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 comes across as an unusual result, it strongly suggests that India being a developing country is yet to develop the required networks across the states to generate spatial interactions.

Keywords: Convergence clubs, distribution dynamics, neighbours' effect, panel data, India

JEL Classification: C14, O1,O5.

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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, i.e., whether regional growth outcomes followed those of their neighbours, and underpins the observed polarisation.

Several countries' studies have highlighted the emergence of convergence clubs: 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
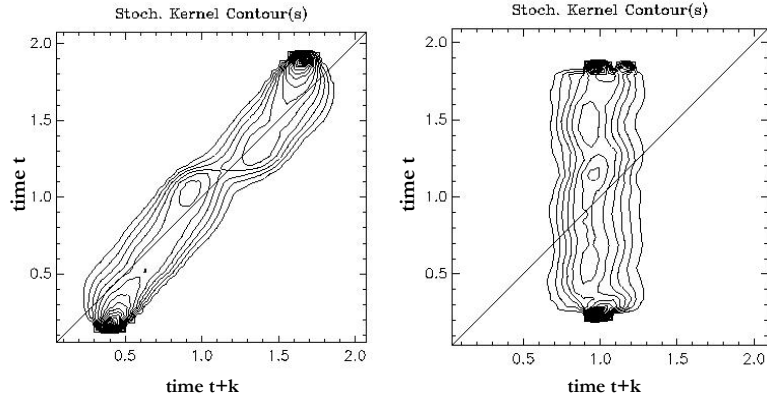
Figure 1: Benchmark stochastic kernels

high income club of states.. The conditioning exercise to identify a "neighbours' effect" shows that states' outcomes have not followed those of neighbouring states. 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 suggests that the lack of a neighbours' effect 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. For this exercise, I construct transition probability matrices. 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.

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. 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
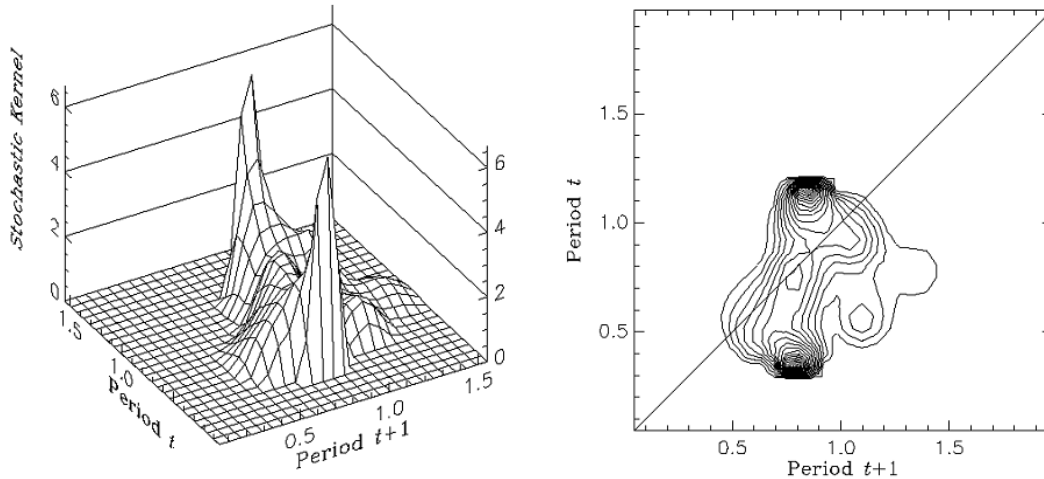
Figure 2: Relative per capita incomes across Indian states, 1 year transitions. 1966-1970
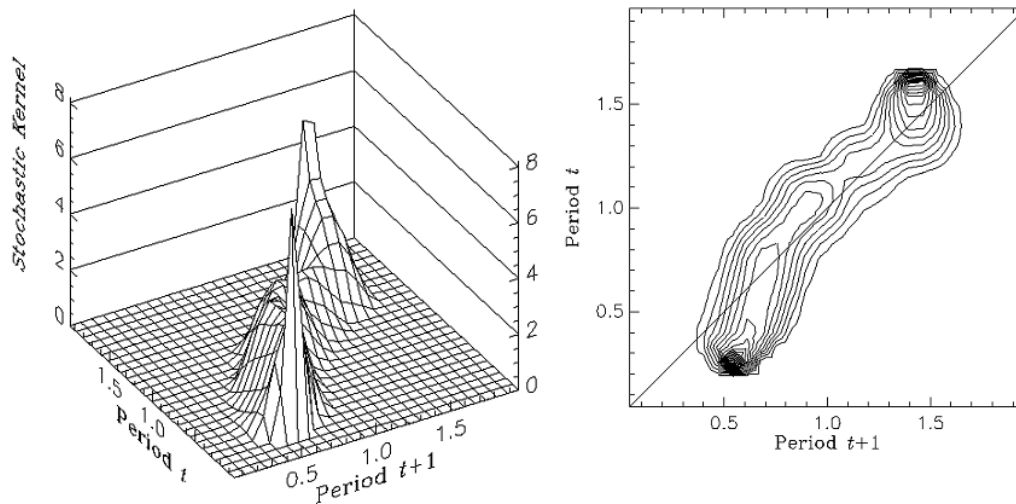

Figure 3: Relative per capita incomes across Indian states, 1 year transitions. 1972-1980

for the four sub-periods 1965-70, 1971–1980, 1981-88, and 1990-97.[1] We choose the four separate decades to demarcate periods of specific policies undertaken by the Indian government. The late 1960s was a period of concerted state planning and prosperous economic growth across most Indian states. The 1970s were characterised by slow growth and industrial stagnation due to the impact of the two oil shocks on the Indian economy. The 1980s were a period of slow recovery, while the 1990s were a period of deregulation and liberalisation of the Indian economy.

Figures 2 to 5 demostrate increasing evidence of persistence and low probabilities of Indian states

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[1] GDP per capita (relative to national average) and price data used for this paper has been obtained from Ozler et al (1996) and from Government of India sources. To account for the different populations across the Indian states, relative GDP per capita has been used as the income unit, rather than just relative GDP. The income unit is been measured *relative* to the national average to account for potential non-stationarity of the individual state GDP trends.
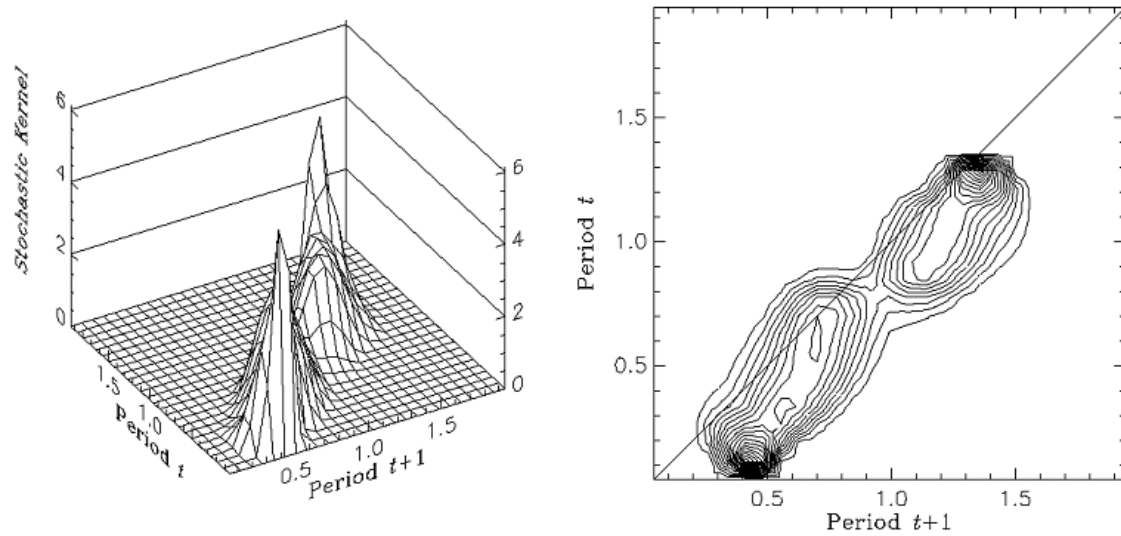
Figure 4: Relative per capita incomes across Indian states, 1 year transitions. 1982-1988
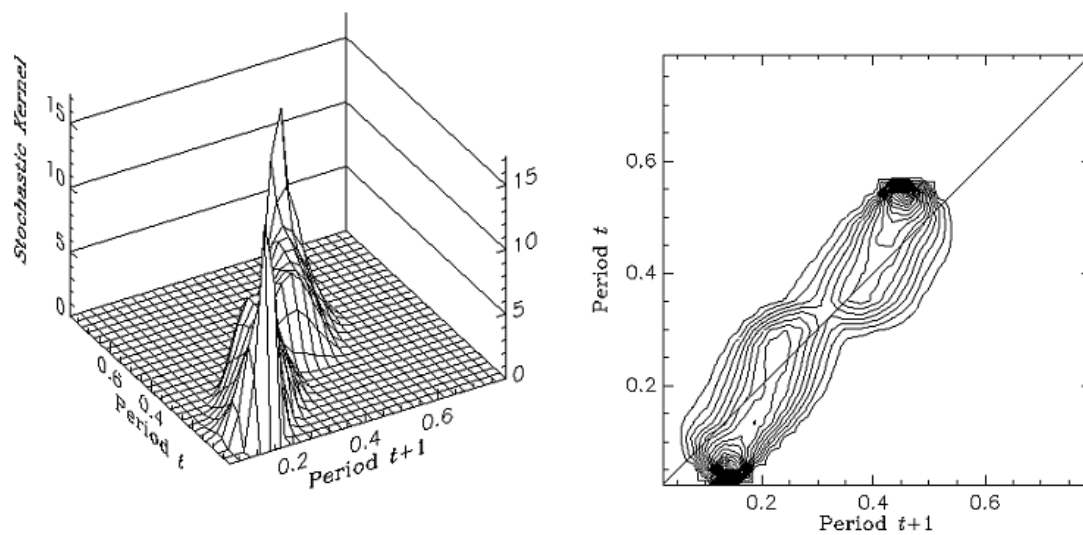

Figure 5: Relative per capita incomes across Indian states, 1 year transitions. 1991-1997

changing their relative position from the 1960s to the 1990s. The most salient feature is the existence of two convergence clubs in all time periods. The cluster of states at one of the peaks consists of low income states at around 50% of the all India average and the other peak consists of high income states at 125% of the national average. The period 1965-70 shows some signs of cohesion: the two clubs are aligned parallel to the original axis (vertical axis). The following time periods, particularly during the later years, have shown the cohesive forces substantially dissipating in influence.

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.[2]

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, which leads to similar economic performances and levels of GDP in contiguous regions. 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 investigate 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 with one year transitions for the full time period - 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

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[2]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

even clearer in the contour plot in Figure 6. The same dynamics are observed for the whole time period, using five year transitions, presented in Figure 7.

There are, however, some interesting dynamics visible. In Figure 6, 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, the fact that there is no conditional convergence suggests that states with similar levels of GDPs are not geographical neighbours. This implies that the neighbouring states in each of these four clubs do not share similar engines of growth. Similar dynamics are also visible for the five year transition estimates in Figure 7, though the number of clusters are now only two.
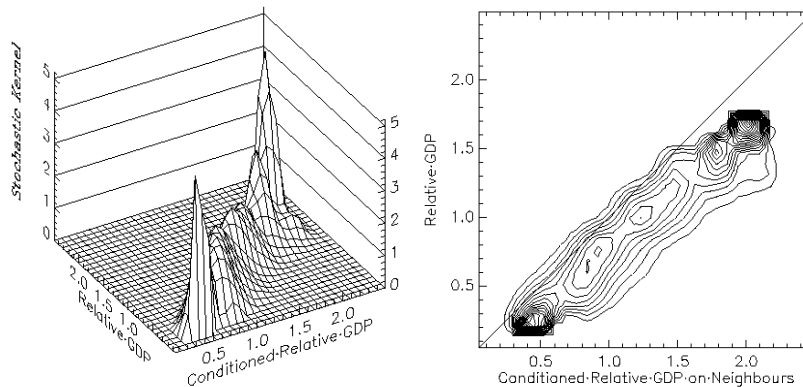

Figure 6: Relative per capita incomes across Indian states: Physical neighbours conditioning, 1 year transitions.

To observe if there are any period specific dynamics, I estimate similar conditioning dynamics for 5 year transitions, for the separate decades: for the 1970s (1975-1980), the 1980s (1985-88) and the 1990s (1995-97) in Figures 8 to 10.[3] For all three decades there is no evidence of any conditional convergence, and therefore it is clear that the conditioning dynamics do not suggest any neighbours' effect, as was also the case for the full period dynamics.

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

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[3]Due to the year availability in the 1960s being 1965-1970, 5 year transition dynamics is not estimatable. One year transition dynamics for all three time periods have been estimated, and each have probability masses lying along the positive diagonal, similar to that of the 5 year transition dynamics, and are not presented to maintain brevity. I am grateful for this suggestion by an anonymous referee.
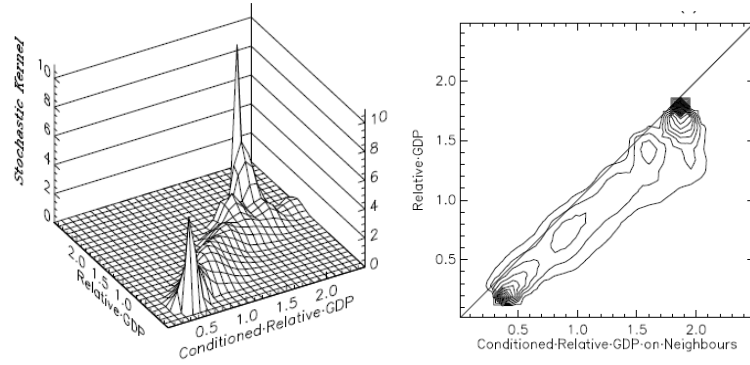
Figure 7: Relative per capita incomes across Indian states: Physical neighbours conditioning, 5 year transitions.
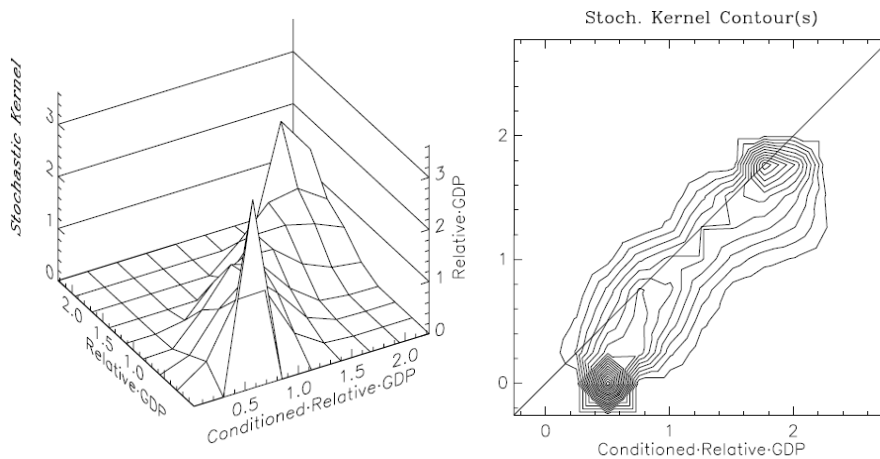

Figure 8: Relative per capita incomes across Indian states: Physical neighbours conditioning, 5 year transitions, 1975-1980.
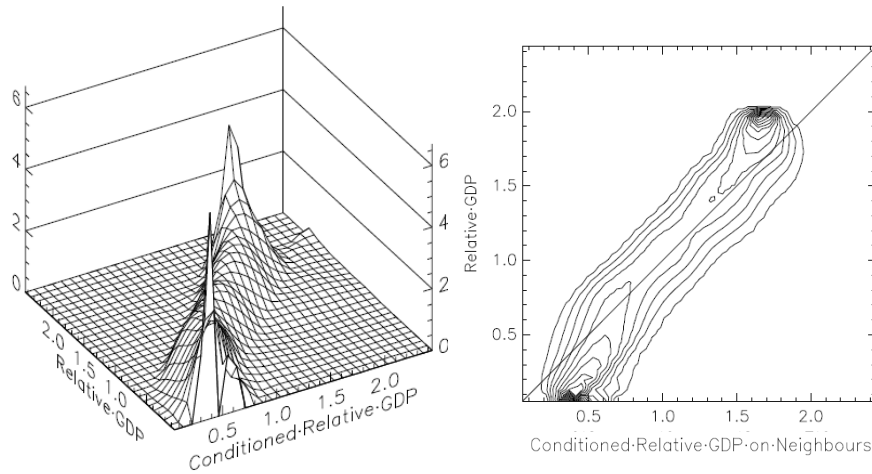
Figure 9: Relative per capita incomes across Indian states: Physical neighbours conditioning, 5 year transitions, 1985-1988.

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 rich southern states have established themselves 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 worth noting. Clearly, the fact that there is a lack of high quality transport to connect the industries and the markets in these contiguous regions explains why we do not obtain a "neighbours' effect". Much of the iron and steel industry caters to the export market, as does a large proportion of the agricultural produce (especially, 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.[4]

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[4]Bandyopadhyay (2004) finds low levels of infrastructure (including roads and railway networks) to be associated
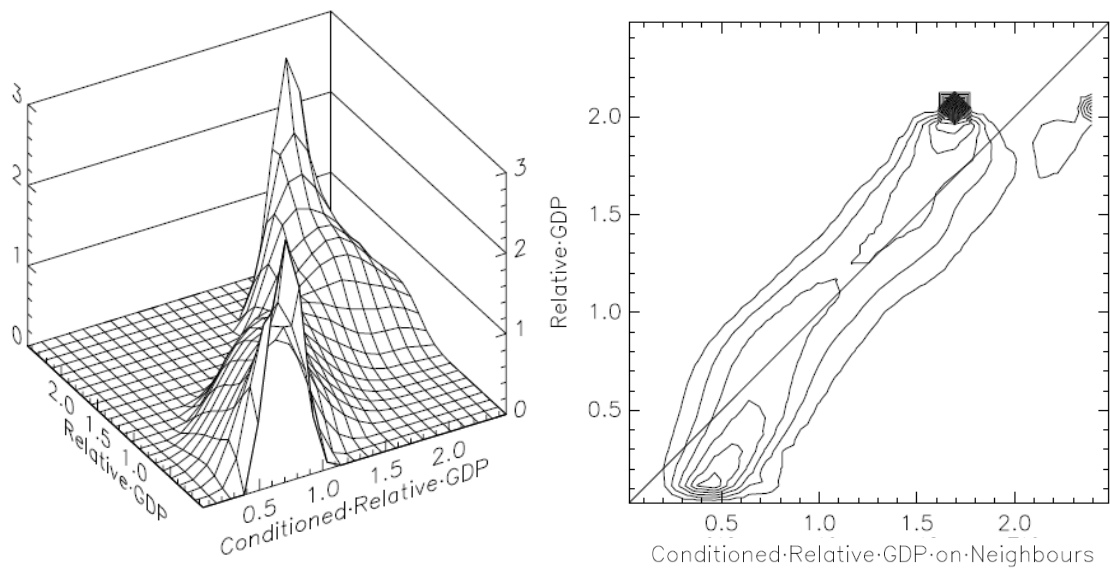
Figure 10: Relative per capita incomes across Indian states: Physical neighbours conditioning, 5 year transitions, 1995-1997.

As regards the richer states specialising in agriculture (Punjab, Haryana), much of their rice and wheat produce is purchased by the Indian central Government for the purpose of the public distribution system. This is to ensure the availability of staple foods at affordable prices set by the Indian central 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, and the dominant cross-state income dynamics are that of persistence and polarisation, with some cohesive tendencies in the 1960s which 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 nature 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 (for example, Quah 1997). The Indian experience therefore strongly suggests that developing countries may not exhibit the same of kind of spatial interactions as developed countries, such as those which have been much studied in the economic geography and regional trade literature.

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with the formation of the lower income convergence club for Indian states.

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A   Data Appendix

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.
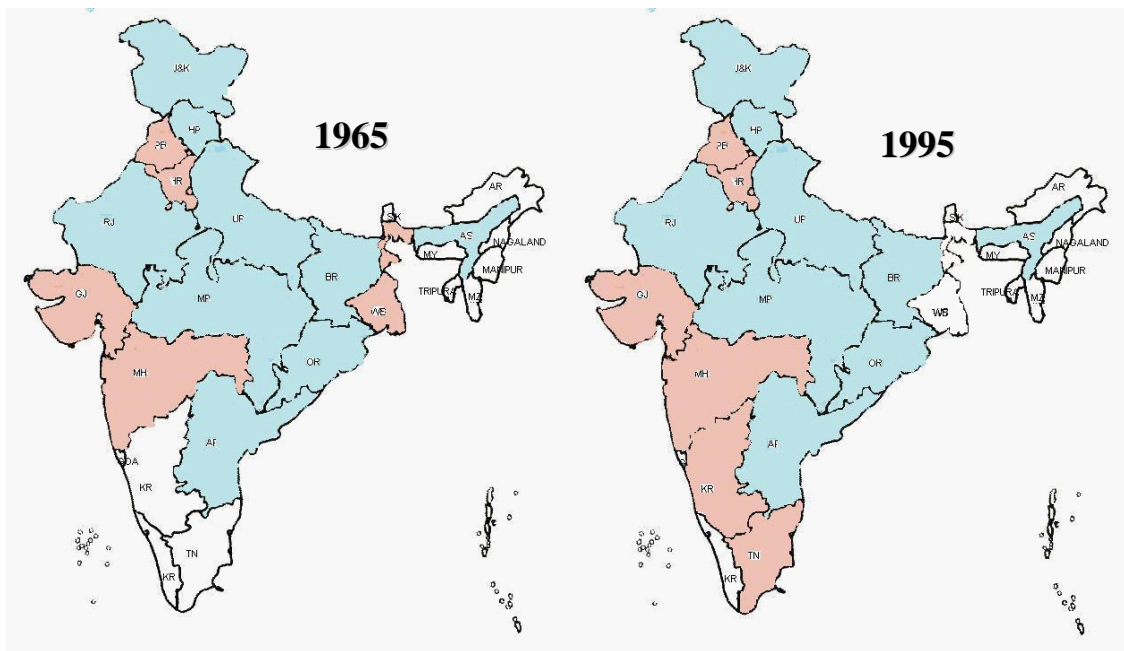
Indian states: Rich (pink), Poor (blue)

Figure 11: States included in the study: AP Andhra Pradesh, AS Assam, BR Bihar, DE Delhi, GJ Gujarat, HA Haryana, J&K Jammu and Kashmir, KR Karnataka, KE Kerala MH Maharashtra, MP Madhya Pradesh, OR Orissa, PB Punjab, RJ Rajasthan, TN Tamil Nadu, UP Uttar Pradesh, WB West Bengal.