Convergence Clubs in Incomes across Indian States: Is There Evidence of a Neighbours’ Effect?

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Abstract

I examine the distribution dynamics of incomes across Indian states using the entire income distribution. Unlike standard regression approaches this approach allows us to identify specific distributional characteristics such as polarisation and stratification. The period between 1965 to 1997 exhibits the formation of two convergence clubs: one at 50% and another at 125% of the national average income. Income disparities across the states declined over the sixties and then increased from the seventies to the nineties. I use the distribution dynamics method to further investigate for a neighbours’ effect - i.e., whether states that cluster together are neighbouring states. The evidence obtained suggests that there is none. While this initially come across as an unusual result, given the large empirical (international) literature on how industries agglomerate spatially, it strongly suggests that India being a developing country is yet to develop the required networks across the states to generate spatial interactions.

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1 Introduction

In this paper, I use the distribution dynamics method to identify polarisation of incomes across Indian states. I further investigate whether there is any evidence of a "neighbouring regions effect" using the distribution dynamics method.

What explains polarisation in incomes? The new economic geography and trade literature have recently sought to find the answer in the "connectedness" of the regions, in addition to their natural growth engines being responsible for growth. For example, have regional outcomes followed those
of their neighbours, and if so, what is the connecting agent? In this paper I use the distribution dynamics method to identify whether the polarisation observed can be associated with the member states of each convergence club being neighbouring regions.

Several countries’ studies have highlighted the emergence of such convergence clubs: to name a few examples, China (Maasoumi and Le Wang 2008), Greece (Fotopoulos 2006), the European Union (Pittau and Zelli 2006) and Brazil (Andrade et al 2004). I find evidence of two convergence clubs, a low income club and a high income club of states. There is little evidence of mobility of states between the two clubs. I explore whether there is any evidence of whether state outcomes follow outcomes of that of a neighbouring state. The exercise here shows that states’ outcomes have not followed those of neighbouring states; there is some weak evidence for only a certain set of regions. This finding is contrary to much of the applied regional-macro literature where regional outcomes are often found to be strongly correlated with that of neighbours, and is suggestive that this is characteristic of developing countries.

2 The Distribution Dynamics

In this section I track the evolution of each region’s relative income over time to reveal empirics of polarisation and stratification. To do so I construct transition probability matrices. More specifically, the income distribution is divided into a number of "income states"; each spatial unit is then located within this income space. The transition probability matrix then describes the probabilities with which the Indian states would transit from one income state to another. The stochastic kernel, as used in Quah (1997), improves on the transition probability matrix by allowing the space of income values to be a continuum of states.1

Figure 1 presents two benchmark stochastic kernel contours. The vertical axis measures the time $t$ income distribution, and the horizontal axis measures the time $t+k$ income distribution. If the probability mass runs along the diagonal, as in the first panel in Figure 1, it indicates persistence in the Indian states’ relative positions and therefore exhibits low tendencies of mobility. Convergence is indicated when the probability mass runs parallel to the $t$ axis in the second panel of Figure 1.

Figures 2 to 5 present the stochastic kernels for relative per capita income of 1-year transitions for four sub-periods 1965-70, 1971–1980, 1981-88, and 1990-97. 2

Figures 2 to 5 demonstrate increasing evidence of persistence and low probabilities of Indian states changing their relative position from the 1960s to the 1990s. The most salient feature is that of the

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1One now has an infinite number of rows and columns replacing the transition probability matrix and observes a probability mass (the sloping surface) recording the probabilities of persistence and mobility.

2GDP per capita and price data used for this paper has been obtained from Ozler et al (1996). GDP per capita data for 1989 to 1998 has also been obtained from the World Bank, compiled as a separate dataset, and from Government of India sources. I work with state GDP relative to the national average as the income unit to avoid issues of non-stationarity.
Figure 1: Benchmark stochastic kernels

Figure 2: Relative per capita incomes across Indian states, 1 year transitions. 1965-1970
Figure 3: Relative per capita incomes across Indian states, 1 year transitions. 1971-1980

Figure 4: Relative per capita incomes across Indian states, 1 year transitions. 1981-1988
existence of two convergence clubs in all time periods. Over the periods 1965-70, 1971-80, 1981-88, 1989-1997 we observe (in Figures 2 to 5) the probability mass lengthening and shifting totally in line with the positive diagonal, with the two peaks still at either end of the mass. The cluster of states at the two peaks consists of some low income economies at around 50% of the all India average and another at 125% of the average. The period 1965-70 shows some signs of cohesion: as is clearly revealed in the contour plot, the two clubs are aligned parallel to the original axis (vertical axis). This indicates some tendencies of convergence. The following time periods, particularly during the later years, have shown the cohesive forces substantially dissipating in influence.\(^3\)

To summarise our findings,

- Two convergence clubs are observed - a low income club and a high income club, one at 50% of the national average, another at 125% of the national average. I also obtain some tendencies of convergence in the time period 1965-70.

- The periods 1970s to the 1990s reveal evidence of persistence, and increasing divergence. Some evidence is also obtained of intra-distributional mobility over the late 1960s.

- The stochastic kernels also suggest that disparities have been widening. Robustness statistics (such as bootstrapped standard errors for the probabilities) are statistically irrelevant here and are therefore not presented.

\(^3\)The income distribution dynamics results are also established in Bandyopadhyay (2004). For robustness, I estimate stochastic kernels over the different sub-periods and over 5 and 10 year periods. The results obtained (not presented for brevity and obtainable from the author) reveal the the same results as above: there has been convergence over the late 1960s, with increasing divergence over the 1970s, 1980s and 1990s.
3 Is there evidence of a neighbouring states effect?

One straightforward explanation of the observed income dynamics in Section 2 could be that the evolution of the inter-state income disparities can be understood in terms of the evolution of groups with neighbouring regions with similar outcomes. This is discussed in the economics of agglomeration literature, that similar industries may establish themselves in contiguous regions. It is therefore common to find spatial concentration in industries and firms, which leads to similar economic performances and levels of GDP in contiguous regions. Also, the new economic geography literature as theorised by Krugman (1991) develops the idea that regional development is determined by spatial interactions between economic agents. This may occur due to proximity of the agents, previous development in that region or on the spatial structure of the economic system generally (for example the benefits of good access to a large market). The lack of spatial interactions between regions within a country is thus often seen as an indicator of underdevelopment.

To look into the possibility of there being a "neighbours effect", we estimate a stochastic kernel which maps the state’s incomes (unconditional distribution) to a conditioned distribution consisting of each state’s income relative to the population-weighted average of incomes of physically contiguous states (not including the state itself) (Quah 1997). Figure 6 presents the conditioning stochastic kernel - we do not obtain any evidence of all Indian states’ GDP outcomes following their geographic neighbours. In other words, there is no conditional convergence. This is even clearer in the contour plot in Figure 6.

There are, however, some interesting dynamics visible. There are four convergence clubs - two at either ends of the probability mass and another two in between. This indicates that there are four individual clusters of states that have similar levels of incomes. However, for the fact that there is no conditional convergence suggests that states with similar levels of GDPs are not geographical

These results are in agreement with those of Trivedi (2003) where similar clubs are revealed with kernel estimates of the densities of the Indian state income distribution between 1960 to 1992. We also observe that the composition of the two income convergence clubs does not drastically differ over the time periods. A map of Indian states is in the Appendix. The Indian states at 50% of the national average are Assam, Bihar, Jammu and Kashmir, Orissa, Madhya Pradesh, Rajasthan and UP for all the four time periods examined, with the exception of Kerala. Kerala started in the 1960s in the low income club and has moved in and out of it over the time periods examined. The high income club membership has changed over the period: while Delhi, Punjab, Haryana, Gujarat and Maharashtra have dominated the top five ranks for all four decades examined, West Bengal moved out of the high income club in the mid-1970s. Andhra Pradesh and Tamil Nadu have been the most recent entrants (1990s) into the high income club.

Recent work also suggests labour pooling also to contribute towards agglomeration (Krugman, 1991, Overman and Puga 2008).

Fujita and Thisse (2002) highlight that the importance of spatial dimensions is not just restricted to new economic geography but is a general feature of recent theories on the economics of agglomeration.

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neighbours. This implies that the neighbouring states in each of these four clubs do not share similar engines of growth.

This finding seems to contradict the development process across Indian states, at least initially. From the 1960s to the 2000s, Indian states have had a clear divide in terms of their engines of growth. The highest growth states in India since the 1950s have been the agriculturally developed western neighbouring states of Punjab and Haryana, and states of Maharashtra and Gujarat (also neighbours), which are historically the industrially developed states. These four states combined contribute to more than 60% of India’s aggregate GDP. That a higher income club "neighbours effect" is not observed is surprising.

Over the same time period of study the southern states of Karnataka, Andhra Pradesh and Tamil Nadu have grown richer and established their own engines of growth in the manufacturing sector (heavy electricals) for Andhra Pradesh and Tamil Nadu, and software consulting and information technology in Karnataka. That these neighbouring states also do not exhibit a "neighbours effect" is also worth noting. Clearly, the fact that there is a lack of high quality transport and communication to connect the industries and the markets in these contiguous regions explains why we do not obtain a "neighbours effect". Also, much of the iron and steel industry caters the export market, as does a large proportion of the agricultural produce (wheat and rice). The software consulting industry in the South almost entirely caters to an international market. The lack of well-established connections between the industries and local markets can therefore explain part of India’s slow development, a
pre-condition for the transition of a developing country to that of a developed one. The relevance of the poor quality of industry-to-market connections to India’s development has not been explicitly examined, though there are studies which discuss poor transport infrastructure in India’s poorer states.\(^7\)

As regards the richer states specialising in agriculture (Punjab, Haryana), a point may be noted. Much of the rice and wheat produced for domestic consumption is centrally allocated by the Indian state via the public distribution system. This is to ensure the availability of staple foods at affordable prices set by the Government for the poor population across India. The rest of the agricultural produce is exported. This may explain the lack of a "neighbours’ effect" with regard to the neighbouring agriculturally developed states.

### 4 Conclusion

I examine the convergence of growth and incomes across the Indian states using an empirical model of dynamically evolving distributions. The model reveals “twin peaks” dynamics, or polarisation across the Indian states, over the period of 1965 to 1997 and the dominant cross-state income dynamics are that of persistence, immobility and polarisation, with some cohesive tendencies in the 1960s, only to dissipate over the following three decades.

I find no evidence of conditional convergence in investigating for a "neighbours effect" that explains the polarisation. Given the similar nature of the engines of growth across the (rich) Indian states, this is contrary to what one would expect. This outcome is suggestive that regions which have robust engines of growth not connected sufficiently to regional markets should obtain state assistance in establishing links with regional markets. It is also clear that due to India’s particular process of development, where, for example, the state regularly intervenes in the rice and wheat markets, the "natural" process of industry-market connection does not exist. It is therefore not entirely surprising that we do not obtain a "neighbours effect". This is in contrast to many of the studies of the European Union and the US where strong "neighbours effects" are observed. The Indian experience therefore strongly suggests that developing countries may not exhibit the same kind of spatial interactions as developed countries, such as those which have been much studied in the economic geography and regional trade literature.

\(^7\)Bandyopadhyay (2004) identifies low levels of infrastructure (including roads and railway networks) to be associated with the formation of the the lower income convergence club for Indian states. Rud (2008) also finds that low levels of electric networks to be associated with low levels of development across Indian states.
References


A Data Appendix

States used in the study:
   Andhra Pradesh
   Assam
   Bihar
   Delhi
   Gujarat
   Haryana
   Jammu and Kashmir
   Karnataka
   Kerala
   Madhya Pradesh
   Maharashtra
   Orissa
   Punjab
   Rajasthan
   Tamil Nadu
   Uttar Pradesh
   West Bengal

   Other states were excluded from the study due to the incomplete data available over the given period. These states together constitute for over 80% of the national population.

   Price data that has been used to deflate the nominal GDPs has also been obtained from the above mentioned data set, and is the adjusted CPIAL index.
Indian states: Rich (pink), Poor (blue)

Figure 7: AS Assam, BR Bihar, GJ Gujarat, HP Himachal Pradesh, J&K Jammu and Kashmir, KR Karnataka, MH Maharashtra, MP Madhya Pradesh, OR Orissa, PB Punjab, RJ Rajasthan, TN Tamil Nadu, UP Uttar Pradesh, WB West Bengal.