Divergent Policies for Convergence Clubs: A Study of Post-Reform Indian States

Sabyasachi Kar
Debajit Jha

2021

IEG Working Paper No. 449

November 2021

Divergent Policies for Convergence Clubs: A Study of Post-Reform Indian States

Sabyasachi Kar[1]

Debajit Jha[2]

JEL Codes: E65, O10, O18, O43, O47, O53

Keywords: Club Convergence, Growth Transition, Policy Divergence, Investment Climate, Institutional Reform, Indian Economy

Abstract: Should economies attempting to break out of low-growth convergence clubs adopt policies distinctly different from those in high-growth clubs? This paper proposes a framework that helps answer this question. To do this, we extend the logic of policy divergence from the growth transitions literature to the analysis of club convergence. We then test this framework by applying it to an analysis of regional growth in India in the post-reform period. Our framework identifies sixteen sub-national regions in India belonging to two low-growth clubs that should focus on improving their investment climate. Another fifteen such regions from two high-growth clubs however, need urgent institutional reforms.

[1] RBI Chair Professor, Institute of Economic Growth, Delhi. Email: skar_ieg@yahoo.com
[2] Assistant Professor, Jindal School of Government and Public Policy, O P Jindal Global University, Sonipat, Haryana. Email: jhadebajit@gmail.com and djha@jgu.edu.in
We are thankful to Montek Singh Ahluwalia, Rinku Murgai and Ajit Ghosh for useful comments on the paper.

1. Introduction

The neoclassical growth framework is based on the assumption that all economies have a long-run steady state growth trajectory. An economy may temporarily deviate from this trajectory due to a shock, but diminishing returns to capital will ensure that it converges towards the steady state over time. A large strand of the empirical growth analysis has attempted to test this assumption giving rise to the literature on convergence, based on cross-country evidence[3] as well as evidence from regional economies within countries[4].

A recent strand of the empirical growth literature has moved away from the assumption that there is a single steady state for all economies. This approach argues that due to the possibility of multiple equilibria, economies may converge to steady states of numerous clubs, rather than converging to a single steady state. Multiple equilibria may arise due to non-linearities in the production function and lead to outcomes that can be best described as convergence-clubs[5]. These results are consistent with theoretical growth models generating poverty traps such that members of lower convergence-clubs find they are unable to move on to higher clubs[6].

If economies are indeed trapped in different convergence clubs - some high-growth and others low-growth - then it is reasonable to question the effectiveness of the same growth policy for all of these clubs. In particular, the objective of economies in the low-growth clubs would be to break out of these traps while the objective of high-growth clubs would be to remain in their clubs. Is it possible to develop a framework that help in differentiating between these divergent objectives? We argue that another strand of the empirical growth literature that focusses on growth transitions, and highlights the importance of such policy divergence, can indeed help us develop such a framework for convergence clubs.

[3] There are a number of excellent surveys on this topic (e.g. Durlauf and Quah, 1999; Temple, 1999; Islam, 2003; Durlauf et al., 2005), which rigorously deal with these approaches and the problems associated with them.
[4] Barro and Sala-i-Martin (1991, 1992a and 1995) and Sala-i-Martin (1996) reported evidence of absolute convergence across U.S. states, Japanese prefectures and several European countries, and conditional convergence across a group of European regions. Shioji (1996) confirms earlier results of unconditional β-convergence for Japan, Holz- Eakin (1993) and Garofalo and Yamarik (2002) corroborate evidence of conditional β-convergence within the U.S. states using a human capital augmented version of the neoclassical growth model following Mankiw et al. (1992). Similarly, Cashin (1995) reported evidence of β-convergence across states of Australia. Cashin and Sahay (1996) found evidence of absolute β-convergence among Indian states.
[5] See Quah (1993; 1996; 1997), Kar et. al (2019)
[6] Club convergence in a neoclassical framework may appear due to a threshold-level of human capital (e.g. Lucas, 1988; Azariadis and Drazen, 1990), or capital market imperfections (e.g. Galor and Zeira, 1993) and endogenous fertility (e.g. Barro and Becker, 1989; Becker et al., 1990) in the presence of non-convex production function of human capital, or due to the variation in the timing of take-off from stagnation to growth across economies (Galor, 2007).

The growth transitions literature has highlighted the medium term growth volatility in developing economies. Here medium term means average growth rates over five years or more, so these are clearly not standard business cycle behaviour that drives more short term (a year or less) growth volatility. This literature considers the long-run growth trajectories of economies as the outcome of a sequence of medium-run growth transitions, each transition leading to a significantly higher or lower average growth rate compared to the period before the transition. In other words, the long run growth rate of an economy is the net effect of all the growth accelerations (growth up-breaks) and growth slowdowns (growth down-breaks) during that period[7].

An extremely important contribution of the growth transition literature that will be useful for our purposes, is that it justifies the adoption of policy divergence in developing countries. According to this approach, economies that are on a relatively low long-term growth trajectory can achieve growth up-breaks relatively easily, by adopting policies that improve their investment climate (explained in details in the next section). However, according to this framework, such growth up-breaks are not going to lead to sustainable long run growth, unless these economies move on to adopt policies for institutional reforms (the next section provides more details on this). In other words, in the absence of such institutional reforms, growth up-breaks will soon be followed by growth down-breaks. Thus, according to this approach, economies with low growth rates should first attempt to improve their investment climate in order to attain higher growth rates, and then go on to adopt institutional reforms, so that they can maintain the high rates of growth. This also implies that there is policy divergence between low-growth economies and those that have transitioned to higher growth paths[8].

How do we extend the idea of policy divergence to the convergence club framework? In this context, it may be noted that growth transitions and convergence-club formations are both manifestations of the nature of long run growth, and hence there is a reasonable possibility that they are not unrelated. Specifically, it is easy to understand that whether an economy joins a high-growth or low-growth club could depend on the growth up-breaks or down-breaks in these economies, apart from their initial growth rates before such transitions. As we explain in the next section in details, knowledge about the nature of the impact of growth

[7] See Kar et al. (2013)
[8] see Rodrik (2005)

transitions on club formation can help us identify appropriate policies for economies stuck in different convergence clubs[9].

The objective of this paper is to propose and test a framework that helps match different convergence clubs to divergent growth policies. To do this, we first attempt to understand the role of growth transitions in the formation of convergence clubs. Second, based on this understanding, we attempt to identify distinctly different growth policies appropriate for economies belonging to different convergence clubs.

This issue has additional relevance in the context of regional growth dynamics (within a country). It is well understood that important drivers of the growth process within a country will potentially have an impact on both regional growth transitions as well as regional club formation[10]. In particular, national growth transitions could potentially have uneven effects on regional growth transitions and these uneven effects could play a role in regional club formation. If true, any knowledge about the factors underlying the national transitions could be used to provide policy conclusions for the improvement of regional growth outcomes. In this paper, we investigate this issue by studying the growth dynamics of the sub-national regions of the Indian economy in the post-reform period, i.e., since the early nineties[11]. Specifically, we investigate whether the growth transitions of sub-national regions are able to throw additional light on the formation of convergence clubs in India, after controlling for initial conditions. We do this by using a three-step framework that integrates the two strands of the growth literature, club convergence and growth transitions. To the best of our knowledge, this is a completely novel approach since this has never been attempted in any other study on India or any other economy.

Methodologically, the first step uses the club convergence approach to identify convergence-clubs among Indian states and union territories in the post-reform period. Based on thirty-one states and union territories in India, we find that regional growth in this period gives rise to four distinct growth clubs. The second step identifies growth transitions, i.e., growth up-breaks and down-breaks in the states and union territories in our sample over the post-reform

[9] An alternative method could directly identify growth clubs that are constrained by poor investment climate and those that are constrained by poor institutions, by using measures of these constraints. However, the indices that are usually available for such measures are often based on questionable assumptions and may give misleading results. Measures of growth transitions are ex-post measures of these constraints, and are more dependable from this point of view.

[10] This is much less probable at the cross-country level as there are few drivers of global growth that can have a similar effect.

[11] The period of study is limited to the post-reform period as regional output data is available only since 1993.

period. We find that in a total of thirty one states and union territories, thirteen have no breaks, fourteen have only up-breaks, and four have up-breaks as well as down-breaks. In the third and final step, we run regressions, controlling for initial conditions (which is the average growth rate before any growth transition takes place), and estimating the impact of (i) growth accelerations (up-breaks) and (ii) growth slowdowns (down-breaks), in generating convergence clubs over the period under study. Based on these results, we draw conclusions about the appropriate growth policies for regions belonging to these different clubs.

This paper consists of six sections. Section two provides a brief overview of the policy divergence argument based on the growth transition literature, extending the implication of this argument to the formation of convergence clubs. Section three reviews the relevant literature in the Indian context. Section four describes the empirical methodology and data used for the study. Section five presents the empirical results. Section six discusses policy implications and concludes.

2. Growth Transitions, Policy Divergence and their role in Convergence Clubs

This section has two objectives. First, we discuss the conceptual framework behind the idea of policy divergence in the growth transitions literature. Second, we extend the idea of policy divergence to the club-convergence framework. As we shall see, this will help us identify appropriate policy for different types of convergence clubs.

The growth transitions framework suggests a two-step strategy for long-run sustainable growth in a developing economy. Typically, many of these low income economies are not able to break out of a low growth trajectory as they struggle to implement complicated institutional reforms. Rodrik (2005) shows that in many such countries around the world, a growth acceleration has been achieved simply by adopting policies that improve their investment climate, without first attempting any institutional reforms. Such growth accelerations allow these countries to enjoy higher growth episodes (a minimum of five to eight years in the literature). However, these economies eventually have to attempt institutional reforms in order to sustain their growth rates in the long-run. In the absence of such institutional reforms, the high growth momentum will run out of steam and the economy will become susceptible to shocks (for theoretical studies see North and Thomas, 1973; Engerman and Sokoloff, 1994 and for econometric studies see Hall and Jones, 1999; Acemoglu, Johnson and Robinson, 2001; Rodrik, Subramanian and Trebbi, 2002; Easterly

and Levine, 2002). Thus, there is a natural sequencing of growth policy for developing countries – starting with policies to improve the investment climate in a low growth situation, but switching to more complicated institutional reforms once higher growth has been initiated.

How does the growth transition literature distinguish between (i) policies to improve investment climate and (ii) institutional reforms? First, let us consider the investment climate. There are two types of such policies discussed in the literature, distinguished by their objectives. The first type attempts to remove government imposed barriers or government failures. These barriers and failures range from policy biases towards politically-connected and large firms, failures due to licensing and other regulatory barriers, or even uncertainty of policymaking. All these create dualistic economic structures which discourages entrepreneurial activity and hence, economic growth. For example, Stern (2001) describes government imposed barriers like high inflation and macroeconomic instability, high government wages (which distorts the proper operation of labour markets), arbitrary regulations, a large tax burden, corruption, burdensome licensing requirements, etc., as the most important impediments of investment climate. Similar perspectives can be found in, Friedman et al. (2000), and Aslund and Johnson (2003). Besley and Burgess (2002a) provide evidence across Indian states on the productivity depressing effects of labour market regulations.

The second type of policies supporting the investment climate attempt to correct market imperfections or market failures. These failures can be broadly divided into two categories – (a) learning externalities, and (b) coordination failure due to the presence of market-size externalities induced by increasing returns to scale.[12] There may be several reasons for learning to have externalities that restrict the economy to adopt the technologies needed to diversify into non-traditional and advanced activities. For example, there may be a threshold level of human capital beyond which the return to accumulation of human capital becomes strongly positive (Azariadis and Drazen, 1990). Similarly, Matsuyama (1992) discussed the situation where learning-by-doing is either external to the individual firms; or due to the imperfections in the credit market, the externalities cannot be internalized. In both these cases, learning is under-produced. Coordination failures, on the other hand, leads to the

[12] The kind of learning slipover that is significant for economic growth in the initial phase of development in absence of large investment on innovation technologies is the adaptation of existing technologies (Acemoglu, Aghion and Zilibotti, 2002)

inability to take advantage of scale economies. The big-push theory developed by Rosenstein-Rodan (1943) and formalized by Murphy, Shleifer and Vishny (1989) is based on the argument that a coordinated and simultaneous investment in several areas is needed in order to escape a low-level equilibrium trap. The mechanism that generates coordination failure may vary from country to country. Murphy, Shleifer and Vishny (1989) highlight the complementarity arising from demand spillovers across final goods produced or from bulky infrastructure investments. Rodriguez-Clare (1996), Rodrik (1996, 1996), and Trindade (2003) show that the complementarity operates through specialized intermediate inputs and vertical industry relationships.[13] In all these cases, active government policy is needed to correct these market failures. To sum up, policies for improving the investment climate either involve scaling down government intervention (in case of government barriers or failures) or scaling up government intervention (in case of market failures).

It may be noted that situations of government failures or market failures are both relatively simple to identify and hence policies to correct them are also relatively simple to design. Thus policies supporting the investment climate of an economy are the proverbial low-hanging fruits for achieving growth.

What about institutional reforms? In this context, Rodrik (2005) provides a taxonomy of four different types of market sustaining institutions. These are (a) market-creating institutions, (b) market-regulating institutions, (c) market-stabilizing institutions, (d) market-legitimizing institutions. Since markets need not be self-creating, some form of property rights and contract enforcement are needed to create them. Similarly, as markets are not self-regulating, regulatory bodies and mechanisms to correct market failures are needed. For market stabilization, efficient monetary and fiscal institutions and institutions of prudential regulation and supervision are necessary. Finally, in order to legitimize the market outcome, some form of social protection, social insurance, and democratic institutions are essential.

As opposed to policies targeting the investment climate, institutional reforms are considered to be much more difficult to implement. The main reason for this is that successful institutional set-ups do not have a unique form. In fact, institutional reforms have been found to be most effective in a particular country only when the form or design of the institution is mindful of initial (institutional) conditions, making such reforms consistent with the historical institutions, social norms and political economy of that country. Thus, copying institutional

[13] For a large class of models based on coordination failure see Hoff and Stiglitz (2001).

forms of developed countries may not be a suitable strategy for underdeveloped countries, and may even produce adverse outcomes. Thus the main challenge in undertaking institutional reforms in a developing country is to know, ex ante, what institutions will or will not work in that country. Moreover, such reforms not only face opposition from vested interest who stand to lose from these changes, but also get little support from those who can potentially gain, because of the uncertainty associated with their success. Of course, these reforms become easier if the country has already initiated a higher growth momentum through a growth acceleration, as the higher growth rates make even the uncertainty associated with these reforms more politically feasible and economically viable.

How can we extend the policy divergence approach described above to the policy analysis of convergence clubs? We do this by developing a framework that can investigate the role of growth transitions in convergence club formations. This would then help draw distinct policy conclusions about the low and high growth clubs, using the logic of policy divergence from the growth transitions literature. We can think of this in terms of a simple framework that throws up four possibilities.

1. Consider the economies in a low-growth convergence club. If growth transitions play no role in the formation of such clubs, then they are the outcome of persistent poor growth rates throughout the period. According to the growth transition literature, such economies should try to generate growth up-breaks by improving their investment climate instead of attempting complicated institutional reforms.

2. If growth transitions have played a role in the formation of a low-growth convergence club, then in all probability, they had reasonable growth rates initially, but have experienced a growth down-break at some point. If such down-breaks are due to the lack of institutional reforms, then the economies will find it difficult to go back to higher growth paths just by improving the investment climate. Clearly, the policy challenge is much more complicated in this case compared to the previous case.

3. Next, let us consider the economies of a high-growth convergence club. If growth transitions play no role in the formation of such clubs, then they are the outcome of persistent high growth rates throughout the period. This seems to imply that they have

strong economic institutions and also do not need any policy intervention as long as the growth rates are sustained.

4. If growth transitions have played a role in the formation of a high-growth convergence club, then in all probability, they have experienced a growth up-break at some point. The growth transition literature would then strongly recommend institutional reforms to sustain the growth momentum in these economies. If they have also experienced growth down-breaks, then these institutional reforms become even more critical.

It is clear from the four possibilities described above that the role played by growth transitions in convergence club formation can provide important policy suggestions for better growth outcomes. In the rest of the paper, we attempt to operationalize this intuition based on the dynamics of regional growth in India.

3. Literature Survey

There are three strands of the empirical growth literature on India that is relevant for our study. The first strand deals with the convergence or divergence of sub-national regions in India as a result of their growth trajectories. The second strand deals with the identification of growth transitions in the Indian economy. The third strand deals with policies for improving the investment climate and institutional reforms associated with these growth transitions. In this section we will discuss some of the major contributions to these strands of the literature.

3.1. Convergence, Divergence, Convergence Clubs

There is a very large and growing literature on the dynamics of regional growth in the Indian economy, most of which seem to indicate absolute divergence of Indian regions over time[14]. Some of these studies have looked specifically at the post-reform period. Since this is the period of interest in this study, we restrict ourselves to this part of the literature. Ahluwalia (2000, 2002) was one of the earlier contributions that focused on the 1990s using a population-weighted Gini coefficient, and showed that inequality in real per capita regional income increased from 0.175 in 1991-1992 to 0.233 in 1998-1999 among 14 major Indian states. Sachs et al. (2002) found no sign of absolute or conditional convergence in post-

[14] Chanda and Kabiraj (2020) recently using night light data has shown the evidence of absolute convergence among 520 Indian districts for the period 1996-2010.

reform India. The above studies included only major Indian states due to data constraints in the case of union territories and small states. In contrast, Shetty (2003) included all the Indian states and union territories and confirmed a trend of divergence among Indian states. According to Nagraj et al. (1998), the coefficient of variation of per capita regional output increased rapidly in the 1990s after remaining stable during the 1980s. Rao et al. (1999) also found evidence of divergence in the early 1990s using coefficient of variation. Bhattacharya and Sakthivel (2004) found that inequality in per capita regional income increased in the post-reform period compared to the 1980s.[15] Among the recent studies, Ghosh (2008) shows evidence of divergence in the post-reform period using a time series method to test convergence. There are some other studies that find no clear evidence of convergence or divergence in post-reform India. An important contribution is Singh et al. (2003) that finds no uniform trend of convergence or divergence in this period.

A recent advancement of this literature has involved attempts to test the hypothesis of club convergence along with the hypotheses of convergence and divergence among Indian states using either, time-series regressions, the regression tree approach or the distribution dynamics approach. Gunji et al. (2004) test the hypothesis of club convergence among the 14 major Indian states for the period of 1970 to 2000 using panel unit root method with trend breaks. According to them the GSDP series were nonstationary, and therefore, diverged from each other. The inclusion of structural breaks in the sample changed the results slightly, but the overall picture remained the same. The study found no evidence of club convergence. In contrast, Ghosh (2008) using time series techniques concluded that there existed two distinct clubs – one small group of states were converging to each other (only 4 out of 15) while others diverged. Chaudhuri and Marimoutou (2007) used the generalised regression tree approach for 16 Indian states during the period 1965-2002. The results showed existence of three convergence clubs – one low-income club, one high-income club and one transitional club – over a 25 years period. During this period, the low- and high-income clubs exhibited divergence from each other while the transitional club moved towards the high-income club after reforms. In a recent study, Ghosh et al. (2013) using Philips-Sul (2007) method reported the presence of three convergence clubs among 15 major Indian states for the period 1968-2008. While the study reported that the clubs were diverging from each other since early to mid-1980s, the trend of divergence increased after reforms.

[15] The study calculated coefficient of variation during the pre- and post-reform period to check for evidence of σ-convergence.

In brief, the discussion presented above shows that although the convergence debate in the context of India is yet to reach a consensus on the issue of long-run tendencies in the distribution of regional per capita income, a broad trend in the literature has emerged that shows divergence of state per capita incomes in the post-reform period with a possibility of club convergence among these regions.

3.2. Growth Transitions

Next, we look at the literature on growth transitions in India, based on a small but influential set of studies. Some of these studies have used what could be described as an 'eyeballing approach' while others have used more rigorous statistical techniques. Studies belonging to the first group include De long (2003) that identifies a break in 1985 and Sen (2007) that identifies the break in the mid-seventies. The second group includes Balakrishnan and Parameswaran (2007), who test for multiple structural breaks on Indian output data using the methodology pioneered by Bai and Perron (1998). Balakrishnan and Parameswaran find a single shift in the GDP series which occurs in 1978-1979, and conclude that India's growth acceleration occurred from this year onwards. A similar exercise using the BP method is reported by Rodrik and Subramanian (2004) and they also get a growth break in 1979. What do these studies tell us about growth episodes in the Indian economy? Based on data till the early 2000s, all of them indicate that the Indian economy had two episodes of growth – the "Hindu rate" of stagnation and a subsequent growth acceleration. However, the date of the transition from the lower growth episode to the higher growth episode varies somewhat between these studies. Finally, Kar et al. (2016) used an alternative approach to identify growth transitions. This approach combined the statistical approach with an economic filter to provide a more unified way of establishing breaks in GDP per capita data. The procedure identified 1993 as the first growth acceleration episode in India, and 2002 as the second growth acceleration episode. Based on other economic indicators, they claim that after 2010, the Indian economy transitioned to another growth episode that indicated a growth slowdown. It may be noted that all these studies of growth breaks focus on the Indian economy and not on the sub-national regions within the economy. One of the contributions of the current study is to undertake such an exercise.

3.3. Improving the Investment Climate, Institutional reforms and Growth Transitions

The third strand of literature that is relevant for this paper involves the relationship between policy choices as well as policy challenges associated with growth transitions in the Indian

economy. We focus on growth accelerations and growth slowdowns in India following the reforms in the nineties and relate the policies and institutional reforms associated with these transitions. This period experienced two growth accelerations that happened around 1993 and 2002 respectively (see Kar et. al (2016) and Balakrisnan et. al. (2020)), and a growth slowdown that happened sometime after 2010 (see Kar et. al (2016), Subramanian and Felman (2019)).

The growth acceleration in the early nineties were preceded by and coincided with a lot of reforms that were clearly targeted to improve the investment climate by removing government imposed barriers. For example, in the 1991 industrial policy, the Industrial licensing system was abolished in all except sixteen industries irrespective of the level of investment (Mookherjee, 1995). Private investment was allowed in several industries which were earlier reserved exclusively for the public sector. The role of the Industrial Licensing Act (1951) was reduced to only monitoring the lack of competitiveness among firms. Automatic permission was approved up to 51 percent for foreign equity participation in a specified list of high-investment and high-technology priority sector industries. Simultaneously, significant trade liberalization measures were introduced for capital and intermediate goods by abolishing import licensing of equipment, manufactured intermediate goods, and machinery (Ahluwalia, 1991). In order to increase international trade, tariff rates were lowered. Moreover, policies for financial sector reform have been initiated in the form of decontrols of interest rates, deregulation of the stock market, reduced fiscal deficit, and exchange rate devaluation. The above policy changes had dismantled many government-imposed barriers to domestic private investment, trade, and finance; and increased competition in the domestic private sector which had resulted in increased private investment, more specifically increased private corporate investment (Kar and Sen, 2017).

The second growth acceleration in the early 2000s was associated with policies that again focussed on the investment climate by removing government barriers as well as addressing government failures. A significant share of economic growth in this transition came from communications and IT-related services. The ‘New Telecom Policy’ of 1994 had some serious gaps regarding the entry of private players and hence was unable to fully open and liberalize the telecommunications sector. These loopholes were corrected in the ‘New Telecom Policy’ of 1999 providing a greater competitive environment and level playing field for the service providers. The Department of Telecommunications (DoT) and Mahanagar

Telephone Nigam Limited (MTNL) were also allowed to enter any service area as a third cellular operator (Kathuria, 2000).

The other notable policy change around this period that addressed both government and market failures was in the construction sector. Failures by both the State and the private sector to build physical infrastructure in previous periods had over time resulted in an infrastructure bottleneck in the Indian economy. The early 2000s witnessed an attempt to correct this and so a large part of the growth in this period came from infrastructural development. One major initiative involved the building of national highways connecting major cities in the country. India started to privatize the national highways through the National Highway Authority of India (NHAI). The flagship project of the Golden Quadrilateral was planned in 1999 and launched in 2001. Another important initiative launched in 2000 was the Pradhan Mantri Gram Sadak Yojana (PMGSY), in order to provide motorable roads to all villages with 500 plus population (Dastidar and Nair, 2018).

The literature on policy analysis following the growth slowdown in the last decade has highlighted the challenges of institutional reform in India. The principal institutional challenge has come up in the financial sector. Initially, the Global Financial Crisis (GFC) and the collapse of world trade led to an external sector shock on the Indian economy resulting in a fall in growth rates. This had a debilitating effect on the balance sheets of both the infrastructure sector and the banks that were funding them. This was characterized as the Twin Balance-sheet Crisis (TBC) in the Indian economy (Subramanian and Felman, 2019). While attempts were made to solve this institutional failure, they remained unresolved and the non-performing assets of the banking sector continued to rise during this period. Unfortunately, as the TBC was never fully resolved, it triggered an even bigger financial sector crisis where the balance sheet of the non-bank financial companies sector and the real estate sector also got stressed. This turned the Twin Balance-sheet Crisis into a Four Balance-sheet Crisis (Subramanian and Felman, 2019).

The literature presented in this section indicates that the growth dynamics in India in the post-reform period exhibit signs of club convergence and growth transitions. We extend this literature in two ways. First, we identify growth breaks and resultant growth transitions in sub-national regions of India. Second, we analyse the role of the regional growth transitions in the formation of convergence clubs in India. This analysis also allows us to use the idea of policy divergence to suggest appropriate policies or different convergence clubs in India. The next section will discuss the methodology and data used in this empirical exercise.

4. Methodology and Data

In this section, we discuss in details the methodology and data used in this study. Methodologically, this study has three parts. The first part uses the Phillips and Sul (2007) technique in order to test whether Indian states and union territories converge to a single steady state growth path or move towards multiple growth-clubs. In case such growth-clubs exist, this technique helps us to estimate the number of such clubs and identify individual members (here, states and union territories) of each club. The second part uses the Bai and Perron (2003) technique in order to test for structural breaks in the growth paths of the states and union territories in our sample. These structural breaks are characterised as up-breaks or down-breaks. Finally, the third part estimates the relative roles of initial growth rates, growth accelerations and growth slowdowns in determining the growth club that a particular state or union territory will belong to. This involves running ordered probit regressions of these variables on a variable representing growth clubs.

4.1 Phillip and Sul Methodology to Estimate Growth-Clubs

In this study, we use the Phillips and Sul (2007) methodology in order to identify convergence clubs. This approach consists of a regression based convergence test, also known as the '*log t test*', which captures heterogeneous cross-sectional behaviour, by adopting a model involving a common factor (representing the long-term trend) and idiosyncratic (i.e., unit specific) effects (representing short-run cross-sectional heterogeneity). Such a model may be represented as

$$X_{it} = \alpha_i \mu_t + \varepsilon_{it} \qquad (1)$$

Here, α_i represents the unit specific element, μ_t represents the factor which is common for all the units and ε_{it} is the error term. It may be noted that model (1) seeks to capture the evolution of the elements of X_{it} in relation to the common factor μ_t, using two idiosyncratic (i.e., unit specific) elements, α_i and ε_{it}. Alternatively, equation (1) can be written in terms of time varying factor representation as:

$$X_{it} = \left(\alpha_i + \frac{\varepsilon_{it}}{\mu_t} \right) \mu_t = b_{it}\, \mu_t \qquad (2)$$

Here, b_{it} measures the distance of an individual unit X_{it} from the common trend component μ_t. This time-varying component b_{it} (which includes all idiosyncratic movements in X_{it}) thus represents the economy-specific transition path of region i to the common trend μ_t. Clearly,

the extent to which individual characteristics differ across economies will be reflected in the diverse shapes of economic transition defined by b_{it}.

In equation (2), testing for convergence requires estimating b_{it} as well as μ_t. In this general case however, the number of observations in the panel is less than the number of unknowns in the model, making it impossible to estimate b_{it}. In order to solve this problem, Phillips and Sul (2007) defines convergence in terms of a relative transition coefficient given by

$$h_{it} = \frac{X_{it}}{1/N\sum_{i=1}^{n} X_{it}} = \frac{b_{it}}{1/N\sum_{i=1}^{n} b_{it}} \qquad (3)$$

The last part of equation (3) shows that like $b_{it,}$ h_{it} also traces out the transition element for economy i, but does so relative to the cross-section average. It may be noted that, by focusing on h_{it}, the framework eliminates the common growth path $\mu_{t,}$ and is defined completely in terms of the idiosyncratic part of the variable. For convergence, this framework needs a common transition behavior across all economies, with $h_{it} \rightarrow 1$, for all cross sectional units i, as $t \rightarrow \infty$. In this relative transition framework, the curves traced out by h_{it} may differ across the cross sections in the short run, while allowing for ultimate convergence (when $h_{it} \rightarrow 1$, for all i, as $t \rightarrow \infty$) in the long run. Next, the methodology defines the cross-sectional variance of $h_{it,}$ by

$$H_t = \frac{1}{N}\sum_{i=1}^{N}(h_{it} - 1)^2 \qquad (4)$$

And the statistical convergence property $H_t \rightarrow 0$ translates into the null hypothesis of economic convergence between countries in the panel.

To formulate a null hypothesis of convergence, the method needs to impose some more structure on b_{it}. Phillips and Sul (2007) assume that b_{it} follows a decay model which has the following semi-parametric form

$$b_{it} = b_i + \frac{\sigma_i \xi_{it}}{L(t)t^{\beta}} \qquad (5)$$

where b_i is a fixed value that b_{it} may reach in the long run, σ_i is an idiosyncratic scale parameter, and ξ_{it} is a random variable that is iid (0,1) across i, but may be a weakly dependent time series. $L(t)$ is a slowly varying function (like $\log t$) for which $L(t) \rightarrow \infty$ as

$t \to \infty$ and β is the decay rate. β governs the rate at which the cross section variation over the transitions decays to zero over time.

In terms of the semi-parametric form assumed above, the null hypothesis of overall convergence may be written as

H_0: $b_i = b$ for all i and $\beta \geq 0$

This implies that all the idiosyncratic effects have a common long-run value and that they all converge toward this value.

The alternative hypothesis is given as

H_A: Either (i) $b_i = b$ for all i and $\beta < 0$ (Absolute Divergence)

Or (ii) $b_i \neq b$ for some i and $\beta \geq 0$ (Club Convergence)

In either of the two cases, the null hypothesis of absolute convergence breaks down. It may be noted that in case (i) this is due to the fact that the cross-sections exhibit absolute divergence (i.e., they do not all converge towards the common value) while in case (ii) this is due to the fact that the cross-sections exhibit club convergence (i.e., although there is convergence towards long-run values, there are, in fact, more than one long-run value). Therefore, the alternative hypothesis also includes the possibility of club convergence.

Finally, to test for convergence, the methodology proposes a regression model that tests whether H_t, the cross sectional variance of the relative transition coefficient h_{it}, tends to zero in the long run. Phillips and Sul (2007) prove rigorously that using equations (3), (4) and (5), the above condition can be reduced to the regression equation

$$\log (H_1/H_t) - 2\log L(t) = p + q \log t + u_t, \text{ for } t = [rT], [rT]+1, \ldots T \quad (6)$$

With $\hat{q} = 2\hat{\beta}$, where β is the decay rate in equation (5)

Equation (6) is the *log t test* regression[16], where H_1 represents the variance of the relative transition coefficient at the beginning of the sample (i.e., $t = 1$), and H_t represents the same at any point in time t (i.e., $t = 1, 2, \ldots, T$). Since any convergence of the relative transition coefficients would require H_t to fall continuously as a proportion of H_1, the term $\log(H_1/H_t)$ is a measure of this convergence. $L(t)$ is assumed to be a slowly varying function of time and

[16] For detailed derivation of *log t* regression equation refer Phillips and Sul (2007), appendix, pp. 44-48.

Phillips and Sul (2007) suggest using the log function for this variable (i.e., *L(t) = log(t)*). Note that the equation is estimated on a truncated sample which is defined by the size of the total sample *T*, and a parameter *r*, such that the truncated sample goes from *r*T* (or the closest integer to *r*T*) to *T*. Although *r* can lie anywhere between zero and one, the limit distribution and power properties of the test depend on the value of *r* and hence, *r* has to be chosen to balance between the two. Phillips and Sul (2007) run simulation experiments that suggest *r = 0.3* is a satisfactory choice in terms of both size and power, and they suggest using this for all *log t tests*. Based on this truncated sample, equation (6) is estimated using a heteroscedasticity and autocorrelation consistent one sided *t*-test. It is then applied to test the inequality of the null hypothesis i.e., $\beta \geq 0$. The null hypothesis of convergence is rejected if $t_{\hat{q}}$< -1.65 (5% significance level).

As discussed above, this methodology embeds the possibility of club convergence in the absence of absolute convergence. In the actual application of this methodology, we confirm the outcome – absolute convergence, club convergence or absolute divergence – through a two-step approach. The first step involves testing for absolute convergence for the entire sample using the *log t test*. If the null hypothesis of convergence cannot be rejected, we accept that the cross sections exhibit absolute convergence over the period. If the null is rejected, it could either be a case of club convergence or absolute divergence. The second step tests for club convergence. This involves identifying sub-groups of the whole sample for which the *log t test* shows convergence. If such sub-group or clusters can be identified, we conclude that the data exhibits club convergence. Otherwise we conclude that the data exhibits absolute divergence.

The identification of clubs or subgroups (if absolute convergence has been rejected) is itself a multi-step process involving a clustering mechanism procedure. First, the cross-sectional units are sorted in descending order of the value of the variable of interest (say, per capita income) in the last period for which data is available (Phillips and Sul (2007) argue that convergence is usually most apparent in the final time period of the sample). Next, the method tries to identify the first convergence club. For this, first the core group of the club has to be identified. This is done by selecting the *k* highest units in the panel of size *N*, where $N > k \geq 2$. The value of *k* is chosen such that it maximizes the *t*-statistic (from the *log t test*), amongst all those subgroups that do not reject the null of convergence. Once this core is selected, more units are added until an additional unit shows a rejection of the null of convergence for that group. The core and the additional units thus identified make up the first

convergence club. After the first convergence club is identified, there may be many more units left in the sample. The approach then attempts to identify a second and a third and a fourth convergence club and so forth - using the same steps that had identified the first convergence club - until the sample is exhausted or there are some units left that do not converge to any club. These units exhibit absolute divergence.

Finally, in case the above process identifies more than one convergence club, tests are conducted to determine whether some of these clubs can be merged to form larger convergence clubs. To test for the merging of clubs, the procedure starts with the two highest clubs. Taking all units from the set of convergence clubs, the *log t test* is run, and if the *t-statistic* does not reject convergence, both clubs are merged to form one larger club. Then the test is repeated after adding the next highest club etc., and the process is continued until the *t-statistic* indicates that the convergence hypothesis is rejected. Once the first merger is complete the process attempts to identify more mergers from the rest of the convergence clubs. The process is concluded when all possible mergers have been completed.

4.2 Bai and Perron Methodology to Estimate Growth Up-Breaks and Down-Breaks

In order to identify growth breaks in Indian states and union territories, we have used Bai and Perron (2003) technique, which simultaneously provide solution to endogenously determining the break dates and estimating multiple structural changes in a linear regression framework. This is a two-step method. The first step is to identify the maximum number of possible breaks. In the second step the test then uses a sequential method to identify statistically significant break date. The sequential method first assumes a single structural break in the data series and test for the equality of the regression parameters in the two segments. If test reject the null hypothesis of a single break, then the sample is divided into two sub-samples and the same procedure is repeated for each sub-samples. This sequential method is repeated until the test rejects the null hypothesis and identifies a structural break. The break dates in this method are identified as the global minimiser of the sum of residual squares of a linear regression following a dynamic programming algorithm.

For m breaks and $m+1$ segments the break points ($T_1,.....T_m$) are treated as unknown. The aim is determine the break dates and number of the breaks T_j (for $j = 1,.....,m$). In an ordinary least square framework m parameters are obtained after minimizing the residual

sum of squares for each partition. Then using a dynamic programming algorithm a triangular Residual Sum of Square (RSS) matrix is derived to estimate the breakpoints ($T_1,.....T_m$).

The breakpoints are derived from the following equation

$(T_1,.....T_m) = \arg\min S_T(T_1,.....T_m)$.

Where, $S_T(T_1,.....T_m)$ is the RSS for given m partition and it is achieved minimizing over all possible partitions of the data.

4.3 Methodology to Estimate role of Initial Growth and Growth-Breaks in Growth-Clubs

Finally, from the two exercises described above, we have the dependent (left-hand-side) variable and the independent (right-hand-side) variables for our regression exercise. The dependent variable (named 'clubs' in our regression exercise) describes which growth-club each state or union territory belongs to. Since the clubs are distinct, this is a categorical variable. Moreover, there is a natural ordering to this categorical variable since the growth clubs represent the whole range of growth performance from the worst to the best. This can be captured by giving higher values to the dummy variable 'clubs' corresponding to better performing growth-clubs. Thus, ordered probit regression is the appropriate estimation technique to use in this case.

The exercise to identify growth transitions provides us with the two main regressors, (i) number of up-breaks and (iii) number of down-breaks. However, we need to remember that by the assumptions of the Bai-Perron method, the first growth transition can take place only after a minimum number of years from the beginning of the period under study. Thus, apart from the growth transitions, the convergence club formation may also be due to this initial condition, i.e., the average growth rate before the first growth transition. This variable then is our third regressor in the ordered probit regression. It may be noted that for those economies that do not experience any growth transitions, the value of this variable is the same as the average growth rate for the whole period.

A discussion of regression strategy is incomplete without some analysis of the possible endogeneity of the regressors. It needs to be understood however, that in the proposed ordered probit regression, the regressors (number of up-breaks or down-breaks) are not determinants of the dependent variable (the specific club that economies belong to). Rather, the determinants of growth transitions (for example a policy change) are also likely to impact

the dependent variable (club formation). Thus, the regressors are endogenous by construction, where the underlying factors are omitted variables in the regressions. The objective of the exercise then is to identify correlation or co-movements between the dependent and independent variables, rather than identify causal relationships.

4.4 Data

In order to carry out the tests for club convergence as well as growth breaks for the post-reform period, we need data on per capita income of Indian states and union territories. For this, we use gross state domestic product (GSDP) data for the period 1993 to 2019, provided by Economic and Political Weekly Research Foundation (EPWRF). In order to calculate per capita GSDP we divide GSDP figures by corresponding population figures of the states for respective years. The population data has been collected from the census of India. The census of India provides population figures at decadal intervals. For the interim years we have calculated the population figure of the states assuming a fixed growth rate of population between any two census years. The last census data is available in the year 2011. After 2011, we use population figures reported by EPWRF along with the state GDP figures.

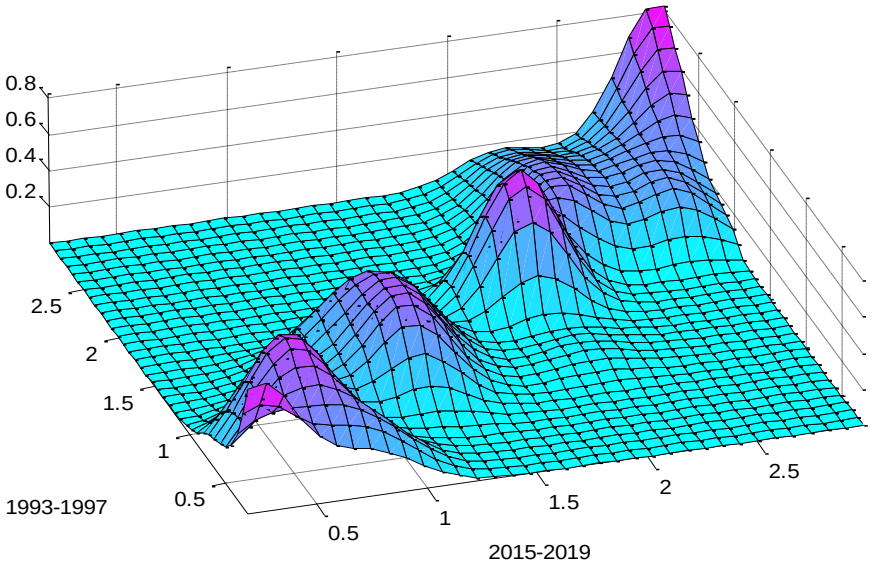
5. Empirical Results

Corresponding to the methodology described above, we have three parts to this section.

5.1 Club Convergence

The existence of uneven growth across Indian regions raises the possibility of club convergence. Are there any indications of convergence clubs among these regions in India in the post-reform period? In order to throw some light on this issue, we first present a three-dimensional plot known as the stochastic kernel. This figure captures how the initial post-reform distribution of per capita income of Indian states and union territories evolved towards the final distribution (we have data till 2019) as well as the probability of this dynamics. The three-dimensional plot of the stochastic kernel has been presented in Figure 1. In this figure the average per capita income of all regions is normalized to the value 1. The distinct multiple peaks in Figure 1 clearly indicate the emergence and persistence of multiple convergence clubs in the post-reform period.

Figure 1: Three dimensional stochastic kernel of Indian sub-national regions



Source: Author's calculation based on per capita GSDP data, EPWRF

Next, in order to statistically test for the existence of these clubs, as well as the precise number of such clubs, we next carry out the Phillips and Sul test. We present the results of absolute convergence of the whole sample and club convergence of the sub samples in Table 1, together with the club members in each case. Column 2 reports the results of the absolute convergence of the whole sample. The *t-statistics* is lower than the critical value (i.e., -1.65) suggesting that there is no evidence of absolute convergence in the overall sample. Columns 3 to 6 report the results of the possibility of convergence clubs. The Phillips and Sul test suggests the possibility of four convergence clubs. For all these clubs, the value of the *t-statistics* is more than -1.65, suggesting that the per capita income of all regions converge towards one of these clubs and there are no regions that exhibit divergence from all four clubs. Next, Table 2 reports whether there is any possibility of merger between the adjacent clubs. The *t-statistics* in all the cases is found to be less than -1.65 and hence rejects the possibility of merger of the clubs. Hence the results of the *log t-test* suggest that there are four distinct clubs which are diverging from each other.

This divergence between the clubs can also be observed from the relative transition paths of the clubs presented in Figure 2 that represent the time path of the mean per capita income of the members of each club as a ratio of the average per capita income of all regions. It is clear here that the relative transition paths of the clubs are moving away from each other.

Table 1: *Log-t* test for absolute and club convergence

Clubs	Absolute Convergence (Single club)	Club 4	Club 3	Club 2	Club 1
Club size	31	8	7	11	5
Club Members	All the states in the sample	Andhra Pradesh, Delhi, Chandigarh, Goa, Gujarat, Haryana, Sikkim, Uttarakhand	Andaman & Nicobor Island, Himachal Pradesh, Karnataka, Kerala, Maharashtra, Puducherry, Tamil Nadu	Arunachal Pradesh, Chhattisgarh, Jammu & Kashmir, Madhya Pradesh, Meghalaya, Nagaland, Odisha, Punjab, Rajasthan, Tripura, West Bengal	Assam, Jharkhand, Manipur, Uttar Pradesh, Bihar
t-stat	-180.62	- 1.21	- 1.22	7.93	- 0.80

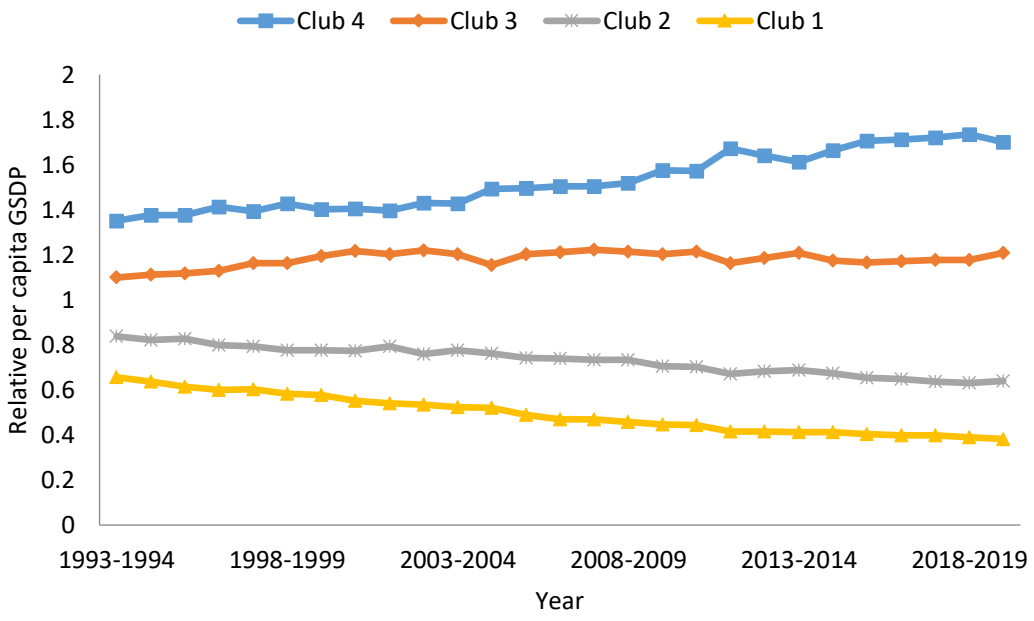
Note: t-statistic larger than -1.65 indicates convergence.
Source: Author's calculation based on per capita GSDP data, EPWRF

Table 2: Merging of Clubs

Clubs	**Club 4+3**	**Club 3+2**	**Club 2+1**
Club Size	15	18	16
t-stat	- 10.00	- 72.42	-29.14

Note: t-statistic larger than -1.65 indicates convergence.
Source: Author's calculation based on per capita GSDP data, EPWRF

Figure 2: Relative transition path of the four clubs, 1993-2019

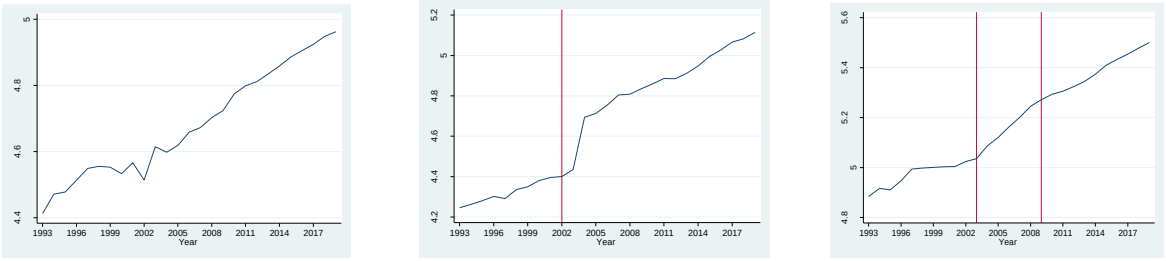


Source: Author's calculation based on per capita GSDP data, EPWRF

5.2 Identification of Growth Breaks

In order to identify the growth transitions in the Indian states and union territories, we apply the Bai and Perron structural break test. We find that these regions exhibit three different types of outcomes in terms of breaks in their growth trajectories in the post-reform period. Figure 3 represents these outcomes in three Indian states, namely Rajasthan, Andhra Pradesh and Delhi. The break date that represents a growth transition, if any, is depicted by a vertical red line in the figure. Rajasthan exhibits uneven but steady growth without any break in this period. Andhra Pradesh clearly shows one break, a growth up-break in 2002. Delhi has two breaks, a growth up-break in 2003 and a growth down-break in 2009.

Figure 3: Growth Breaks in Indian sub-national regions



Rajasthan Andhra Pradesh Delhi

Source: Author's calculation based on per capita GSDP data, EPWRF

The results of the structural break test of per capita GSDP growth rates for all 31 Indian states and union territories for the period 1993 to 2019 have been presented in Table 3. The statistically significant break years are reported in column 3. We have identified a total of 22 such break years. The number of up-breaks and the number of down-breaks have been presented in Column 4 and 5 respectively.[17] While the number of statistically significant up-breaks is identified as 18, there are 4 identified down-breaks.

We also report the average per capita growth during each episode corresponding to the breaks for every region. The average per capita growth for the first, second and third episodes are presented in Column 6, 7 and 8 respectively. The average per capita growth of each region for the entire period has been reported in Column 9. As explained in the methodology section, if no break is identified for a region, the average growth for the first episode is the same as the growth rate of the entire period.

[17] Up breaks represents growth acceleration while down breaks represent growth declaration.

Table 3: Structural breaks of Per Capita GSDP growth rates, 1993-2019

Clubs	Region/ State	Significant Break Years	Num. Of Up Breaks	Num. of Down Breaks	Avg. Gr. Epi_1	Avg. Gr. Epi_2	Avg. Gr. Epi_3	Avg. Gr. 94-19
Club 4	CHAN		0	0	6.33	---	---	6.33
	DEL	2003*, 2009**	1	1	3.64	9.52	5.43	5.68
	GOA		0	0	6.83	---	---	6.83
	GUJ		0	0	6.47	---	---	6.47
	HAR	2002*	1	0	3.92	7.15	---	6.03
	SIK	2005*, 2011**	1	1	4.49	19.13	6.53	8.5
	UT	2003*, 2009**	1	1	3.57	13.16	6.43	6.88
	AP	2002*	1	0	4.11	11.21	---	8.75
	Total	**8**	**5**	**3**				
Club 3	AN	2005*	1	0	2.3	9.15	---	5.99
	HP	2002*, 2010**	1	1	4.82	7.27	6.03	6
	KAR		0	0	6.07	---	---	6.07
	KER	2001*	1	0	4.45	6.65	---	5.97
	MA	2001*	1	0	2.93	6.66	---	5.51
	PUDU		0	0	6.28	---	---	6.28
	TN	2003*	1	0	4.14	7.68	---	6.32
	Total	**6**	**5**	**1**				
Club 2	ARP		0	0	3.79	---	---	3.79
	CHH	2000*	1	0	0.2	5.33	---	3.95
	JK	2001*	1	0	1.84	3.83	---	3.22
	MP	2002*	1	0	1.6	5.89	---	4.4
	MEG		0	0	3.72	---	---	3.72
	NAG	1999*	1	0	-0.67	6.7	---	5
	ODI	2002*	1	0	1.96	7.26	---	5.42
	PUN	2004*	1	0	2.5	5.23	---	4.08
	RAJ		0	0	5.2	---	---	5.2
	TRI		0	0	7.27	---	---	7.27
	WB		0	0	4.8	---	---	4.8
	Total	**6**	**6**	**0**				
Club 1	ASS	2001*	1	0	0.56	4	---	2.94
	JHAR		0	0	3.83	---	---	3.83
	MAN		0	0	3.04	---	---	3.04
	BIH		0	0	4.51	---	---	4.51
	UP	2004*	1	0	2.01	4.95	---	3.7
	Total	**2**	**2**	**0**				
All States Total		**22**	**18**	**4**				

Note: Single stars (*) represent up-breaks and double stars (**) represent down-breaks in column 3.
Source: Author's calculation based on per capita GSDP data, EPWRF

There is substantial variation in the number of significant up and down breaks in different clubs. Thus club 1 has only 2 up-breaks, while clubs 3 and 4 have 5 each and club 2 has 6 of them. Variations are also observed in the number of down-breaks across clubs. While clubs 1 and 2 have no down-breaks, club 3 has 1 and club 4 has 3 down-breaks. As a result of these up and down breaks, club 1 exhibits 2 growth transitions, club 2 and 3 have 6 each and club 4 has 8 of them.

5.3 Impact of Growth Transitions on Convergence Clubs

Finally, we run an ordered probit model in order to estimate the impact of growth transitions on the probability of a region (state or union territory) converging to a high-growth or low-growth convergence club. The dependent variable ('clubs') is a categorical variable taking values from 1 to 4, each value representing the specific club that the region converges to (1 for the lowest growth club and 4 for the highest growth club). The independent variables include controls for initial conditions and proxies for growth transitions. Controls for initial conditions are measured by the average growth rates of a region before the first growth transition takes place. For a region that undergoes no transition, this value is identical to the average growth rate for the entire period. On the other hand, if the region undergoes one or more transitions, this variable takes the value of the average growth rate before the first transition. Next, growth transitions are captured by (i) number of growth up-breaks and (ii) number of growth down-breaks in a region. It may be noted that all of these independent variables have been generated in section 5.2 and presented in Table 3.

Table 4: Ordered Probit Results (including marginal effects)

Variables	Clubs	Club 1 (Marginal Effect)	Club 2 (Marginal Effect)	Club 3 (Marginal Effect)	Club 4 (Marginal Effect)
Average Growth Rate Before First Transition	0.75 (0.20)*	- 0.07 (0.04)***	- 0.22 (0.09)**	0.15 (0.08)***	0.15 (0.05)*
Number of Up Breaks	2.34 (0.75)*	- 0.36 (0.17)**	- 0.37 (0.15)**	0.33 (0.13)*	0.41 (0.14)*
Number of Down Breaks	0.68 (0.77)	- 0.04 (0.04)	- 0.22 (0.25)	0.09 (0.07)	0.18 (0.24)

*Note: *, **, *** indicate significance at 1%, 5% and 10% level.*
Source: Author's calculation based on per capita GSDP, EPWRF

The results of the ordered probit model are presented in Table 4. Column 2 presents the results of the basic model while Column 3 to 6 presents the marginal effects. Column 2

shows that while the coefficient of average pre-transition growth and number of up-breaks are positive and statistically significant, the coefficient of the number of down-breaks is insignificant. The marginal effects show that the average pre-transition growth and the number of up breaks are significant for all the four clubs while the number of down breaks is insignificant for all the clubs. The sign of the marginal effects of the average pre-transition growth and the number of up-breaks are negative for clubs 1 and 2; they are positive for clubs 3 and 4. Thus, higher pre-transition growth and higher number of up-breaks diminish the possibility of converging to the low growth clubs and increase the probability of converging to the high growth clubs. In terms of the marginal effects, result for club 1 suggest that if average initial growth increases by one percent, the probability of being in club 1 declines by 7 percent. Similarly, with one up break (compared to none), the probability of being in club 1 declines by 36 percent. The results are similar for club 2. The marginal effect of average initial growth and number of up breaks for club 3 and 4 is significant and opposite in sign compared to club 1 and 2 (Column 5 and 6). The results show that if average initial income increases by one percent, the probability of being in club 3 increases by fifteen percent while the probability of being in club 4 also increases by fifteen percent. Similarly, with one up-break, the probability of being in club 3 increases by 33 percent while that for club 4 increases by 41 percent.

6. Policy Implications and Concluding Remarks

How do we interpret the results presented in section 5.3? First, let us consider the argument we made in section 1 that national growth transitions could potentially drive regional growth transitions. Further, the effect of these national growth transitions could be uneven (affecting some regions more than others) and these uneven effects could play a role in regional club formation. In section 3.3, we reviewed three growth transitions that the Indian economy underwent during the period covered by the empirical analysis in section 5. These were the two growth up-breaks that happened around 1993 and 2002 and a growth slowdown that happened sometime around 2010. A close look at Table 3 reveals that all the regional up-breaks are clustered around 2002, which is the median year for up-breaks. Similarly, the down-breaks are distributed close to 2010, with the median year being 2009. Based on this, we interpret the up-breaks and down-breaks in the regional economies as the result of the growth up-break in 2002 and slowdown around 2010 in the Indian economy. The pre-transition growth rates that start at 1993 are assumed to be the effect of the up-break in the

Indian economy around 1993. Based on these interpretations, we find from Table 4 that for the period under study, the uneven regional effects of both the up-breaks in the Indian economy (1993 and 2002) played a role in driving club convergence in India. This supports our claim that national growth transitions and their uneven effects across regions may indeed be important in understanding regional club convergence.

Next, we turn to the critical issue of policy divergence. Specifically, what do the results imply for growth policies in the states and union territories belonging to the different clubs? As we have explained in section 2, low growth convergence clubs that are the result of slowdowns due to institutional challenges have a far more difficult task breaking out of these growth traps. Institutional reforms are difficult to undertake in any circumstances, but the lack of growth momentum and resultant lack of resources in low growth clubs making it even more difficult to initiate and carry out these reforms. Fortunately, the results in Table 4 show that in the Indian case, growth slowdowns have no impact on regional club convergence. To understand this more clearly, note that none of the states and union territories in clubs 1 and 2 (i.e. the low growth clubs) in Table 3, have a growth slowdown. Thus, the institutional challenges in the Indian financial sector that we discussed in section 3.3 may not be a binding constraint for these regions. This is true for clubs 1 and 2 individually, as the marginal effects in Table 4 demonstrate. This opens up the possibility of these regions breaking out of their low growth traps by adopting simpler policy reforms that will improve their investment climate, as described in section 2. More specifically, some of these reforms (see section 3.3) have already shown results for a number of states that could take advantage of the growth up-break around 2002. This is the best policy option for regions in club 1 and 2. Next, we consider the regions in club 3 and 4. As we have explained in section 2, high growth clubs that are driven by up-breaks as a result of improving their investment climate can sustain their growth in the long run only by adopting institutional reforms. As we have discussed in section 4, regional growth up-breaks significantly increases the probability of converging to a higher growth club in India. Moreover, the discussion in section 3.3 highlighted that these up-breaks were closely related to policies for improving the investment climate, rather than any institutional reforms. Thus, regions in club 3 and 4 need institutional reforms to sustain their growth rates.

To conclude, if all regions of India were to have growth trajectories that are similar to clubs 3 or 4 (the high growth clubs), then growth divergences would be minimised and average growth rates of the aggregate economy would be far higher. The policy implications

discussed above indicate that for this to happen, regions need to adopt divergent policies rather than using the same approach across the board. Thus the sixteen regions belonging to the two lower growth clubs should focus on improving their investment climate, while the fifteen regions forming the two higher growth clubs need more difficult institutional reforms. This is also more feasible from the political economy point of view, since poorer regions find it far more difficult to implement institutional reforms. Policymakers would do well to keep this in mind when growth policies are considered, particularly at the regional level.

References

Acemoglu, D., Aghion, P., Zilibotti, F. (2002). "Distance to frontier, selection, and economic growth". NBER Working Paper No. 9066, July.\

Acemoglu, D., Johnson, S., Robinson, J.A. (2001). "The colonial origins of comparative development: An empirical investigation". *American Economic Review,* Vol. 91 (5), pp. 1369–1401.

Ahluwalia, I.J. (1991). 'Productivity and Growth in Indian Manufacturing', New Delhi: Oxford University Press.

Ahluwalia, M. S. (2000). "Economic Performance of States in Post-reforms Period", *Economic and Political Weekly,* May.

Ahluwalia, M. S. (2002). "State-Level Performance under Economic Reforms in India" in A O Krueger (ed), *Economic Policy Reforms and the Indian Economy*, Oxford University Press, New Delhi.

Aslund, A., Johnson, S. (2003). "Small enterprises and economic policy". Working Paper. Sloan School, MIT

Azariadis, C., and Drazen, A., (1990). "Threshold Externalities in Economic Development", *The Quarterly Journal of Economics,* Vol. 105(2), pp 501-26.

Bai, J and Perron, P. (2003). "Computation and Analysis of Multiple Structural Change Models", *Journal of Applied Econometrics*, 6, pp 72–78.

Balakrishnan, P., and Parameswaran, M. (2007). "Understanding Economic Growth in India: A Prerequisite", *Economic & Political Weekly*, July 14, pp 2915-22.

Balakrishnan, P., Das, M., and Parameswaran, M.,. (2021). "Growth Transitions in India: Myth and Reality, *Economic and Political Weekly*, Vol. 56, No. 11, 13th March.

Barro, R J and G S Becker (1989). "Fertility choice in a model of economic growth" *Econometrica*, Vol. 57, pp 481-501.

Barro, R J and X Sala-i-Martin (1990). "Economic Growth and Convergence across the United States", *National Bureau of Economic Research*, Working paper No. 3419, MA, Cambridge.

Barro, R J and X Sala-i-Martin (1992). 'Convergence', *Journal of Political Economy*, Vol 100, No 2, pp 223-51.

Becker, G S, K M Murphy and R Tamura (1990). "Human capital, fertility, and economic growth", *Journal of Political Economy*, Vol 98, pp S12-37.

Berg, A, J Ostry and J Zettelmeyer (2012). "What makes growth sustained?", *Journal of Development Economics*, 98 (2), pp 149–166.

Besley, T., Burgess, R. (2002). "Can labor regulation hinder economic performance? Evidence from India". CEPR Discussion Paper No. 3260.

Bhattacharya, B B and S Sakthivel (2004). "Regional Growth and Disparity in India", *Economic and Political Weekly*, March.

Cashin, P (1995). "Economic Growth and Convergence across the Seven Colonies of Australia: 1861-1991", *Economic Record*, 71 (213), pp 132-144.

Cashin, P and R Sahay (1996). 'International Migration, Centre-State Grants, and Economic Growth in the States of India', *IMF Staff Papers*, Vol 43, No 1.

Chanda, A. and Kabiraj, S. (2020). "Shedding Light on Regional Growth and Convergence in India", Vol. 133. *World Development*, pp. 104961.

Chaudhuri, B and V Marimautou (2007). "Growth and convergence clubs in Indian States, 1965-2002", unpublished mimeo.

Dastidar and Nair (2018). "Golden Quadrilateral: Vajpayee's Biggest Infra Effort in Roadways", Indian Express, 17th August. https://indianexpress.com/article/india/atal-bihari-vajpayee-golden-quadrilateral-5310899/

De Long, J. B. (2003). 'India since Independence: An Analytical Growth Narrative', in Rodrik, D. (ed.), In Search of Prosperity: Analytical Narratives on Economic Growth, Princeton: Princeton University Press.

Durlauf, S N and D T Quah (1999). "The New Empirics of Economic Growth". In Taylor, J and Woodford, M (Eds.), *Handbook of Macroeconomics*, Amsterdam: North-Holland.

Durlauf, S N, P A Johnson and J Temple (2005). "Growth Econometrics", Handbook of Economic Growth, in: P Aghion and S Durlauf (ed.), Handbook of Economic Growth, edition 1, volume 1, chapter 8, pp 555-677, Elsevier.

Easterly, W., Levine, R. (2002). "Tropics, germs, and crops: How endowments influence economic development". Mimeo, Center for Global Development and Institute for International Economics.

Engerman, S.L. and Sokoloff, K.L. (1994). "Factor endowments, institutions, and differential paths of growth among New World economies: A view from economic historians of the United States". NBER Working Paper No. H0066.

Friedman, E., Johnson, S., Kaufmann, D., Zoido-Lobaton, P. (2000). "Dodging the grabbing hand: The determinants of unofficial activity in 69 countries". *Journal of Public Economics*, Vol. 76, 459–493.

Galor, O (2007). "Multiple Growth Regimes – Insights from Unified Growth Theory", *Journal of Macroeconomics*, Vol 29, No 3, pp 470-475.

Galor, O and J Zeira (1993). "Income distribution and macroeconomics" *Review of Economic Studies*, Vol 60, pp 35-52.

Garofalo, G A and S Yamarik (2002). "Regional Convergence: Evidence from a New State-by-State Capital Stock Series", *Review of Economics and Statistics*, 84 (2), pp 316-323.

Ghosh, M (2008). "Economic reforms, growth and regional divergence in India", *Margin: The Journal of Applied Economic Research*, Vol 2, pp. 265-85.

Ghosh, M, A Ghoshray and I Malki (2013). "Regional divergence and club convergence in India", *Economic Modelling*, Vol *30*, pp 733–742.

Gunji, H and Y Nikaido (2004). "Convergence across Indian states: a re-evaluation", paper presented at 2004 Japanese Economic Association Annual Meeting, Meiji Gakuin University, Tokyo, available at: http://rose.lib.hosei.ac.jp/dspace/bitstream/10114/4244/1/121gunji.pdf

Hall, R. and Jones, C.I. (1999). "Why do some countries produce so much more output per worker than others?". *Quarterly Journal of Economics*, Vol. 114 (1), pp. 83–116.

Hausmann, R., L Pritchett and D Rodrik (2005). "Growth Accelerations", *Journal of Economic Growth*", Vol 10, pp 303-329.

Hoff, K., Stiglitz, J. (2001). "Modern economic theory and development". In: Meier, G.M., Stiglitz, J.E. (Eds.), Frontiers of Development Economics. Oxford University Press, New York, pp. 389–459.

Holtz-Eakin, Douglas (1993). "Solow and the States: Capital Accumulation, Productivity, and Economic Growth", *National Tax Journal*, Volume 46, Number 4.

Islam, N (1995). "Growth Empirics: A Panel Data Approach", *Quarterly Journal of Economics*, Vol 110, No 4, pp 1127-70.

Islam, N (2003). "What Have We Learned from the Convergence Debate?," *Journal of Economic Surveys*, Vol 17, pp 309-362.

Kar, S., Pritchett, L., Raihan, S., & Sen, K. (2013). Looking for a break: Identifying transitions in growth regimes. *Journal of Macroeconomics*, *38*, 151-166.

Kar, S. and K Sen (2016). "The Political Economy of India's Growth Episodes", Palgrave Macmillan, 2016.

Kar, S., Roy, A., & Sen, K. (2019). The double trap: Institutions and economic development. *Economic modelling*, *76*, 243-259.

Kathuria, R (2000). "Telecom Policy Reforms in India", Global Business Review, Vol. 1, No. 2, pp. 301-326.

Kerekes, M (2011). "Analyzing Patterns of Economic Growth: A Production Frontier Approach". Mimeo.

Lucas, R E (1988). "On the Mechanics of Economic Development", *Journal of Monetary Economics*, 22 (1), pp 3-42.

Mankiw, N G, D Romer and D Weil (1992). "A Contribution to the Empirics of Economic Growth," *Quarterly Journal of Economics*, 107, 2, pp 407-37.

Matsuyama, K. (1992). "Agricultural productivity, comparative advantage, and economic growth". *Journal of Economic Theory*, December, 317–334.

Mookherjee, D. (1995). 'Introduction', in Mookherjee, D. (ed.), Indian Industry: Policies and Performance, Oxford: Oxford University Press, pp. 1–43.

Murphy, K.M., Shleifer, A., Vishny, R.W. (1989). "Industrialization and the big push". *Journal of Political Economy*, Vol. 97 (5), 1003–1026.

Nagaraj, R, A Varoudakis and M Veganzones (1998). "Long-Run Growth Trends and Convergence Across Indian States", Technical Paper No 131, *OECD Development Centre, Paris, France.*

North, D.C., Thomas, R. (1973). The Rise of the Western World: A New Economic History. Cambridge University Press, Cambridge.

Phillips, P. C. B. and ,Sul, D., (2007). "Transition modeling and econometric convergence tests". Econometrica 75, 1771-1855.

Pritchett, L (2000). "Understanding Patterns of Economic Growth: Searching for Hills among Plateaus, Mountains, and Plains," *World Bank Economic Review*, Vol 14, No 2, pp 221-50.

Quah, D T (1993). "Empirical cross-section dynamics in economic growth", *European Economic Review*, Vol 37, No 2, pp 426-34.

Quah, D T (1996). "Empirics for economic growth and convergence", *European Economic Review*, Vol. 40 No. 6, pp. 1353-75.

Quah, D T (1997). "Empirics for growth and distribution: stratification, polarization, and convergence clubs", *Journal of Economic Growth*, Vol. 2 No. 1, pp. 27-59.

Rao, M G, R T Shand and K P Kalirajan (1999). "Convergence of incomes across Indian States", *Economic and Political Weekly*, Vol 34, No 13, pp 769-78.

Robert J. Barro, Xavier Sala-I-Martin (1991). "Convergence Across States and Regions", *Brookings Papers on Economic Activity*, Vol. 1991, No. 1 (1991), pp. 107-182

Rodriguez-Clare, A. (1996). "The division of labor and economic development". *Journal of Development Economics*, Vol. 49 (April), pp. 3–32.

Rodrik, D and A Subramanian (2004). "Why India can grow at 7 percent a year or more: projections and reflections", *IMF Working Papers. 04/118, International Monetary Fund, Washington, DC.*

Rodrik, D. (1996a). "Coordination failures and government policy: A model with applications to East Asia and Eastern Europe", *Journal of International Economics*, Vol. 40, pp. 1–22.

Rodrik, D. (1996b). "Understanding economic policy reform". *Journal of Economic Literature*, Vol. XXXIV (March), pp. 9–41.

Rodrik, D. (2005). 'Growth Strategies', in P. Aghion and S. Durlauf (eds.), Handbook of Economic Growth, Vol. 1A, Amsterdam: Elsevier.

Rodrik, D., Subramanian, A. and Trebbi, F. (2002). "Institutions rule: The primacy of institutions over geography and integration in economic development". Kennedy School of Government, Harvard University (October).

Rosenstein-Rodan, P. (1943). "Problems of industrialization of Eastern and Southeastern Europe". *Economic Journal,* Vol. 53, pp. 202–211.

Sachs, J D, N Bajpai and A Ramiah (2002). "Understanding regional economic growth in India", *Asian Economic Papers,* Vol 1, No 3, pp 32-62.

Sala-i-Martin, X (1996). "Regional Cohesion: Evidence and Theories of Regional Growth and Convergence", *European Economic Review,* 40 (6), pp 1325-1352.

Sen, K. (2007). "Why Did the Elephant Start to Trot? India's Growth Acceleration Re-Examined", *Economic and Political Weekly* , Vol. 43, pp. 37–49.

Shetty, S L (2003). "Growth of SDP and structural changes in state economies: interstate comparisons", *Economic and Political Weekly,* Vol 38, No 49, pp 5189-200.

Shioji, E (1996). "Regional Growth in Japan". CEPR Discussion Paper No. 1425, London: CEPR.

Singh, N, L Bhandari, A Chen and A Khare (2003). "Regional inequality in India: a fresh look", *Economic and Political Weekly*, Vol 38, No 11, pp 1069-73.

Stern, N. (2001). "A strategy for development". ABCDE Keynote Address, Washington, DC, World Bank (May).

Subramanian, Arvind, and Josh Felman. (2019). "India's Great Slowdown: What Happened? What's the Way Out?" CID Working Paper Series.370, Harvard University, Cambridge, MA, December.

Temple, J (1999). "The New Growth Evidence," *Journal of Economic Literature*, 37, 1, 112-56.

Trindade, V. (2003). "The big push, industrialization, and international trade: The role of exports". Maxwell School, Syracuse University, March.

Recent IEG Working Papers:

Chakravarty, Satarupa; Das, Sukanya and Das, Saudamini (Nov. 2021). Unreliable Public Water Supply and Coping Mechanisms of Low-Income Households in Delhi, Working Paper Sr. No.: 448

Sahoo, Pravakar and Dash, Ranjan Kumar (Nov. 2021). Differential Growth Impact of FDI on LICs, LMICs, and ECs: The Role of Absorptive Capabilities, Working Paper Sr. No.: 447

Kar, Sabyasachi, Bashir, Amaani and Jain, Mayank (Oct.2021).New Approaches to Forecasting Growth and Inflation: Big Data and Machine Learning, Working Paper Sr. No.: 446

Mohapatra, Sonali Madhusmita (Oct. 2021). Export Performance: A Study of Labour and Capital Intensive Manufacturing Industries in India, Working Paper Sr. No.: 445

Priyadarshini, D. and Kar, Sabyasachi (Sep. 2021). Central Bank Digital Currency (CBDC): Critical Issues and the Indian Perspective, Working Paper Sr. No.: 444

Garg, Bhavesh and Sahoo, Pravakar (Sep. 2021). DO DIFFERENT TYPES OF CAPITAL INFLOWS HAVE DIFFERENTIAL IMPACT ON OUTPUT? Evidence from Time series and Panel Analysis, Working Paper Sr. No.: 443

Garg, Sandhya and Gupta, Samarth (Sep. 2021). Financial Access and Gender Gap in Entrepreneurship and Employment: Evidence from Rural India, Working Paper Sr. No.: 442

Sahoo, Pravakar and Bishnoi, Ashwani (Sep. 2021). Drivers of Corporate Investment Slowdown in India: A Firm Level Analysis, Working Paper Sr. No.: 441

IEG Working Paper No. 449

INSTITUTE OF ECONOMIC GROWTH

University Enclave, University of Delhi
(North Campus) Delhi 110007, India
Tel: 27667288/365/424
Email: system@iegindia.org