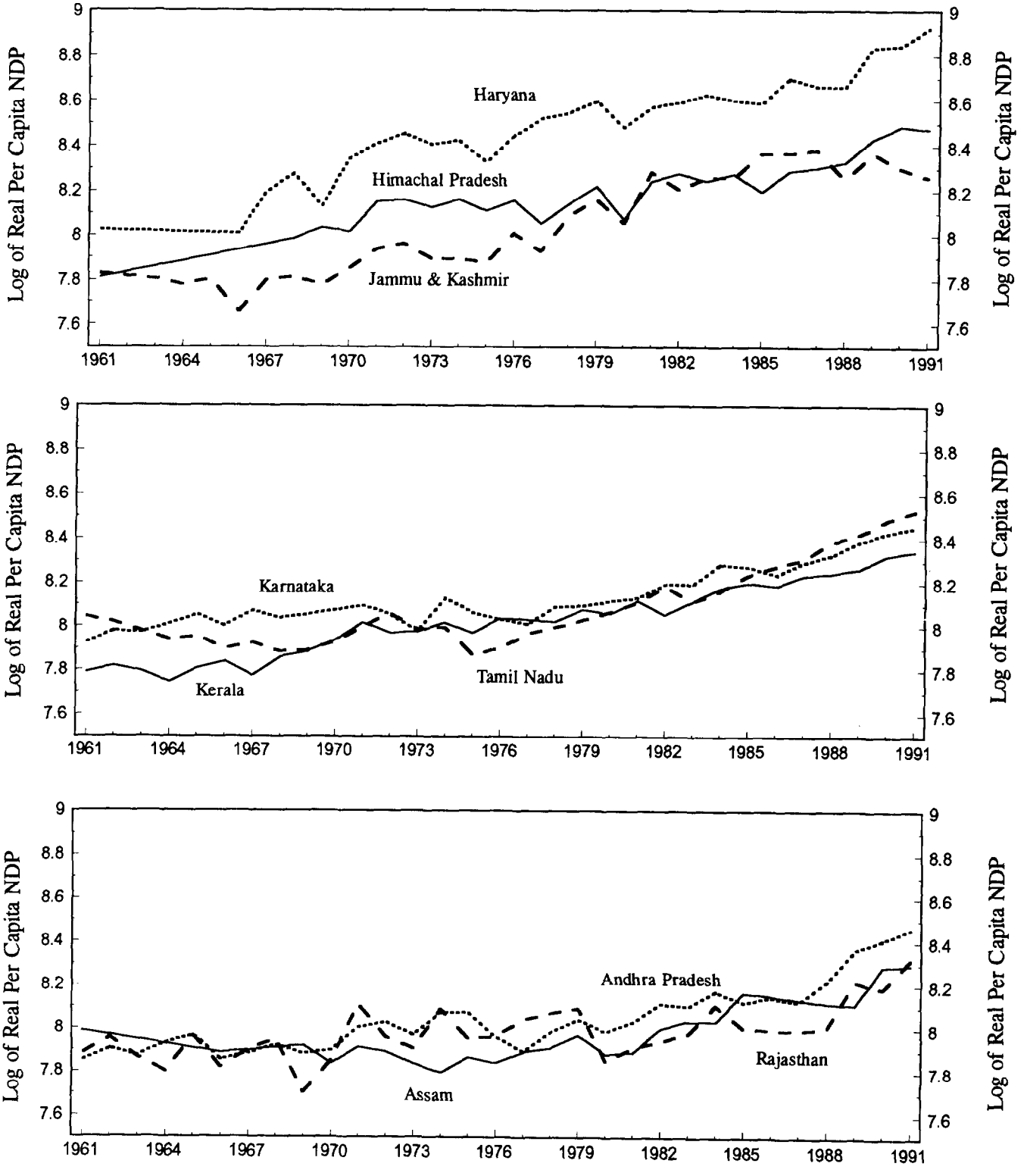
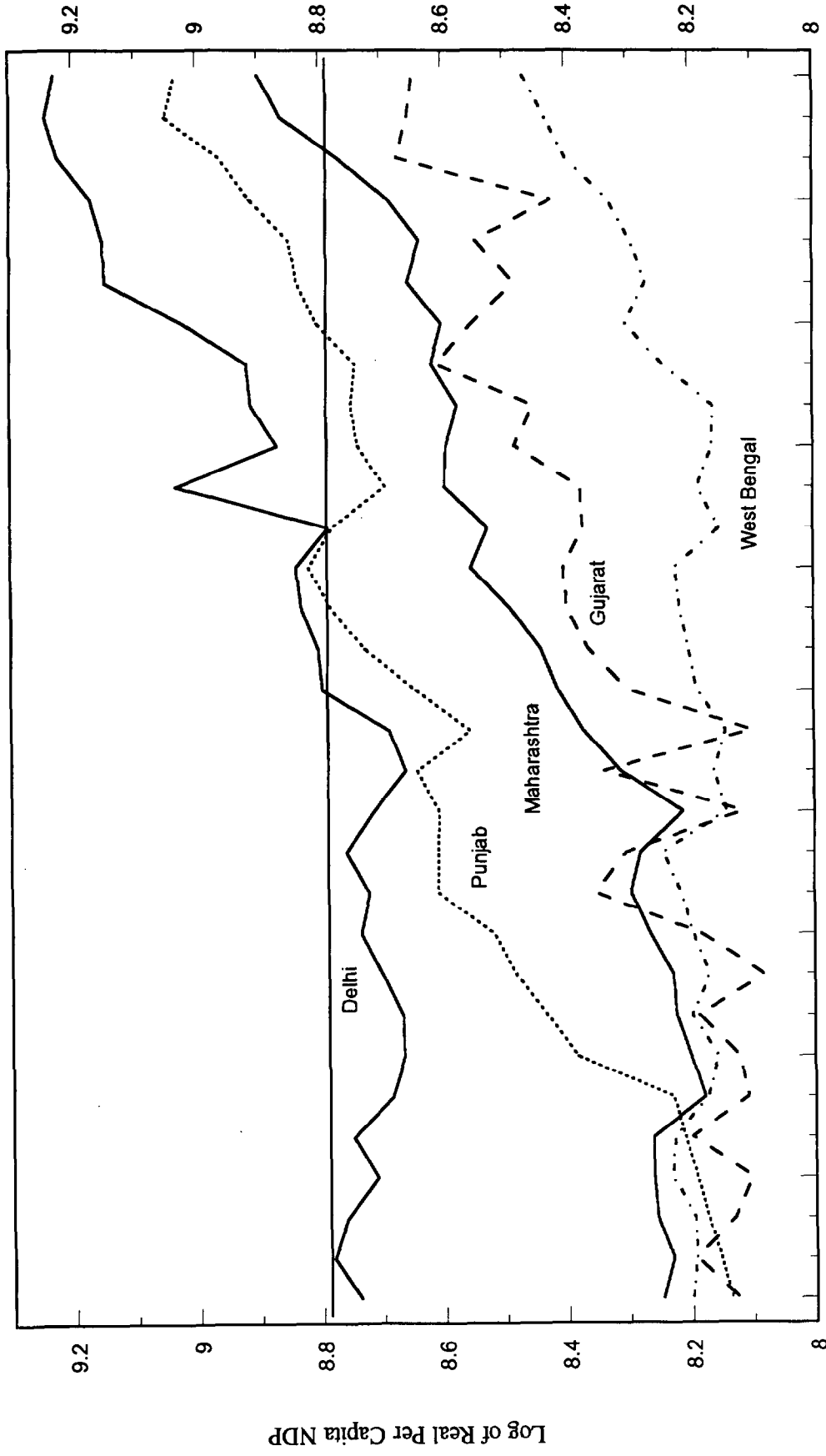


Figure 3

Real Per Capita NDP (1990 Rupees)
Five Initially-Rich States , 1961-91



III. Concepts of Convergence

Barro and Sala-i-Martin (1992a) derive an equation in discrete time for the average growth rate of per capita output, y, over the interval between t-T and t:

$$\ln(y_{it}/y_{i,t-T}) = C-\left(1-e^{-\beta T}\right)\ln(y_{i,t-T}) + \epsilon_{it} \qquad (1)$$

where i indexes the economy; T is the length of the observation interval; t is time; $y_{i,t-T}$ is real per capita net domestic product (NDP) for each economy at time t-T, the beginning of the subperiod; 1/ y_{it} is real per capita NDP at time t; β is the convergence coefficient; 2/ ϵ_{it} is an independent error term; and C is the constant term, which is common across states. In the neoclassical growth model of Solow (1956) and Swan (1956), convergence is conditional, as what drives β is the level of per capita income for each economy relative to its own steady-state per capita income and steady-state growth rate, which need not be homogeneous across economies. The probability of such homogeneity is, however, greater for regions of a given country, which are more likely to share common levels of technology, common preferences and common political institutions. Here we follow Barro and Sala-i-Martin (1992a) and assume that all twenty state economies have the same steady-state levels of real per capita NDP and steady-state growth rates, and so equation (1) implies absolute convergence if $\beta>0$. 3/

Two measures of convergence follow from equation (1). The first, known as β-convergence, asks whether initially-poor economies tend to grow faster than initially-rich ones (that is, whether there is mean reversion in the level of real per capita NDP across economies). Another concept is σ-convergence, which considers the decline of the cross-sectional dispersion of real per capita NDP over time. That is, it asks whether the standard deviation of the logarithm of per capita NDP (the coefficient of variation) is shrinking across economies over time. Barro and Sala-i-Martin (1992a) note that β-convergence is a necessary but not a sufficient condition for

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1/ The concept of state net domestic product is discussed in detail in Section IV.

2/ For a Cobb-Douglas production function in intensive form, and assuming a constant saving rate (as do Solow 1956 and Swan 1956), there is a closed-form solution for the convergence coefficient: $\beta=(1-\alpha)(g+n+\delta)$, where α is the share of capital in output, n is the rate of population growth, g is the exogenous rate of labor-augmenting technical progress, and δ is the depreciation rate.

3/ This assumption is tested (and could not be rejected) empirically in Section V below.

σ-convergence, as a positive β will tend to reduce σ_t (the dispersion of $\ln(y_{it})$ in equation (1)) for a given distribution of ϵ_{it}, but new exogenous shocks to ϵ_{it} will tend to raise σ_t.

An aggregate shock such as a large relative fall in the price of agricultural commodities would reduce the value of real output (akin to an income effect) in agriculture-based states. Conversely, it would raise the value of real output for those states which did not have a relatively large agricultural sector. Such disturbances alter the distribution of the error term, ϵ_{it}, so that ϵ_{it} is no longer distributed independently of ϵ_{jt} for states i and j, thus tending to raise σ_t temporarily above its steady-state value, σ. However, given that the steady-state distribution of ϵ_{it} does not change, for any given temporary shock, $\sigma_t \rightarrow \sigma$ over time.

Omitted variable bias can result if we do not control for these shocks. For example, such an aggregate shock to agricultural prices would differentially affect the more rural-based Indian states. If such states were initially poor, then an adverse price shock would induce underestimation of the subsequent speed of convergence, as the omitted (shock) variable would be positively correlated with initial income, $y_{i,t-T}$. 1/ Moreover, the main sectoral shift of employment in the Indian states over this period was from agriculture to other sectors, principally manufacturing and services. As economies develop, workers generally shift out of agriculture, and if these other sectors have higher labor productivity than agriculture, then this shift alone in the pattern of the workforce would generate growth in those states with initially-high shares of their economy in agriculture (Kuznets 1966). 2/ Hence the share of each state's NDP derived from agriculture in the initial year of each subperiod ($AGR_{i,t-T}$), and the share derived from manufacturing in the initial year of each subperiod ($MAN_{i,t-T}$) are added as explanatory variables in the estimation of equation (1), to control for the sectoral composition of state production.

IV. Data

In this paper we consider the period 1961-91, using data on twenty states of India. 3/ The output data used is per capita state net domestic

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1/ It is assumed here that y_{it} represents real per capita income from the production of goods and services in economy i, and so changes in relative prices appear as changes in y_{it}. That is, assuming no quantities change, a fall in agricultural (or manufacturing) prices generates a lower growth rate of y_{it} in economies which are large agricultural (manufacturing) producers.

2/ See Mitra (1988) for an analysis of Kuznet's hypothesis in the context of the states of India.

3/ The data are taken from official Government of India sources, to ensure consistency in definition and compilation and to aid the comparability of data across states and through time. All income, price and fiscal data are for years ending March. See the Appendix for further details.

product (NDP) in constant (1990 Rupees) prices, derived from: current price data on state and union territory NDP and per capita NDP (PCNDP) at factor cost (Government of India 1986, 1995), deflated by the national GDP deflator (DEF), base year 1990 (International Monetary Fund 1994). The state-based measures of NDP are analogs of national net domestic product--they measure income originating from factors of production physically located within the boundaries of each state, and represent the value of goods and services produced within a state. The NDP and PCNDP series are prepared on the basis of a uniform methodology as prescribed by the Central Statistical Organization (CSO), which is discussed in detail by Dholakia (1985), Government of India (1986) and Choudhury (1993). 1/ Two additional points should be made regarding the output data.

First, at the regional level there could be important differences between the income originating within the boundaries of any given state and the income accruing to the residents of that state, due to flows of factor incomes across state borders. However, in the Indian context, data on income accruing to residents by state do not exist. Second, the relative standard of living of the residents of any given state may not be accurately reflected in per capita income, to the extent that state-based per capita consumption expenditure diverges from per capita income. Choudhury (1993) found that between 1967-87 the divergence was small for most states, except for Rajasthan and Uttar Pradesh where consumption exceeded income (as both states were large net exporters of goods and services to other states), and for Tamil Nadu and Karnataka where income exceeded consumption.

The state population estimates (POP) are derived from census figures for 1961, 1971, 1981 and 1991, and mid-year population estimates are used for all other years (Government of India 1991a, 1991b, Registrar General and Census Commissioner 1991). Data on the share of manufacturing (MAN) and agriculture, forestry and fishing (AGR) in state NDP at factor cost are taken from Government of India (1986).

As a measure of internal population mobility, census data on migration during the 1960s and 1970s were used to calculate the intercensal annual average net migration into each state as a share of that state's population at the beginning of each intercensal period (MIG). Net migration figures for the 1981-91 subperiod were derived from state-based vital statistics (population growth, crude birth and death rates) due to the unavailability

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1/ The CSO-consolidated series for state NDP uses the same methodology and source material as those for the national estimates of NDP. However, to the extent that minor revisions called for by the availability of new source material are not retrospectively incorporated for earlier years, the state NDP estimates are not strictly comparable over time. Similarly, differences in the source material used, data availability and the extent of statistical development mean that the quality of income measures may vary across states at any given point in time (Government of India 1986).

of 1991 census data (Government of India 1991a, 1991b, Registrar General and Census Commissioner for India 1977, 1988). 1/

Estimates of state per capita disposable income (SDI) are derived by adding the grant component of transfers (TR) from the central government to state governments to NDP, then dividing by POP and applying the appropriate DEF. As noted in Section II, TR comprises statutory grants-in-aid, grants due to state and central plan schemes and grants due to centrally-sponsored schemes. State disposable income (SDI) is the state-based analog of national disposable income, in that it represents the total income available to residents of a given state for consumption and saving. As mentioned above, in the Indian context this concept will not be a perfect state-based analog of the national accounts definition of national disposable income, as our measure of SDI excludes net factor incomes flowing across state borders to residents of a state.

To examine whether there are regional differences in the steady-state level of per capita income to which the states of India are converging, each of the 20 states was allocated into one of four geographic regions; these dummy variables were east (six states), north (six states), south (four states) and west (four states). Further details on the definition, derivation and sources of all the variables used in this study can be found in the Appendix. Tables 1, 2, and Appendix Table A1 present summary statistics of the above data for each of the twenty state economies.

V. Did the Initially-Poor States Grow Faster than the Initially-Rich Ones?

The analysis of disparities in per capita incomes and growth rates across the states of India has been a popular theme for research on the Indian union, with key contributions by Chaudhry (1966), Mukherjee (1969), Nair (1971), Majumdar (1976), Majumdar and Kapoor (1980), Choudhury (1980), Dholakia (1985), Nair (1985), Rao (1985), Singh (1985), Sastry and Nag (1990), Singh (1992), Choudhury (1993), and Ghuman and Kaur (1993). However, apart from the important work of Dholakia (1985), most of these papers did not move beyond analyses of trend movements in NDP and per capita NDP, or the ranking of states by per capita income, or focussed more narrowly on determining the causes of sectoral-based shocks to income or consumption in particular states. The task of this empirical section is to analyze formally whether the initially-poor states grew faster than the initially-rich ones between 1961-91, using equation (1) and real per capita NDP as the measure of income.

Column (1) of Table 3 reports the regression estimates of the convergence coefficient (β) in equation (1), where the only explanatory variables are a constant term (not reported) and the logarithm of initial subperiod income ($\ln(y_{i,t-T})$). Note that a positive coefficient on initial

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1/ Unless otherwise denoted, net migration in this paper is synonymous with net immigration.

Table 3. Cross-State Regressions for Indian Net Domestic Product (NDP), 1961-91 1/

Period	(1) Basic Equation $\hat{\beta}$ (se)	R^2 [$\hat{s}$]	(2) Equation Controlling for Agri. Shocks $\hat{\beta}$ (se)	$\hat{\theta}$ (se)	R^2 [$\hat{s}$]	(3) Equation Controlling for Agri. and Manu. Shocks $\hat{\beta}$ (se)	$\hat{\theta}$ (se)	$\hat{\tau}$ (se)	R^2 [$\hat{s}$]
1961-91	0.0027 (0.0057)	0.654 [0.207]							
1961-71	0.0125 (0.0129)	0.769 [0.149]	0.0010 (0.0172)	0.0902 (0.1061)	0.779 [0.150]	-0.0077 (0.0183)	0.0730 (0.1083)	-0.0984 (0.1079)	0.790 [0.151]
1971-81	0.0034 (0.0124)	0.781 [0.158]	0.0220 (0.0165)	-0.1736 (0.0791)	0.830 [0.144]	0.0223 (0.0170)	-0.1567 (0.0886)	0.0275 (0.0589)	0.832 [0.147]
1981-91	0.0022 (0.0083)	0.890 [0.116]	0.0029 (0.0114)	-0.0060 (0.0653)	0.890 [0.120]	0.0075 (0.0102)	0.0577 (0.0595)	0.1283 (0.0455)	0.927 [0.101]
β restricted 2/	-0.0012 (0.0040)		0.0052 (0.0059)			0.0153 (0.0069)			
Wald test 3/	11.581		6.314			3.827			
p-value	0.0041		0.0426			0.1476			

Notes: The regressions use nonlinear least squares to estimate equations of the form: $\ln(y_{it}) = \alpha + [\ln(y_{i,t-T})]\ (e^{-\beta T}) +$ other variables, where $y_{i,t-T}$ is the real per capita NDP (in constant 1990 Rupees) in state i at time t-T; y_{it} is the real per capita NDP (in constant 1990 Rupees) in state i at time t; T is the length of each subperiod; "other variables" are the share of agriculture in each state's NDP at time t-T, $AGR_{i,t-T}$ (reported as $\hat{\theta}$), and the share of manufacturing in each state's NDP at time t-T, $MAN_{i,t-T}$ (reported as $\hat{\tau}$).

1/ All regressions are for 19 states and the Union Territory of Delhi. Underneath the estimates of β, θ and τ are reported the heteroscedastic-consistent standard errors (in parentheses). R^2 is the coefficient of determination; underneath it is the standard error of the regression [$\hat{s}$]. All regressions are run with a constant term, α (not reported).

2/ Restricted refers to a combined regression which constrains the value of β to be the same across the equations of a given system, and the restricted β are estimated using iterative, weighted seemingly unrelated regression, which allows for the correlation of error terms across subperiods.

3/ The Wald test and associated p-value (a χ^2 with n-1 degrees of freedom in an n-equation system) refers to the test for equality of the coefficient on the logarithm of initial income (β) across the subperiods. The 0.05 χ^2 value with two degrees of freedom is 5.9915.

income can be translated as initially-poor states growing faster than initially-rich ones. The first row of column (1) in Table 3 reports the results for a single regression on the period 1961-91, and it is found that β=0.0027 [s.e.=0.0057] is the result, with a coefficient of determination of 0.654 and standard error of the regression of 0.207. However, while this estimate of β is not statistically different from zero, the simple correlation between $\ln(y_{1961})$ and the 1961-91 growth rate of -0.116 reflects β-convergence (Figure 4). As expected, both Manipur (MN) and Himachal Pradesh (HP) had below-average per capita incomes in 1961, and relatively high rates of growth of per capita incomes in the 30 years thereafter. While Delhi (D) clearly had the highest per capita income in 1961, its 1961-91 growth rate was close to that which would be predicted given its initial level of per capita NDP.

Rows two to four of column (1) of Table 3 divide the 1961-91 period into three intercensal subperiods: 1961-71, 1971-81 and 1981-91. Nonlinear least squares estimates of equation (1) find that the estimated convergence coefficients for 1961-71, 1971-81 and 1981-91 have the appropriate (positive) sign, indicating β-convergence, yet are not statistically significant.

Figures 5 to 7 depict the negative correlation between initial income and the subsequent growth rate for these subperiods, which is clearly strongest for the subperiod 1961-71. The relatively strong growth performance in the 1961-71 subperiod of initially-poor Manipur (MN), Kerala (KE) and Himachal Pradesh (HP), and the relatively poor performance of initially-rich Delhi (D), is clear from Figure 5. Accordingly, there is quite rapid β-convergence in the 1960s as the initially-poor states grew faster than their initially-rich counterparts, which barely grew at all in per capita terms--the simple correlation of $\ln(y_{1961})$ with the growth rate for 1961-71 is -0.237.

The relatively good growth performance of initially-rich Delhi (D), Punjab (P), Haryana (H), Maharashtra (MH) and Gujarat (G) in the 1971-81 and 1981-91 subperiods stands out in Figures 6 and 7. The correlation of $\ln(y_{1971})$ with the 1971-81 growth rate is much lower at -0.065; and the correlation of $\ln(y_{1981})$ with the 1981-91 growth rate is also low at -0.064. Accordingly, there is only slight β-convergence in these intercensal periods. 1/ A multivariate regression on the three-equation system yields a restricted estimate of β=-0.0012, which is not statistically significant, and a Wald test of the hypothesis of the same β-coefficient in all three subperiods indicates that this hypothesis is rejected.

1/ States in which real per capita NDP declined were: Assam, Delhi and Tamil Nadu in the 1960s; Assam, West Bengal and Rajasthan in the 1970s; and Jammu and Kashmir in the 1980s. However, it is important to recognize that, while decennial rates of growth of real NDP were positive in all these cases, they did not keep pace with intercensal population growth rates.

Figure 4

Convergence of Real Per Capita NDP Across 20 Indian States:
1961 NDP and 1961-91 NDP Growth

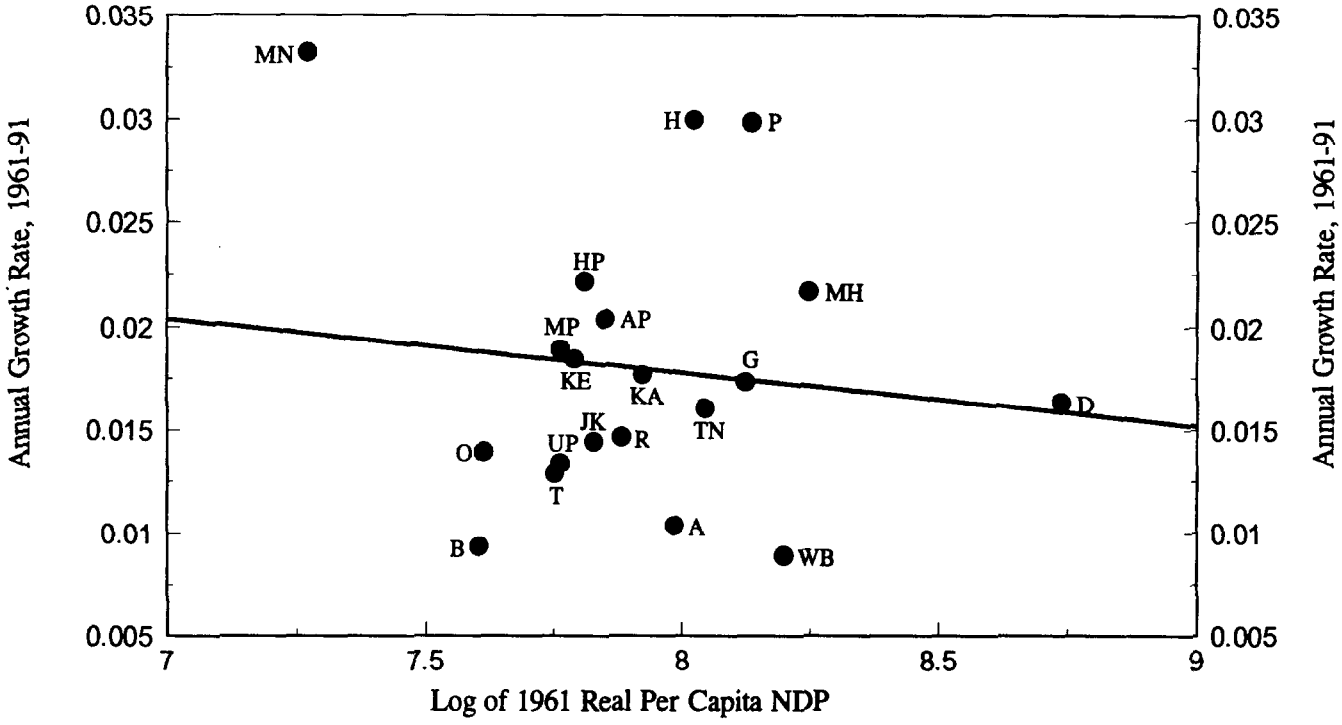


Figure 5

Convergence of Real Per Capita NDP Across 20 Indian States:
1961 NDP and 1961-71 NDP Growth

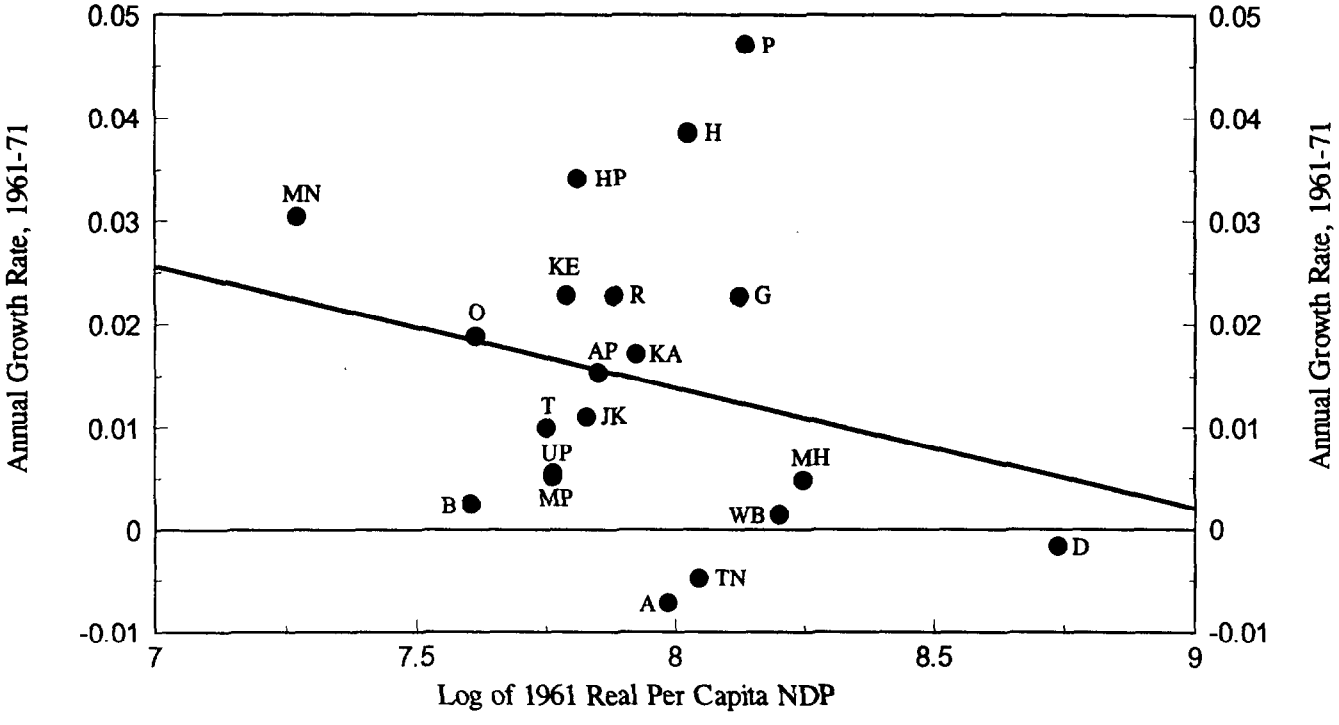


Figure 6

Convergence of Real Per Capita NDP Across 20 Indian States:
1971 NDP and 1971-81 NDP Growth

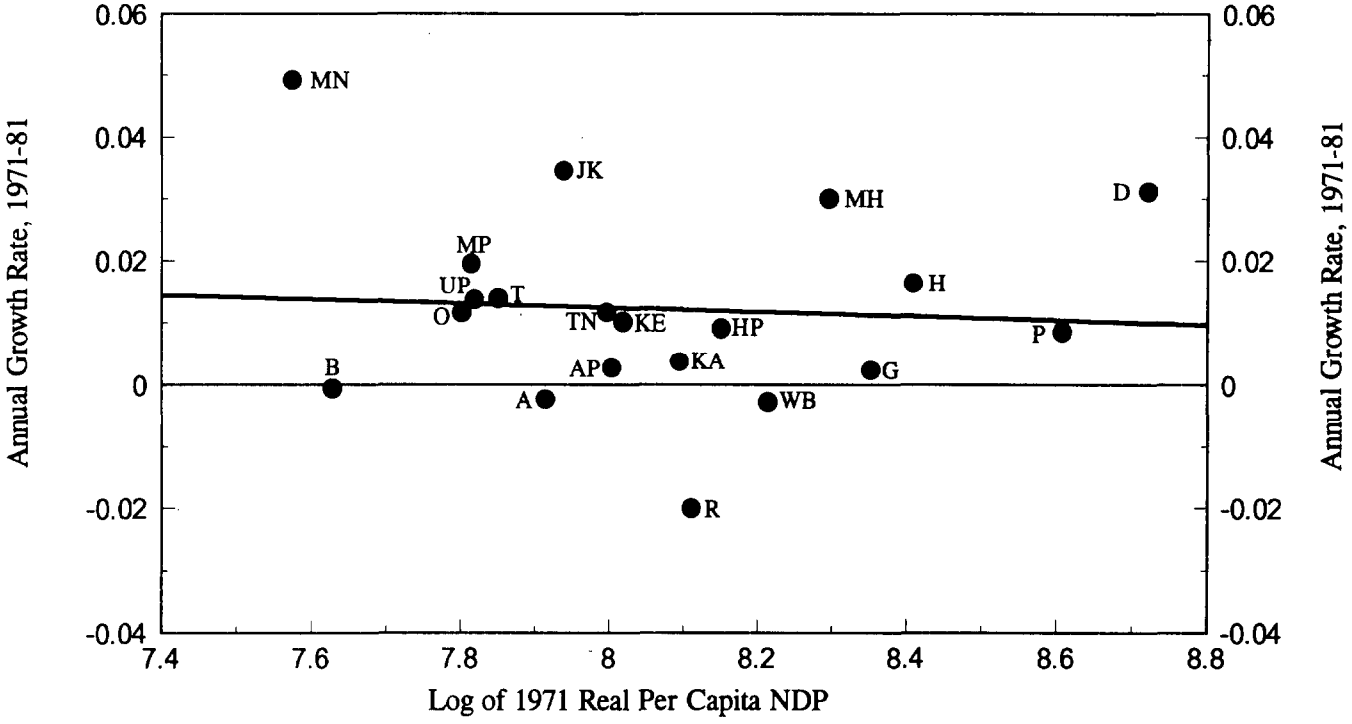
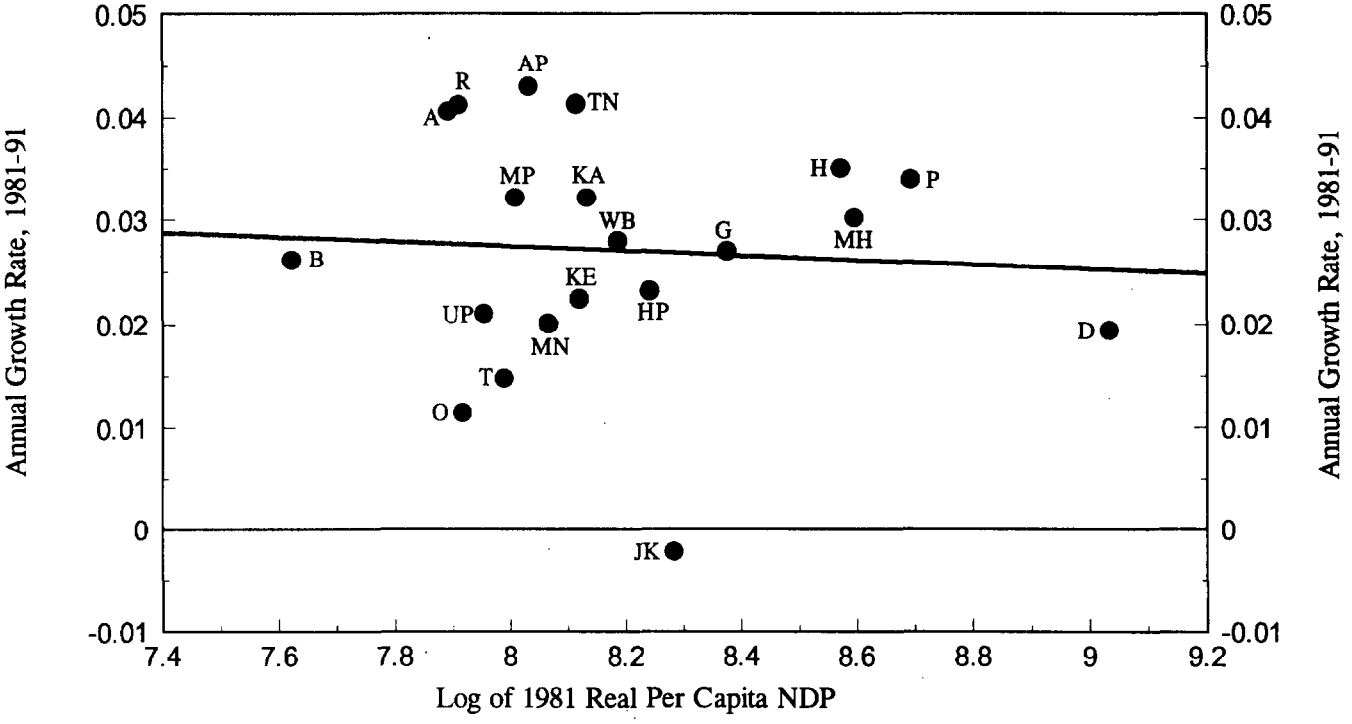


Figure 7

Convergence of Real Per Capita NDP Across 20 Indian States:
1981 NDP and 1981-91 NDP Growth



The apparent instability of the convergence coefficients in the three subperiods could reflect aggregate disturbances which differentially affected state NDP (as mentioned in Section III above). 1/ Accordingly, in column (2) of Table 3 the share of NDP derived from the agricultural sector of each state ($AGR_{i,t-T}$) is added to the basic regression to control for aggregate shocks. As a result, the estimated coefficient for the subperiod 1971-81 is raised considerably (from $\hat{\beta}$=0.0034 to $\hat{\beta}$=0.0220), and that for the subperiod 1961-71 is lowered considerably (from $\hat{\beta}$=0.0125 to $\hat{\beta}$=0.0010). The restricted coefficient in the multivariate regression (row five, column (2)) now has a value of $\hat{\beta}$=0.0052 which is not statistically significant, and a Wald test of the hypothesis of equality of the estimated β-coefficients across the three subperiods indicates that this hypothesis is again rejected. It appears that $AGR_{i,t-T}$ is unable to fully capture the influence of aggregate shocks on the growth process, although it does provide information on the sectoral pattern of state growth across the three subperiods.

Accordingly, in column (3) of Table 3 the share of NDP derived from the manufacturing sector of each state ($MAN_{i,t-T}$) is added to the basic regression to further control for aggregate shocks. This variable is likely to be particularly important in the Indian context, given the industrialization strategy pursued in India from the early 1960s until the mid-1980s. Its absence from the growth regression would thus be expected to result in omitted variable bias. The result is that the estimated coefficient for the subperiod 1971-81 remains much the same as in column (2) (from $\hat{\beta}$=0.0220 to $\hat{\beta}$=0.0223); that for the subperiod 1981-91 is raised (from $\hat{\beta}$=0.0029 to $\hat{\beta}$=0.0075); and that for the subperiod 1961-71 is lowered (from $\hat{\beta}$=0.0010 to $\hat{\beta}$=-0.0077). The restricted coefficient in the multivariate regression (row five, column (3)) now has a statistically significant value of $\hat{\beta}$=0.0153, and a Wald test of the hypothesis of equality of the estimated β-coefficients across the three subperiods indicates that this hypothesis is not rejected. Such a value for β implies a half-life of the logarithm of per capita income (the time it takes to close one-half of the gap between any state's initial

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1/ A further cause of potential bias is our use of a national deflator to adjust nominal state NDP figures for the change in prices. That is, where P_{INDIA} (the level of India's national GDP deflator) is used rather than P_i (state-based deflators) to derive real NDP for each state from nominal state NDP, if prices differ across states at points in time, the correlation between P_{INDIA} and the error term will induce bias in the estimated coefficients. However, the use of a common (national) deflator for each state at each point in time in a cross-sectional analysis will affect only the constant term in each regression. Moreover, work by Dholakia (1986) confirms that for the 1960s, the series of real per capita state NDP at local and at national prices were statistically identical. Bhattacharyay (1982) also finds that there was little cross-state variation in the purchasing power of a rupee between 1964-78.

level of per capita income and the common steady-state level of per capita income) of 45 years. 1/

The agricultural variable (reported as $\hat{\theta}$ in column (2) of Table 3) is negative for the 1971-81 and 1981-91 subperiods and positive for the 1961-71 subperiod. This indicates that, for example, those states where the agricultural sector was a large contributor to NDP had relatively lower levels of final per capita income in the 1971-81 subperiod. That is, they enjoyed relatively lower rates of growth of per capita income over that subperiod ($\hat{\theta}$=-0.1736). Note that in row three of column (2) it is the period 1971-81 which exhibits the largest convergence coefficient ($\hat{\beta}$=0.0220). The relative decline in agricultural commodity prices over the decade hurt those economies specializing in such products. In 1971 Bihar, Orissa, Tripura and Uttar Pradesh had below-average per capita incomes, yet each had a relatively large share of their 1971 NDP derived from agriculture: the correlation of $\ln(y_{1971})$ with AGR_{1971} is -0.534. Consequently, because of the positive correlation between the aggregate shock and initial income, β was under-estimated in row three of column (1): it reflected the tendency of the poorer states to be agricultural and hence to experience relatively slow growth during this subperiod (Table 3). For the 1961-71 subperiod, again agricultural-based states tended to be relatively poor (the correlation of $\ln(y_{1961})$ with AGR_{1961} was -0.766), yet the positive shock to agriculture meant that in row two of column (1) β was over-estimated: controlling for the aggregate shock lowered β in row two of column (2), because of the negative correlation between the agricultural shock and initial income (Table 3).

Similarly, the manufacturing variable (reported as $\hat{\tau}$ in column (3) of Table 3) is positive for the 1971-81 and 1981-91 subperiods and negative for the 1961-71 subperiod. This indicates that, for example, those states where the manufacturing sector was a large contributor to NDP had relatively higher levels of final per capita income in the 1981-91 subperiod. That is, they enjoyed relatively higher rates of growth of per capita income over that subperiod ($\hat{\tau}$=0.1283). Note that in row two of column (3) it is the period 1961-71 which exhibits the greatest shift in its convergence coefficient (from $\hat{\beta}$=0.0010 to $\hat{\beta}$=-0.0077). The relative decline in manufacturing prices over that decade hurt those economies specializing in such products. In 1961 Delhi, Maharashtra, West Bengal, Gujarat, Tamil Nadu and Assam had above-average per capita incomes, yet each had a relatively large share of their 1961 NDP derived from manufacturing: the correlation of $\ln(y_{1961})$ with MAN_{1961} is 0.718. Consequently, because of the negative correlation between the aggregate shock and initial income, β was over-estimated in row two of column (2): it reflected the tendency of richer states to be manufacturing based and hence to experience relatively slow growth during this subperiod (Table 3). For the 1981-91 subperiod, again manufacturing-based states tended to be relatively rich (the correlation of $\ln(y_{1981})$ with MAN_{1981} was 0.504), yet the positive shock to manufacturing

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1/ The formula for the "half life" (HL) in years is: $HL=\log(2)/\beta$.

meant that $\hat{\beta}$ in row two of column (2) was under-estimated: controlling for the aggregate shock raised β in row four of column (3), because of the positive correlation between the manufacturing shock and initial income (Table 3).

The estimated speed of convergence for the Indian states between 1961-91 (β=0.0153) is slower than that found in most earlier studies of regional economies of developed countries: the states of the United States (β=0.0249) between 1880-1988 by Barro and Sala-i-Martin (1992a); the regions of European OECD countries (β=0.0178) between 1950-85 by Barro and Sala-i-Martin (1991); the provinces of Canada (β=0.024) between 1961-91 by Coulomb and Lee (1993); the regional economies of Austral(as)ia (β=0.0121) between 1861-1991 by Cashin (1995); 98 (OECD and non-OECD) countries (β=0.0111) between 1960-85 by Barro (1991); the prefectures of Japan (β=0.034) between 1930-87 by Barro and Sala-i-Martin (1992b); the prefectures of Japan (β=0.033) between 1960-88 by Shioji (1993); and the developed and developing island economies of the South Pacific (β=0.0432) between 1971-93 by Cashin and Loayza (1995). 1/ 2/ Barro and Sala-i-Martin (1991) hypothesized that the more heterogeneous the steady states to which a group of economies are converging, the slower the speed of convergence, even after controlling for the disparate steady states. That is, regions of a given country (such as the United States, Canada, Japan, India and Austral(as)ia) should exhibit the fastest convergence, followed by similar national economies (such as the OECD), followed by all national economies. While for some subperiods the present findings fit into this hierarchy of convergence speeds, over the full sample period this does not appear to be the case for the Indian states. However, the fact that β-convergence is observed in India without controlling for differences in steady-state growth rates or steady-state levels of per capita incomes is indicative of homogeneity across the states of India with respect to steady

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1/ As noted in Section III, using the Cobb-Douglas-based closed-form solution for the speed of convergence from the Solow-Swan (1956) model yields $\beta=(1-\alpha)(n+g+\delta)$. Assuming that $(g+\delta)$=0.04 (reflecting the slow rate of exogenous technical change in developing countries); letting n=0.03 (replicating India's rapid rate of population growth), then β=0.015 can only be approximated with a value for α of about 0.75. As argued by Barro and Sala-i-Martin (1995), such a capital share is too high for a narrow concept of physical capital, but would be consistent with a broad concept of capital that also includes human capital.

2/ A speed of convergence of about 1.5 per cent per year is close to that obtained for a sample of 95 developing countries (β=0.014) between 1970-90 by Khan and Kumar (1993).

states, yet heterogeneous initial levels of per capita state incomes. 1/ Hence, absolute and conditional convergence in the Indian states do appear to be almost synonymous. 2/

VI. Did the Cross-State Dispersion of Per Capita Incomes Widen or Narrow?

To determine the extent of the dispersion of per capita incomes across the twenty Indian states, the unweighted cross-sectional standard deviation of $\ln(y_{it})$, σNDP_t, was calculated for the period 1961-91. 3/ Figure 8 shows that over this period there has been an increase in the dispersion of real per capita incomes (σNDP_t) across the Indian states, except for the subperiods 1962-68, 1972-75, 1977-78 and 1980-84. The dispersion fell from 0.292 in 1961 and 0.328 in 1962 to 0.268 in 1975, then increased to reach 0.339 in 1980, fell to 0.297 in 1984, and then rose to 0.333 by 1991. 4/ 5/

The dispersion of real per capita NDP across the states narrowed between 1961-71 due to robust growth rates in initially-poor states (Manipur, Kerala and Himachal Pradesh) and slow growth rates in initially-rich states (Delhi, West Bengal and Maharashtra). However, in the 1971-81 and 1981-91 subperiods the initially-poor states (Manipur, Bihar and Orissa in 1971; Bihar, Assam and Orissa in 1981) and the initially-rich states (Delhi, Punjab and Haryana in 1971; Delhi, Punjab and Maharashtra in 1981) had similar rates of economic growth (Figure 6 and 7). 6/

1/ Moreover, a formal test of the null hypothesis that the coefficients on the regional dummy variables are all equal to zero found that the hypothesis could not be rejected. A test of this restriction, run by adding the dummies to the three intercensal regressions of Table 3, yielded a Likelihood Ratio test statistic of 8.112; the corresponding χ^2 value with 9 degrees of freedom at the 0.05 percent level is 16.919.

2/ In future work the authors will examine the robustness of this result, using alternative models of the growth process.

3/ The σNDP_t calculations exclude certain states for certain years, due to the unavailability of data on state per capita NDP. These are: Assam, Haryana, Himachal Pradesh and Punjab for 1962-65; Himachal Pradesh for 1966; Assam and Himachal Pradesh for 1967; and Assam for 1968.

4/ A least squares regression of σNDP_t on a time trend and a constant term revealed that for the 1961-91 subperiod the coefficient on the time trend (λ) was small yet significantly positive (λ=0.0015 [s.e.=0.0004]). This indicates that σNDP_t has been increasing at the small trend rate of growth of 0.15 percent per year over the 1961-91 period.

5/ As noted in Section II and by both Barro and Sala-i-Martin (1992a) and Quah (1993), even if absolute β-convergence holds (as it does for the states of India), the dispersion of per capita incomes across economies need not decline.

6/ Evidence of increasing regional disparities in the 1980s was also found in the work of Majumdar and Kapoor (1980), Nair (1985), Singh (1985) and Rao (1985) on the cross-state dispersion of per capita incomes.

Figure 8

Dispersion of Real Per Capita Incomes: Twenty Indian States, 1961-91

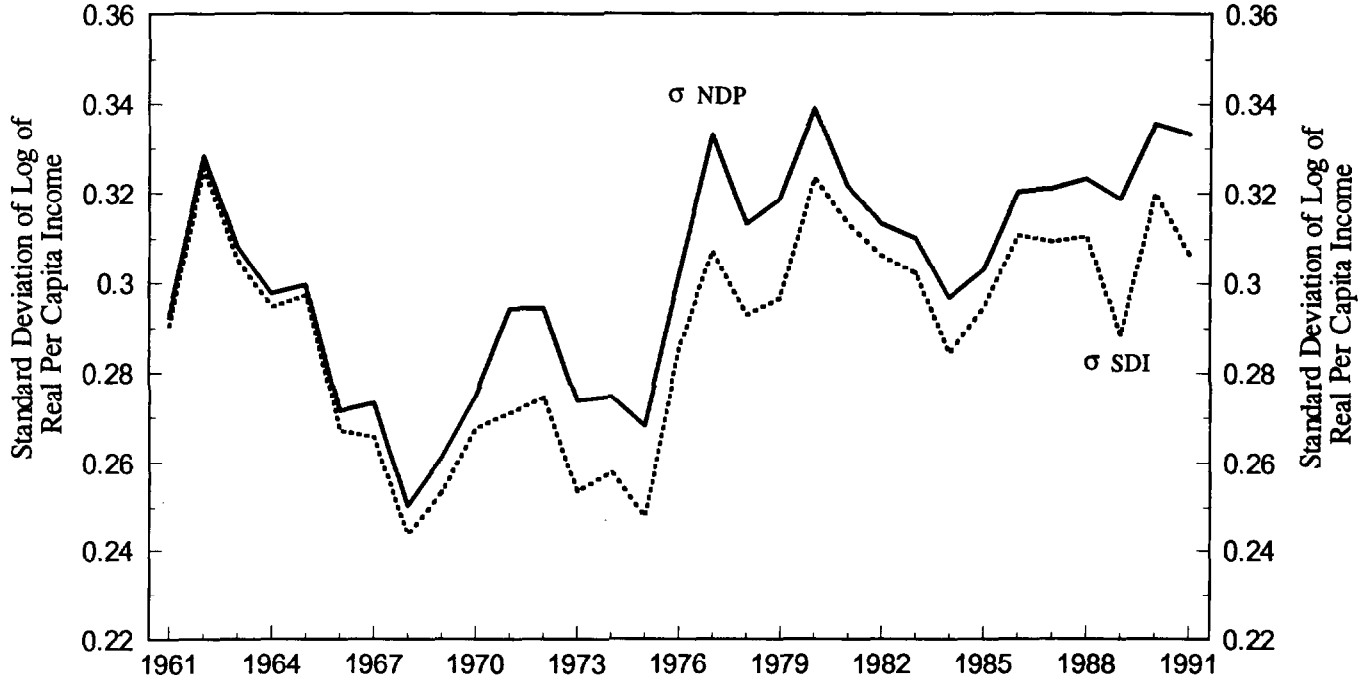
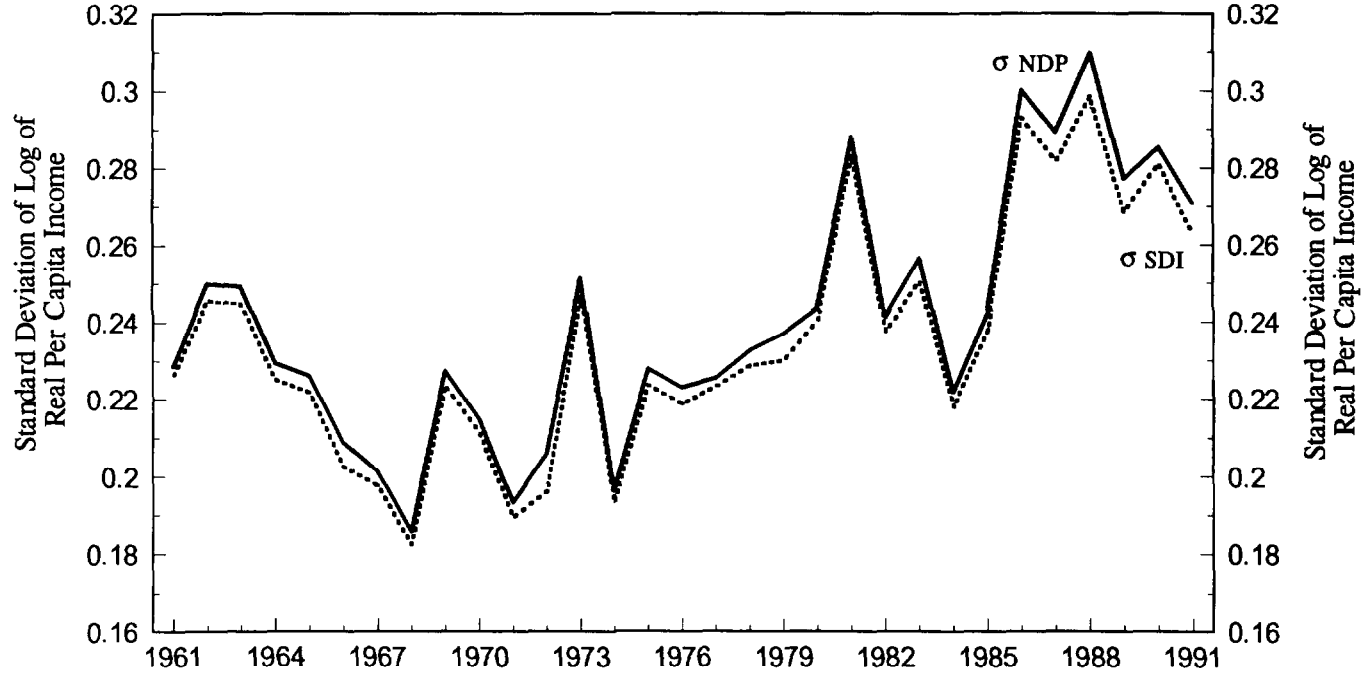


Figure 9

Dispersion of Real Per Capita Incomes: Five Initially-Rich Indian States, 1961-91



This process of a widening in the cross-sectional dispersion of real per capita NDP for the Indian states contrasts with the pattern exhibited by developed countries (the states of Australia, the prefectures of Japan and the states of the United States), where the minimum value of σ_t was found to be 0.12, 0.12 and 0.14, respectively (Cashin 1995, Barro and Sala-i-Martin 1992b). One explanation for the observed pattern of σNDP_t for India is that the steady-state value for σ is about 0.32, and that σNDP_t should remain close to this level until there is an aggregate shock which differentially affects the states. Interestingly, India's steady-state value of σ is over twice the level of those for the regional economies of Australia, Japan and the United States, and most likely reflects higher barriers to the free flow of capital and labor across the Indian states than those existing in these developed economies.

In Figure 8 is also plotted a measure of the dispersal of state per capita disposable incomes, σSDI_t, where SDI is defined as state NDP plus center-state grants. 1/ Given the presence of center-state grants which are allocated more to relatively poor states than relatively rich states, then it would be expected *a priori* that the dispersion of per capita income would be greater for σNDP_t than σSDI_t. This is indeed the case, as $\sigma NDP_t > \sigma SDI_t$ for all t (Figure 8). Accordingly, center-state grants have been operating to equalize per capita incomes across the twenty states--the poor states are the relative beneficiaries of this aspect of Indian fiscal federalism, at the expense of their relatively rich counterparts. For state disposable income there is only slight σ-divergence over the 1961-91 period: σSDI_t rose from 0.290 in 1961 and a period-high of 0.326 in 1962 to reach 0.324 in 1980, fell to 0.284 in 1984, and then rose to 0.306 by 1991.

The gap between σSDI_t and σNDP_t widened considerably after the mid-1960s, which reveals the much greater role played by center-state grants after this date (Figure 8). That is, while the dispersion of per capita NDP has widened, there has also been an increase in grants to relatively poor states over the 1961-91 period. This has resulted in relatively little change in the dispersion of per capita SDI across the states of India during this period, as grants have compensated for the widening dispersion of the per capita NDP component of per capita SDI. In particular, after 1975 the value of σSDI_t has fluctuated around 0.30, while that of σNDP_t has fluctuated around 0.32; between 1966-75 the σ_t values fluctuated around 0.26 and 0.27, respectively.

A useful disaggregation of the data is to examine whether the initially-rich economies in 1961 (Delhi, Maharashtra, West Bengal, Gujarat and Punjab) experienced σ-convergence as a sub-group, and whether the initially-poor economies (Manipur, Bihar, Orissa, Tripura, Madhya Pradesh

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1/ Due to the unavailability of data, information on grants from the central government to the Union Territory of Delhi over the period 1961-91 are unavailable. Accordingly, our measure of σSDI_t does not include center-state grants to Delhi.

and Uttar Pradesh) and initially-middle-income economies (Andhra Pradesh, Assam, Haryana, Himachal Pradesh, Jammu and Kashmir, Karnataka, Kerala, Rajasthan, Tamil Nadu) did likewise. The results are depicted in Figures 9 to 11.

The gap between σNDP_t and σSDI_t is small for the five initially-rich states, indicating that grants have had little effect on the dispersion of per capita incomes across these states (Figure 9). However, even among these rich states $\sigma NDP_t > \sigma SDI_t$ for all t, indicating that the poor members of this sub-group benefitted from center-state grants relatively more than their richer counterparts. Overall, there is σ-divergence for both measures of income; σNDP_t rises from 0.229 in 1961 to 0.271 in 1991, and σSDI_t rises from 0.226 in 1961 to 0.263 in 1991. This result can be largely attributed to the relatively rapid growth of rich Delhi, and the relatively slow growth of poor West Bengal.

Interestingly, while $\sigma NDP_t > \sigma SDI_t$ from 1961-75 for the nine initially-middle-income states, $\sigma NDP_t < \sigma SDI_t$ between 1976-88 (Figure 11). While the poor members of this sub-group were relative beneficiaries of center-state grants in the former sub-period, the reverse occurred in the latter sub-period. From 1990 onwards, σNDP_t is again greater than σSDI_t. Overall, there is clear σ-divergence for both measures of income; σNDP_t rises from 0.089 in 1961 to 0.188 in 1991, and σSDI_t rises from 0.087 in 1961 to 0.171 in 1991. This result can be largely attributed to the relatively rapid growth of rich Haryana, and the relatively weak growth performance of poor Jammu and Kashmir.

For the six initially-poor states there is little difference between σNDP_t and σSDI_t until 1970--center-state grants played a minor role in influencing the dispersion of per capita income across the initially-poor states in these early years (Figure 10). However, beginning in 1970 σSDI_t exhibits erratic behavior--$\sigma NDP_{1970} < \sigma SDI_{1970}$, then the dispersion of per capita NDP jumps so that $\sigma NDP_{1971} > \sigma SDI_{1971}$, then the dispersion of per capita disposable income jumps so that $\sigma NDP_{1972} < \sigma SDI_{1972}$. This erratic behavior can be largely attributed to the beginning of payments of grants to Manipur (in 1971) and Tripura (in 1972). However, between 1972-91 σNDP_t is clearly smaller than σSDI_t, indicating that the rich members of this sub-group were relative beneficiaries of center-state grants. That is, the grants acted to exacerbate inequalities in per capita incomes across the six poor states, especially after 1974. The high level of per capita grants received by both Manipur and Tripura, combined with the relatively low level of per capita grants received by Bihar and Uttar Pradesh, resulted in σ-divergence for σSDI_t between 1974-85, and slight σ-convergence for σSDI_t

Figure 10

Dispersion of Real Per Capita Incomes: Six Initially-Poor Indian States, 1961-91

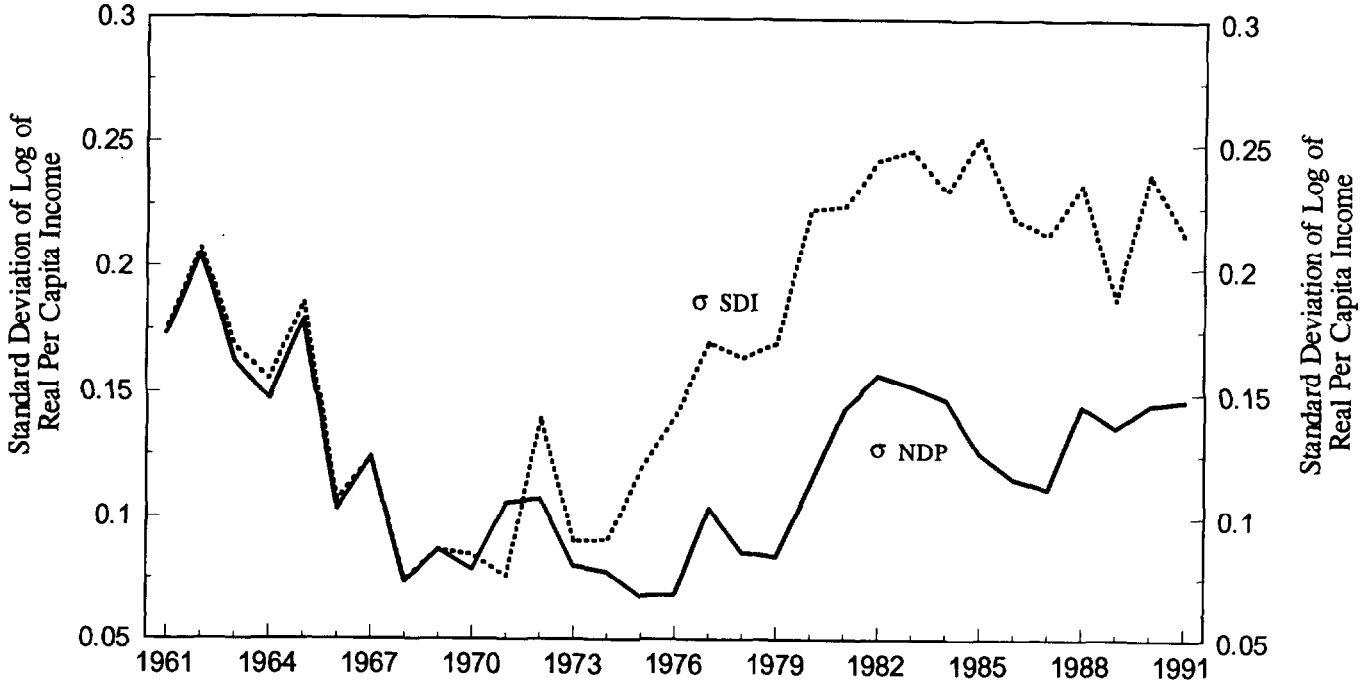
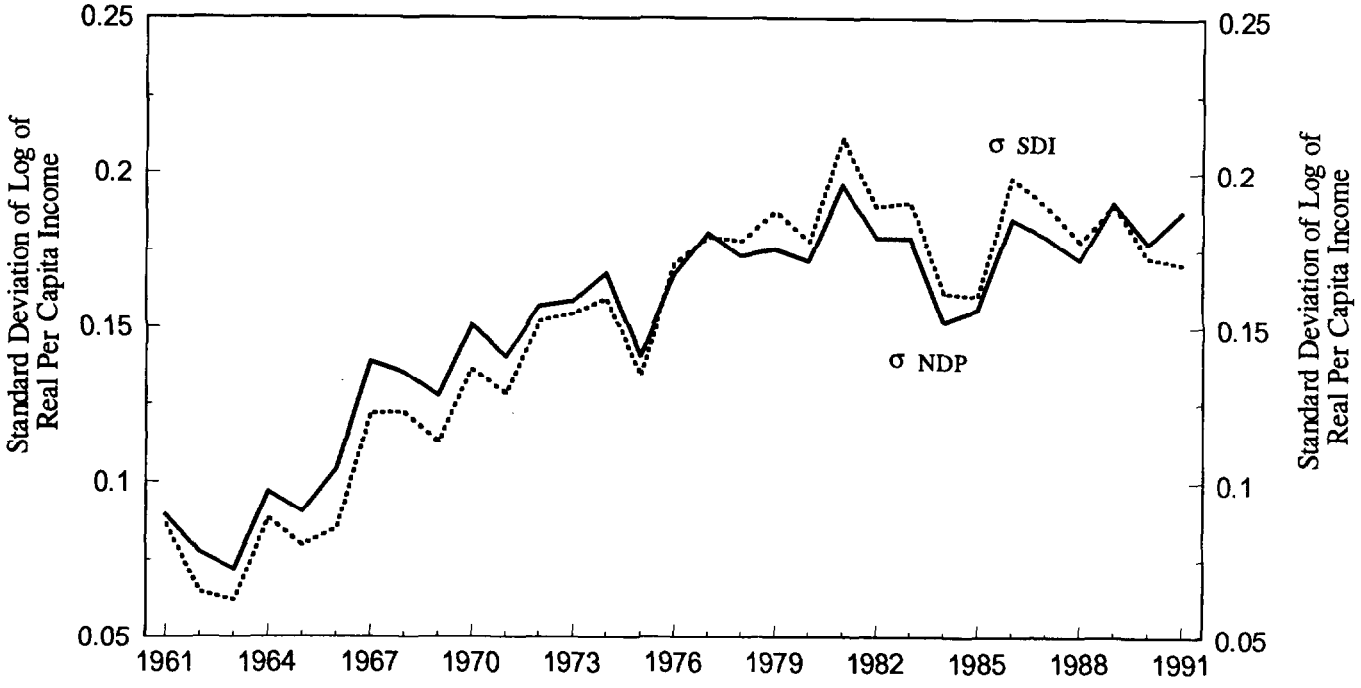


Figure 11

Dispersion of Real Per Capita Incomes: Nine Initially-Middle-Income Indian States, 1961-91



after this period. 1/ The value of σSDI_t for the six initially-poor states rises from 0.176 in 1961 to 0.214 in 1991, after reaching a period-high of 0.253 in 1985 and a period-low of 0.075 in 1971. Indeed, there is σ-convergence for the six initially-poor states with respect to σNDP_t, which declined from 0.173 in 1961 to 0.147 in 1991--per capita incomes in the poorest Indian states became more similar over this period. This was largely due to the relatively rapid growth of poor Manipur, and the relatively weak growth performance of rich Tripura and Uttar Pradesh.

VII. How Strongly Does Net Migration Respond to Cross-State Differentials in Per Capita Incomes?

One important mechanism by which differences in cross-regional per capita incomes can be equalized within national economies is by population movements from relatively poor to relatively rich regions. Interstate migration in India is of particular interest, because of the strong heterogeneity across states in their levels of per capita income and demographic characteristics (see Tables 1 and 2). In this section we examine the strength of the interrelationship between net in-migration and initial per capita incomes for the twenty states of India.

In terms of total volume, rural-to-rural migration dominates over other streams of migration (such as rural-to-urban) in India. Moreover, there is a clear preponderance of women in rural-to-rural migration, due to the system of patrilocal migration after marriage. For example, intercensal migration across the states between 1971-81 resulted in 70 male rural-to-rural migrants per 100 females; for rural-to-urban migrants the ratio was 142 males per 100 females (Skeldon 1986). However, this marriage-based migration is mainly across district boundaries separating neighboring settlements of a given state; most of this type of population movement is eliminated from census data on cross-state migration (Datta 1985). Urban-to-urban and rural-to-urban migration are the dominant components of interstate migration in India; each comprised about 32 percent of all intercensal cross-state migrants between 1971-81 (Skeldon 1986). As with most other developing countries, long-distance migration in India is male-dominated and overwhelmingly urban-oriented.

Table 4 sets out the volume of interstate migration between 1961-91, on an intercensal basis, taken from official migration data from the Registrar General and Census Commissioner for India (1977, 1988) for cross-state

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1/ An examination of the dispersion of per capita state disposable incomes for four of the six initially-poor states, excluding Manipur and Tripura, yields σNDP_t approximately equal to σSDI_t between 1961-88, while σNDP_t was clearly greater than σSDI_t after 1989. Accordingly, it appears that in comparison with Manipur and Tripura, the states of Bihar, Orissa, Uttar Pradesh and Madhya Pradesh benefitted much less from center-state grants prior to the late 1980s.

Table 4. Volume of Inter-State Migration, Inter-Censal Basis, 1961-91 1/

	1971 Census Migration 2/			Average Annual Net Migration as share of 1961 State Population	1981 Census Migration 2/			Average Annual Net Migration as share of 1971 State Population	1982-91 Vital Statistics 5/		Average Annual Net Migration as share of 1981 State Population
	In 3/	Out 4/	Net		In 3/	Out 4/	Net		Net Migration Rate 6/	Net Migration (million)	
Andhra Pradesh (AP)	400955	529405	-128450	-0.0004	426399	554634	-128235	-0.0003	4.26	2.280	0.0043
Assam (A)	271415	152878	118537	0.0011	--	195755	--	0.0051	1.47	0.265	0.0015
Bihar (B)	443725	963433	-519708	-0.0011	432008	1030990	-598982	-0.0011	-0.34	-0.239	-0.0003
Delhi (D)	813459	241711	571748	0.0215	1229744	277686	952058	0.0234	29.30	1.822	0.0293
Gujarat (G)	407375	338402	68973	0.0003	527781	383207	144584	0.0005	-1.15	-0.392	-0.0011
Haryana (H)	483205	417797	65408	0.0009	595343	524961	70382	0.0007	-0.40	-0.051	-0.0004
Himachal Pradesh (HP)	--	123301	--	0.0010	113743	135720	-21977	-0.0006	-2.49	-0.107	-0.0025
Jammu & Kashmir (JK)	49314	64418	-15104	-0.0004	60638	61662	-1024	-0.0000	4.13	0.247	0.0041
Karnataka (KA)	592335	509338	82997	0.0004	704612	666939	37673	0.0001	0.94	0.350	0.0009
Kerala (KE)	169550	467697	-298147	-0.0018	220833	498062	-277229	-0.0013	-3.17	-0.808	-0.0032
Madhya Pradesh (MP)	808895	500859	308036	0.0010	854856	738108	116748	0.0003	3.63	1.892	0.0036
Maharashtra (MH)	1423880	699062	724818	0.0018	1886291	742111	1144180	0.0023	5.68	3.568	0.0057
Manipur (MN)	11368	8465	2903	0.0004	10895	12891	-1996	-0.0002	7.36	0.105	0.0074
Orissa (O)	282145	218629	63516	0.0004	301134	239535	61599	0.0003	0.60	0.158	0.0006
Punjab (P)	371805	601871	-230066	-0.0021	494956	519993	-25037	-0.0002	-3.17	-0.532	-0.0032
Rajasthan (R)	431200	621593	-190393	-0.0009	580773	703401	-122628	-0.0005	3.46	1.186	0.0035
Tamil Nadu (TN)	886385	533513	352872	0.0010	420714	670635	-249921	-0.0006	-0.05	-0.026	-0.0001
Tripura (T)	19903	19982	-79	-0.0000	22289	12644	9645	0.0006	15.54	0.319	0.0155
Uttar Pradesh (UP)	658581	1509040	-850459	-0.0012	685824	2245809	-1559985	-0.0018	2.50	2.769	0.0025
West Bengal (WB)	820165	516407	303758	0.0009	725817	469502	256315	0.0006	0.90	0.491	0.0009

Sources: Registrar General and Census Commissioner (1977, 1988); Government of India (1991a, 1991b) and earlier issues; Authors' calculations.

1/ For 19 states and the Union Territory of Delhi.

2/ Aggregate of migration for duration of residence of less than 1 year, 1-4 years and 5-9 years.

3/ In-migration to the particular state from states of India beyond the state of enumeration. In-migration data on Himachal Pradesh from the 1971 census and Assam from the 1981 census are unavailable. Accordingly, net migration for those states and years has been estimated from vital statistics.

4/ Out-migration from the particular state to states of India beyond the state of enumeration.

5/ Migration estimates for the 1980s are based on vital statistics, as no census data is available.

6/ Net migration rate is $(popgr)_i$ - $(cbr\text{-}cdr)_i$, where $(popgr)_i$ is the rate of population growth of state i between 1981 and 1991 (in percentage terms); $(cbr)_i$ is the rural crude birth rate per 1,000 persons for state i; and $(cdr)_i$ is the rural crude death rate per 1,000 persons for state i.

migration in the 1960s and 1970s, and implied net migration (derived from vital statistics) for cross-state migration in the 1980s. 1/ Our intercensal cross-state migration calculations closely approximate those of Datta (1985) for the 1971 census and Skeldon (1986) for the 1981 census. Gross intercensal migration across states between 1961-71 was 2.07 percent of the all-India population in 1961; gross interstate migration between 1971-81 was 1.96 percent of the 1971 all-India population; and gross interstate migration between 1981-91 was 1.97 percent of the 1981 all-India population (Table 4).

The strong (and increasing) attraction of Delhi for the rest of India stands out in the data, with the aggregate of net migration during the decade as a share of its initial census year population being 0.215 for the 1960s, 0.234 for the 1970s and 0.293 for the 1980s. Other relatively large net immigration states over the 1961-91 period were Manipur, Maharashtra, Madhya Pradesh and Tripura; while Punjab, Himachal Pradesh, Kerala, Bihar were net emigration states over the 1961-91 sample period. 2/ In general, the states of northern India (particularly Punjab and Himachal Pradesh) and Bihar in the east can be characterized as net out-migration regions; the western states (particularly Maharashtra) as net in-migration regions; and the southern states exhibit close to zero net migration. Moreover, net in-migration across the states of India is highly persistent--the simple correlation between MIG_{1961} and MIG_{1971} is 0.974; that between MIG_{1971} and MIG_{1981} is 0.817, and that between MIG_{1961} and MIG_{1981} is 0.825.

In explaining migration we follow Braun (1993) and use a reduced form expression for MIG_{it}, the annual rate of in-migration to state i as a share of the population of state i in the initial year of each intercensal period (t-T):

$$MIG_{it} = \mu + \nu \ln(y_{i,t-T}) + \xi \pi_{i,t-T} + \omega \pi^2_{i,t-T} + \epsilon_{it}, \qquad (2)$$

where $y_{i,t-T}$ is real (constant 1990 Rupees) per capita NDP of state i at the beginning of the intercensal period; $\pi_{i,t-T}$ is the population density (persons per square kilometer) of state i at the beginning of the intercensal period; and ϵ_{it} is an independent error term. The equation

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1/ Mukerji (1982) also uses crude birth and death rates in estimating net migration to the eastern states of India in the 1970s.

2/ Care needs to be taken in interpreting the figure for net migration to the eastern states of India, in particular to Tripura. This is because the derivation of the large figure for migration in the 1980s is based on vital statistics which, unlike those taken directly from the census data for the 1960s and 1970s, also include international migrants.

also includes the square of the population density, which captures non-linearities in the relation between migration and density. We expect initial income, population density and the square of population density to have, respectively, positive, negative and positive effects on net in-migration to state i. 1/ The empirical relationship is tested using iterative, weighted (by initial state populations) least squares.

Figure 12 reveals the relationship between the annual average migration rate between 1961-91 and the logarithm of real per capita income in 1961. 2/ The relationship is clearly positive (with simple correlation 0.574), which is evidence in favor of the proposition that net in-migration is positively affected by cross-state differentials in per capita incomes.

The extremely strong attraction of Delhi (Figure 12) with respect to the rest of India is indicated by much higher net migration rates than would be predicted by its initial level of per capita NDP. While the slope of the regression line would still be positive in the absence of Delhi, the relationship of migration to initial income would have been much weaker. Delhi has successfully attracted migrants for several reasons. First, the differential in per capita incomes between Delhi and all other states has been substantial. This is likely to induce large-scale in-migration, even if the prospects for employment in Delhi were limited (Harris and Todaro 1970). Second, the private sector (industry and services) has expanded rapidly between 1961-91. In India's highly regulated economic environment during 1961-91, physical proximity to a strong central government was a key to success in lobbying efforts. Finally, the central government itself, along with other public sector companies, has expanded and absorbed a growing labor force.

Figures 13 to 15 present the net migration and income relationship for the three subperiods (1961-71, 1971-81 and 1981-91). The results are similar to that depicted in Figure 12--the positive outlier is again Delhi, and apart from Assam in the 1970s and Tripura and Manipur in the 1980s, most states are bunched close to the zero net migration line.

Table 5 presents the results of the regressions on equation (2). The regression on the migration rate for the full period 1961-91 results in a positive coefficient on initial income, yet it is not statistically significant; while the coefficients on density and the square of density are significantly negative and positive, respectively. The next three regressions break up this period into the three intercensal subperiods analyzed in Section V (1961-71, 1971-81 and 1981-91). The values for $\hat{\upsilon}$ are positive for two of the three subperiods, and statistically significant only

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1/ The marginal effect of $y_{i,t-T}$ on MIG_{it} is positive if $\nu>0$; the marginal effect of $\pi_{i,t-T}$ on MIG_{it} is negative if $\xi+2\omega<0$.

2/ The variable on the vertical axis of Figure 12 is: the annual average of in-migration to each state during 1961-91 (the numerator), expressed as a share of the population of each state in 1961 (the denominator).

Figure 12

Migration and Initial State Income - 20 Indian States: 1961-91

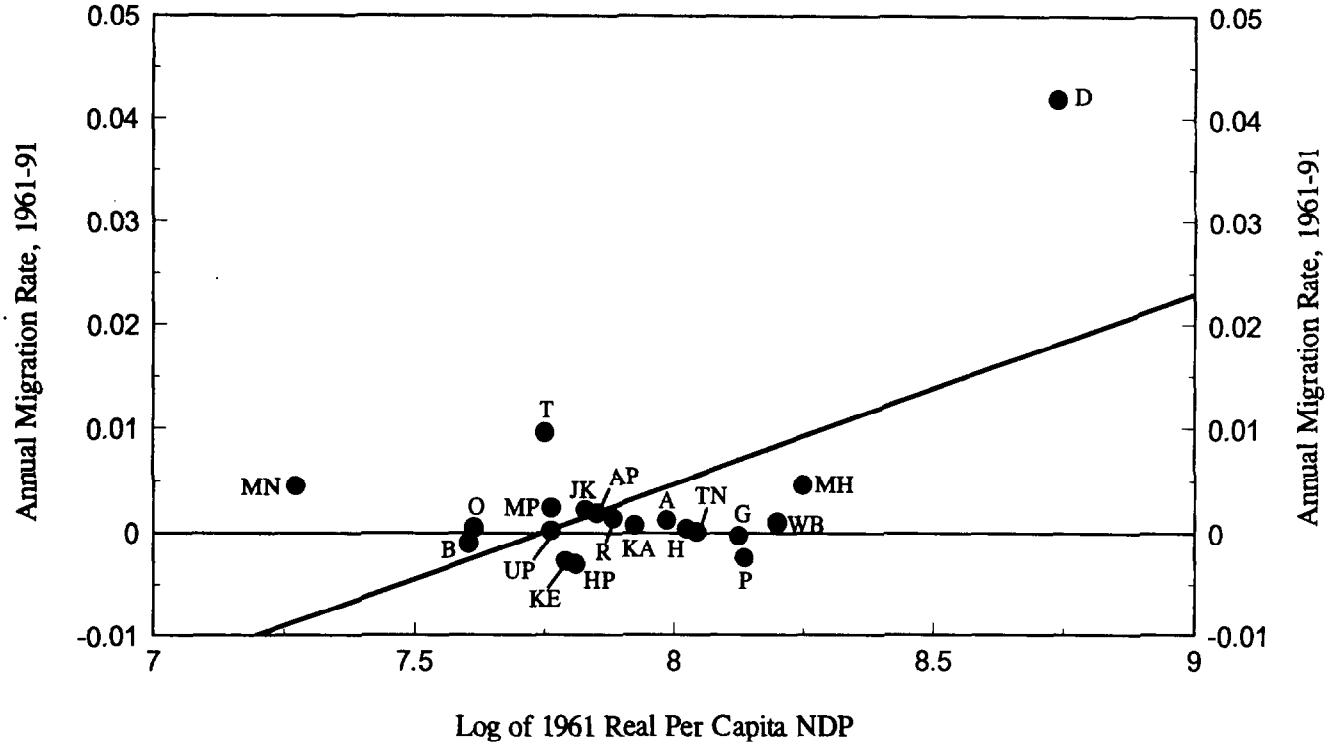

Figure 13

Migration and Initial State Income - 20 Indian States: 1961-71

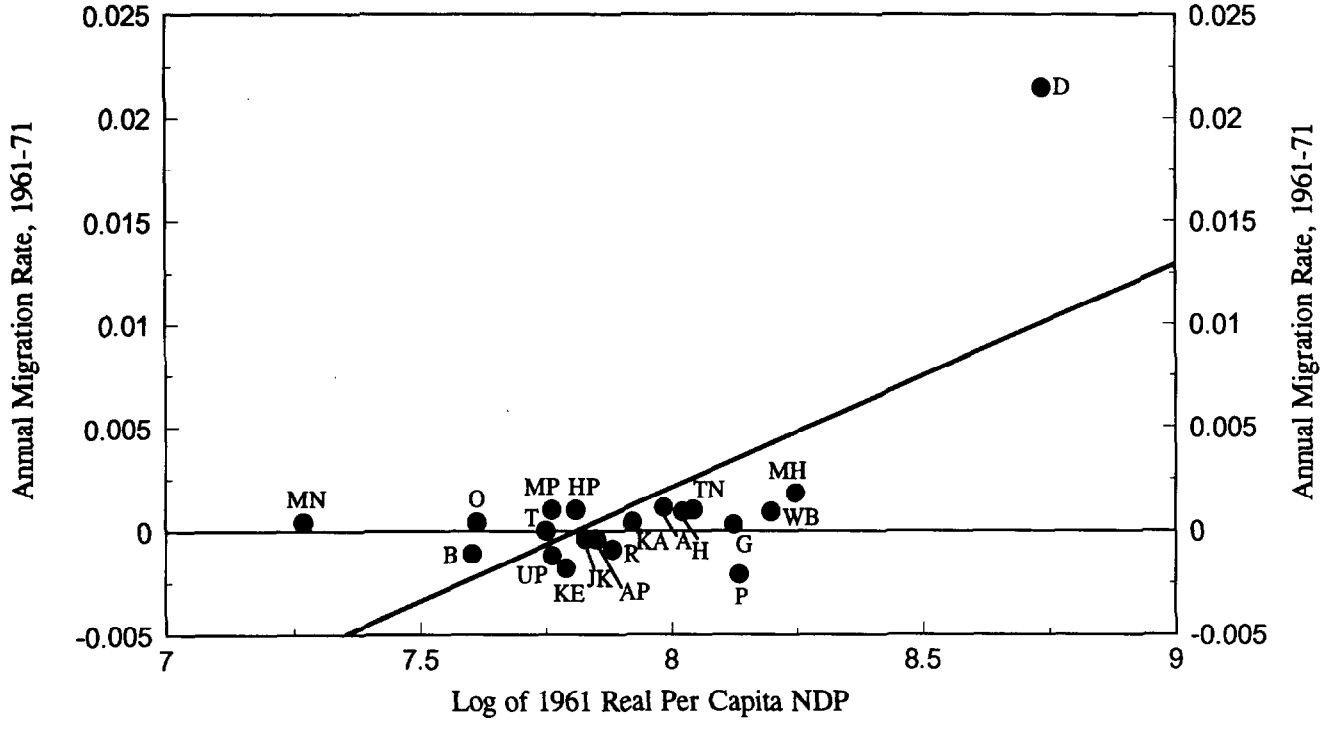

Figure 14

Migration and Initial State Income - 20 Indian States: 1971-81

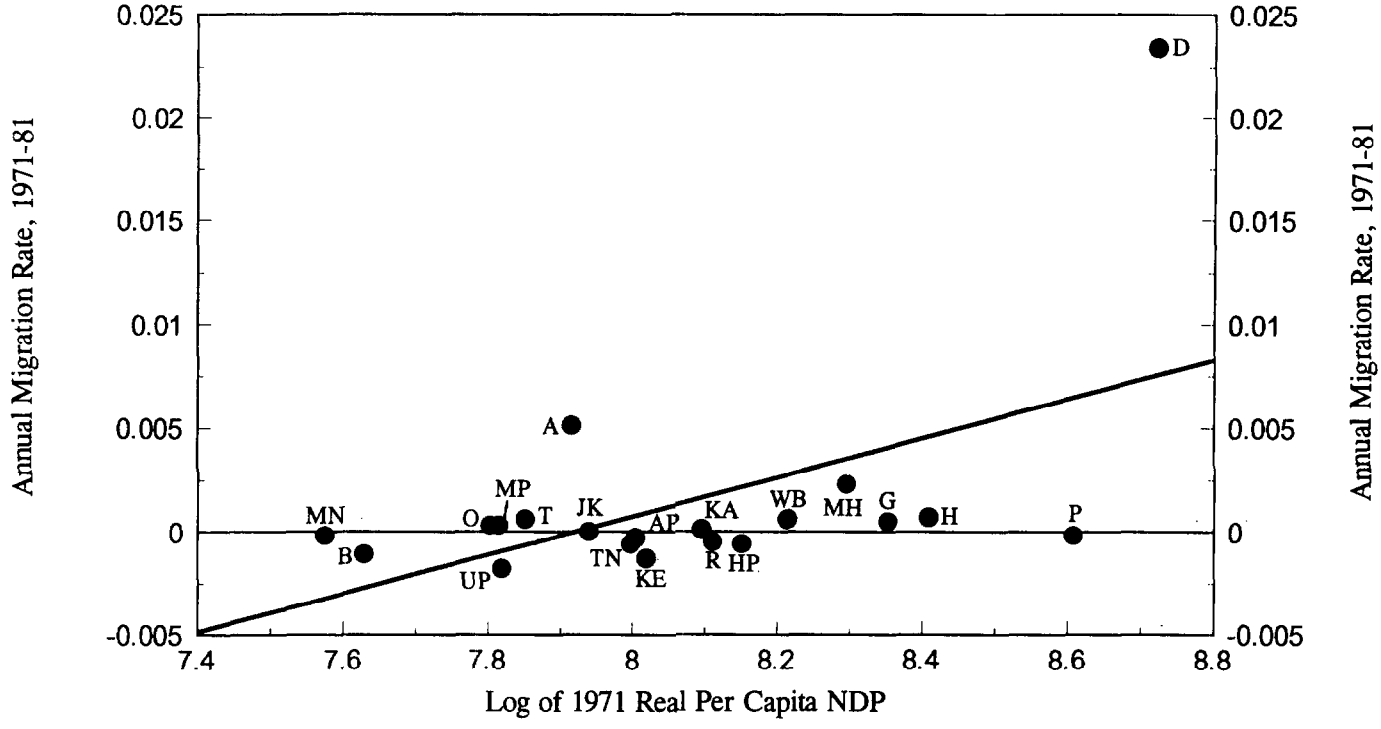

Figure 15

Migration and Initial State Income - 20 Indian States: 1981-91

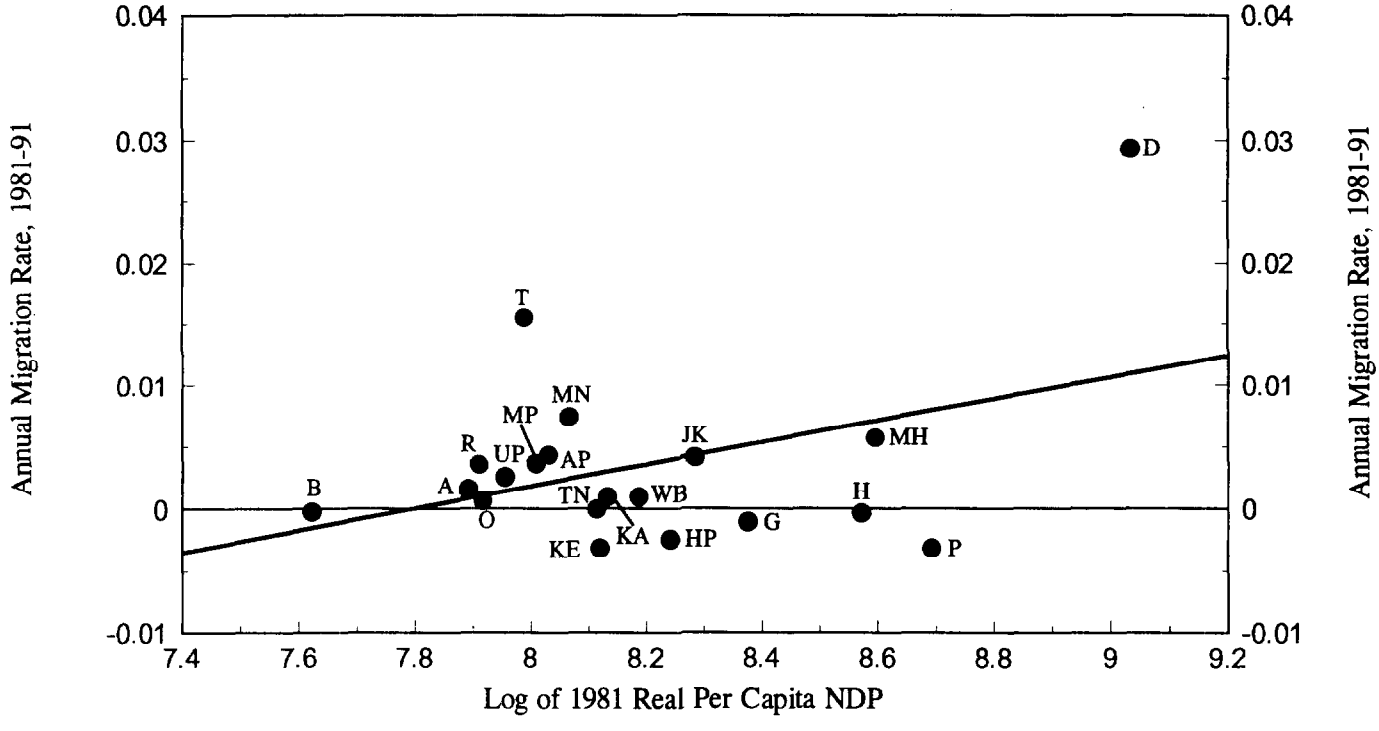

Table 5. Regressions for Net Migration into Indian States, 1961-91

Period	Personal income	Population density	Square of population density	R^2 [$\hat{s}$]
1961-91	0.0030	-0.15E-04	0.16E-07	0.857
	(0.0029)	(0.31E-05)	(0.21E-08)	[0.0017]
1961-71	0.0016	-0.83E-05	0.11E-07	0.839
	(0.0017)	(0.24E-05)	(0.19E-08)	[0.0010]
1971-81	0.0014	-0.88E-05	0.58E-08	0.854
	(0.0006)	(0.27E-05)	(0.11E-08)	[0.0011]
1981-91	-0.0010	-0.10E-04	0.39E-08	0.660
	(0.0028)	(0.34E-05)	(0.88E-09)	[0.0025]
Restricted 1/	0.0012	..	..	..
	(0.0009)	..	..	..

Sources: Authors' calculations, derived from Government of India (1977, 1988); Government of India (1995) and earlier issues; Government of India (1991a) and earlier issues.

Notes: All regressions are for 19 states of India, and the Union Territory of Delhi. The regressions use iterative, weighted (by initial state populations) least squares to estimate equations of the form: $MIG_{it} = \mu + \nu \log(y_{i,t-T}) + \xi \pi_{i,t-T} + \omega(\pi_{i,t-T})^2 +$ other variables, where MIG_{it} is the average annual net migration into state i between years t-T and t, expressed as a share of the state's population in year t-T; $y_{i,t-T}$ is real per capita NDP at the beginning of the subperiod t-T, as described in Table 3; $\pi_{i,t-T}$ is the population density (thousands of people per square kilometer) of state i at the beginning of the subperiod t-T; T is the length of each subperiod; and "other variables" (unreported) are the share of agriculture in each state's NDP at time t-T, $AGR_{i,t-T}$, and the share of manufacturing in each state's NDP at time t-T, $MAN_{i,t-T}$. R^2 is the coefficient of determination. All regressions contain a constant term (unreported). Heteroscedastic-consistent standard errors are in parentheses. The standard errors of the regression, $\hat{s}$, are in brackets.

1/ The restricted regression requires the value of ν to be the same across all three subperiods, and the restricted ν are estimated using iterative, weighted seemingly unrelated regression, which allows for the correlation of error terms across subperiods. The Wald test statistic for equal values for ν is 3.231 and the p-value is 0.199. The 0.05 χ^2 value with two degrees of freedom is 5.9915.

for the 1971-81 subperiod. Moreover, the values for $\hat{\xi}$ and $\hat{\omega}$ are all statistically significant and have the appropriate signs, in each of the three regressions. A multivariate regression on the three-equation system yields in row five a restricted estimate of υ=0.0012, which is not statistically significant. However, a Wald test of the hypothesis of the same υ-coefficient in all three subperiods indicates that this hypothesis cannot be rejected. Everything else held constant, a ten percent differential in initial per capita income would raise net in-migration to the richer state by a very small 0.012 percentage points per year.

This result can be contrasted with those for the states of the United States between 1900-87 and the prefectures of Japan between 1955-85 of Barro and Sala-i-Martin (1992), who find that, everything else held constant, a ten percent differential in initial per capita income would raise net in-migration to the richer region by a relatively large 0.26 and 0.27 percentage points per year, respectively. However, Braun (1993) finds that migration across 80 regions of the five largest European countries (Germany, the United Kingdom, Italy, France and Spain) between 1950-90 responds only weakly to initial income--everything else held constant, a ten percent differential in initial per capita income would raise net in-migration to the richer region by only 0.064 percentage points per year. Accordingly, it appears that while the migration rate for the states of India is positively related to initial per capita income, it is not statistically different from zero. In that sense, the income elasticity of migration across the states of India more closely resembles the relatively weak responsiveness of population movements to income differentials in the regions of Europe than the relatively stronger responsiveness to differentials in the states of the United States or the prefectures of Japan. Implicitly, the costs of cross-regional labor mobility are high in India and Europe--they are relatively low in Japan and the United States. This anemic Indian response of cross-state migration to income differentials is most likely due to a combination of several barriers to the mobility of labor: strong local workers' unions which act to keep out competing potential employees; rigidities in nominal wages (Joshi and Little 1994); lack of housing in fast-growing urban areas; and most importantly, social, cultural and linguistic barriers to the cross-regional substitutability of labor.

VIII. Is Cross-State Migration a Likely Cause of the Convergence of State Per Capita Incomes in India?

As argued above, migration from poor states to rich states should accelerate the speed of convergence of per capita incomes across the twenty states of India. If so, then the estimated convergence coefficients of Table 3 also embody the contribution of migration to the convergence process. Accordingly, the expectation is that in-migration should have a negative effect on the rate of growth of per capita incomes, and that the introduction of migration as an explanatory variable in the growth regressions should lead to a reduction in the estimated β.

The inclusion of migration (MIG_{it}) in the growth regression of column (3) of Table 3 results in a statistically significant restricted estimate of β for the three subperiods of $\hat{\beta}$=0.0244. For two of the three subperiods, the coefficient on MIG_{it} is negative, yet only one is statistically significant. This restricted estimate of β (with migration) is larger than that calculated in the absence of migration ($\hat{\beta}$=0.0153), and most likely reflects the endogeneity of migration and the growth of state per capita incomes--fast-growing states are more likely to attract migrants.

Accordingly, the growth regression was estimated by generalized instrumental variables (GIV), using fitted values from reduced form estimation of MIG as instruments for actual MIG in the structural growth regression (White 1982). 1/ The restricted coefficient on initial income is now $\hat{\beta}$=0.0168 and is statistically significant, yet the coefficients on MIG_{it} for two of the three subperiods are positive, which is the opposite of what would be expected if migration is the cause of cross-state income convergence. If we then restrict the coefficients on MIG_{it} to be the same for all three subperiods, the estimated coefficient on MIG_{it} is positive and statistically insignificant, while the restricted estimate of β is statistically significant at 0.0157. 2/ This speed of convergence is very close to that calculated in the absence of migration ($\hat{\beta}$=0.0153). These results suggest that the process of migration has little effect on the convergence of per capita incomes in the states of India. Holding net migration rates constant, the speed of convergence of per capita incomes in poor states to those in rich states is very close to that estimated in the absence of controls for cross-state migration.

IX. Conclusions

Have the initially-poor economies of India grown faster than their initially-rich counterparts? A key conclusion of this paper is that there has indeed been convergence in real per capita incomes across the states of India during the period 1961-91. The convergence found is absolute because it occurs when no explanatory variables other than the initial level of per capita income are held constant. That is, the twenty states of India displayed homogeneity across states with respect to the steady state level of per capita income, yet exhibited heterogeneous initial levels of per capita income. However, while convergence has occurred, the speed at which the initially-poor states have caught up to the initially-rich states, with 1.5 percent of the gap between them being closed each year, is slower than those obtained in analyses of regional convergence in developed

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1/ The fitted values of MIG_{it} were obtained using the following set of independent variables (the exogenous variables from the structural and reduced form regressions): $\ln(y_{i,t-T})$, $\pi_{i,t-T}$, $\pi^2_{i,t-T}$, $\ln(AGR_{i,t-T})$, $\ln(MAN_{i,t-T})$. The R^2 statistic on the reduced form regressions for MIG_{1961}, MIG_{1971} and MIG_{1981} are 0.839, 0.854, and 0.660, respectively (Table 5).

2/ A Wald test did not reject the hypothesis that the coefficient on MIG_{it} is the same for each of the three subperiods.

countries, which generally center on 2 percent per year. Accordingly, while a typical Indian state would take about 45 years to close one-half of the gap between its initial per capita income and the steady state per capita income, the typical region of a developed country would take only about 35 years to complete the same task.

There has also been a widening in the dispersion of real state per capita incomes in India during the period 1961-91. However, grants from the central government to the states did ensure that the dispersion of state real per capita disposable incomes was narrower than the dispersion of state real per capita incomes, as relatively more grants were transferred to poor states than to their rich counterparts.

The extent to which population movements occurred in response to differential state incomes was rather weak, indicating that significant economic, social and cultural barriers to the free migration of labor across the states of India continue to exist. In that sense the labor markets of Indian states resemble more closely the relatively closed regional labor markets of Europe than the relatively open regional labor markets of the United States and Japan. Finally, as for the above developed countries, there is little evidence that population movements are an important factor in the convergence of state real per capita incomes in India.

The basic data used in this study are annual observations for the period 1961-91. The state and national income data are for fiscal years ending March.

The major data sources were:

IMF -- (International Monetary Fund, International Financial Statistics)

ES -- (Government of India, Economic Survey, various issues)

COI -- (Registrar General and Census Commissioner for India, Census of India, for census years 1961, 1971, 1981 and 1991)

ESDP -- (Government of India, Central Statistical Organization, Estimates of State Domestic Product 1960-61 to 1983-84)

RBI -- (Reserve Bank of India, Reserve Bank of India Bulletin, various issues).

STAT -- (Government of India, Basic Statistics Relating to the Indian Economy, various issues).

BOOK -- (Government of India, Statistical Pocket Book: India, various issues)

Table A1 contains a detailed listing of the mean and standard deviation of the key variables used in the cross-sectional growth regressions. The derivation and description of the data used in the paper are as follows:

AGR -- The logarithm of the share of agriculture, forestry, logging, and fishing in net state domestic product at factor cost at current prices; taken from ESDP. The figure for Assam in 1961 is for its present boundaries (excludes Meghalaya, Nagaland and Mizoram). The 1961 figure for Himachal Pradesh is the 1968 share, as in 1961 it was then part of Punjab State. The figures for Punjab and Haryana for 1961 are both for their present boundaries. In the growth regressions, AGR enters in logarithmic form.

AREA -- Geographic area (in thousands of square kilometers) of each state in each census year; taken from the same sources as POP. For 1961: Himachal Pradesh has the area it had as a Union Territory in 1961; and Haryana is assumed to have the area it had upon the granting of statehood in 1966.

CBR -- Crude birth rate per 1,000 persons in the rural areas of each state; taken from STAT.

CDR -- Crude death rate per 1,000 persons in the rural areas of each state; taken from STAT.

DEF -- NDP deflator for India; taken from IMF line 99b, base 1990=100.

DEN -- The density of each state's population, defined as the number of persons per square kilometer; is derived as (AREA/POP)*1000, and is taken from the same sources as POP.

DENSQ -- The square of DEN; taken from the same sources as POP.

DUM -- Regional dummies for the four regions of India; the 19 states and the Union Territory of Delhi have been allocated as follows: East (Assam, Bihar, Manipur, Orissa, Tripura, West Bengal); North (Haryana, Himachal Pradesh, Jammu and Kashmir, Punjab, Uttar Pradesh, Delhi); South (Andhra Pradesh, Karnataka, Kerala, Tamil Nadu); West (Gujarat, Madhya Pradesh, Maharashtra, Rajasthan).

FLIT -- State-specific literacy rates, indicating the number of literate females per 1,000 females at each census year; taken from Government of India (1983). Data for Assam for 1981 is not available, as due to civil disturbances the 1981 census was not conducted in that state. The 1961 data excludes that part of each state's female population aged between 0-4 years.

LIT -- State-specific literacy rates, indicating the number of literates per 1,000 persons at each census year; taken from Government of India (1983). Data for Assam for 1981 is not available, as due to civil disturbances the 1981 census was not conducted in that state. The 1961 data excludes that part of each state's population aged between 0-4 years.

MAN -- The logarithm of the share of manufacturing in net state domestic product at factor cost at current prices; taken from ESDP. Additional details are as for AGR. In the growth regressions, MAN enters in logarithmic form.

MIG -- Intercensal annual net migration as a share of the state's population in the initial year of the intercensal period; the net migration data is taken from the COI Migration Tables for 1971 (Series 1, Part II-D(i)) and 1981 (Series 1, Part V, A and B). The migration data for the 1980s is an implied net immigration rate and is derived as the difference between the annual rate of population growth and the rate of natural increase (crude birth rates less crude death rates) and is taken from STAT for all states. Where census data was unavailable (Himachal Pradesh for 1971 and Assam for 1981) the implied net immigration rate was calculated, based on data taken from STAT.

NDP -- State net domestic product at factor cost, in current Rs. million; taken from the same sources as PCNDP. Additional details are as for PCNDP.

PCNDP -- Per capita state net domestic product at factor cost, in current Rs; taken from ESDP for 1961 to 1980, and ES for 1981 to 1991. The figures for Delhi for 1982-84 are taken from BOOK. The figure for Himachal Pradesh for 1961 (based on its present boundary) is taken from Lal (1985). The figure for Assam in 1961 is for its present boundaries (excludes Meghalaya, Nagaland and Mizoram). The figures for Punjab and Haryana for 1961 are both for their present boundaries. Figures for the following states (based on their present boundaries) and years are not available: Assam (1962-65, 1967-68), Haryana (1962-65), Himachal Pradesh (1962-67), and Punjab (1962-65).

POP -- State population (in millions) at census dates; taken from STAT for 1961, 1971 and 1981, and from COI for 1991. As there was no census carried out in Assam in 1981, the official statistics interpolate its population using the 1971 and 1991 census results. Similarly, the 1991 census has yet to be conducted in Jammu and Kashmir; the figure in COI is an official projection.

TR -- The grant component of transfers from the central government to state governments, in current Rs. million; taken from RBI. This measure comprises statutory grants-in-aid, grants on account of state and central plan schemes, and grants on account of centrally-sponsored schemes.

URB -- Urban share of state populations in each census year; taken from the same sources as POP.

Table A1. Data for Indian States, 1961-91

Variable	Year(s)	Mean	Standard deviation
Logarithm of NDP 1/	1961	7.918	0.292
	1971	8.066	0.294
	1981	8.187	0.322
	1991	8.458	0.333
Growth of NDP 2/	1961-91	0.0180	0.0066
	1961-71	0.0148	0.0145
	1971-81	0.0121	0.0151
	1981-91	0.0270	0.0111
Share of agriculture in state NDP 3/	1961	0.534	0.128
	1971	0.525	0.141
	1981	0.440	0.127
Share of manufacturing in state NDP 4/	1961	0.118	0.057
	1971	0.113	0.056
	1981	0.134	0.076
Regional dummies			
East		0.300	0.458
North		0.300	0.458
South		0.200	0.400
West		0.200	0.400
Net migration rate 5/	1961-91	0.0032	0.0093
	1961-71	0.0011	0.0048
	1971-81	0.0014	0.0052
	1981-91	0.0034	0.0072
Population density	1961	236.483	369.031
	1971	323.538	565.251
	1981	447.543	864.243
Square of population density	1961	192.107E+03	678.712E+03
	1971	424.185E+03	1590.375E+03
	1981	947.211E+03	3729.197E+03

Sources: Authors' calculations; see Data Appendix for sources and definitions.

1/ The logarithm of income is the logarithm of real (constant 1990 Rupees) per capita NDP in state i at time t, $\ln(y_{it})$.

2/ The growth of income is the annual average growth rate of real (constant 1990 Rupees) per capita NDP in state i between years t-T and t: $(1/T)\ln(y_{it}/y_{i\,t-T})$.

3/ The share of agriculture is the share of NDP derived from the agriculture, forestry and fishing sectors of state i at time t, AGR_{it}.

4/ The share of manufacturing is the share of NDP derived from the manufacturing sector of state i at time t, MAN_{it}.

5/ The net migration rate is the annual average rate of net in-migration (on an intercensal basis) as a share of the population of state i at the initial year of each intercensal period, MIG_{it}. Indian census years were 1961, 1971, 1981 and 1991.

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