

## Chapter 2

# Development Disparities: An Exploration of Past Research

Regional economic disparities have recently gained renewed interest in intellectual and political field. Accelerated global economic integration and market controlled institutional transformation may be expected to intensify regional disparities. So, regional disparity has become a hotly debated topic during the past two or three decades. As the developed nations like the USA, Japan, EU are not free from facing uneven distribution, the countries like India, China, Pakistan are facing the fear of alarming level of regional disparity. According to many researchers regional disparity is a multifaceted concept, encompassing dimensions such as convergence, inequality and polarization. It is important to discuss different studies available in this context. There is a spurt of literature in the development economies centring on regional disparities dealing with both theoretical and empirical issues. For convenience, the relevant literatures have been grouped under two broad categories—theoretical literatures and empirical literatures.

### 2.1 Theoretical Issues

A number of theories and models have been developed to explain disparity in economics. Among them one of the most important is Myrdal's theory of cumulative causation. In this theory the reasons for growing widening disparity in an economy is explained scientifically. According to this theory, developed region grows at the expense of underdeveloped region. The development of a region depends on raw material, capital and labour which come from underdeveloped regions making it more backward. It is true that the development of a region is also based on some initial conditions (Myrdal 1957). Hirschman (1958) was also with the similar view as Myrdal but Hirschman stresses on the role of the state to reduce inequality. There is another famous theory 'Inverted U shape' theory by Kuznets (1955). According to this theory, with the growth of an economy initially regional disparities increase and after a certain stage it will decrease. Williamson (1965) has shown it empiri-

cally taking time series data for 10 countries and cross section data for 24 countries. Both the types of data confirm the inverted U shape hypothesis, i.e. there is a tendency to increase regional inequality initially but it will decrease in the latter phase with the process of development. Another popular theory to judge the dynamics of inequality is convergence theory in neoclassical growth model. This theory satisfies the neoclassical form of production function and assumes constant returns to scale, diminishing returns to each input and some positive and smooth elasticity of substitution between two inputs. In this model, the key factors are aggregate production function, capital accumulation overtime and determinants of economic growth which are exogenously given. (e.g. savings rates, population growth rate,  $n$  and rate of technical progress at the rate,  $g$ ). Assuming that all regions possess similar technology, similar preference and that there are no institutional barriers to the flow of both capital and labour across state borders, the Solow–Swan neoclassical growth model predicts that states would have similar levels of real per capita income (PCI) in the long run. Across regions of a given country that share such a common long run level of real PCI, convergence of PCI is driven by diminishing returns to capital. If the only difference between regional economies lies in the level of their initial stock of capital, the neoclassical growth model predicts that poor regions will grow faster than rich ones—regions with the lower initial values of capital labour ratio will have higher PCI growth rates (Solow 1956). The growth rate decreases monotonically as capital per capita accumulates. The convergence theory measures the speed of an economy from an initial position to its own steady state level, and to the steady state level of other economies. Moreover, the steady state per person is directly proportional to the saving rate and is inversely proportional to the growth rate of population and rate of depreciation of capital. The Solow–Swan (1956) model with human capital gives the strong implications of convergence phenomenon. When this model is augmented by human capital then the speed of convergence is higher and it provides an improved explanation for differences in the income levels across countries and regions. Since accumulation of human capital is correlated with the saving rate and population growth rate, once differences in saving and population growth rate are accounted for, there is convergence at the rate the model predicts (Mankiw et al. 1992). Thus, in the Solow–Swan model, the growth of income per capita is a function of the ultimate determinants of steady state and the initial level of PCI. This is the extended version of neoclassical growth model (Barro and Sala-i-Martin 1995; Barro 1997). Growth of income increases with steady-state value for given value of initial income while it decreases with initial level of income for given value of steady-state value. The target value of income per capita depends on an array of choice and environmental variables. Private sector's choice includes saving rate, labour supply and fertility rate. Each of these depends on the preferences and cost. Therefore, for a given value of choice and environmental variables, a higher starting level of PCI implies a lower per capita growth rate. This type of effect is called conditional convergence. Thus, once the determinants of steady state are controlled for, the neoclassical growth model predicts conditional convergence in the sense that a lower starting value of per capita real income tends to generate a higher per capita growth rate. In other words, the neoclassical growth model

predicts that each economy converges to its own steady state and that the speed of this convergence relates inversely to the distances from the steady state (Barro and Sala-i-Martin 1995).

With the beginning of endogenous growth theory, convergence in the PCI of the nations infused interest among the researchers about its empirical verification. Several authors like Barro and Sala-i-Martin (1991, 1995), Bishop et al. (1993), Quah (1993), etc. went for empirically testing the convergence theories for countries. Barro and Sala-i-Martin have studied the regions of different countries and found that the regions are converging at the rate of 2% every year. These studies have shown that the initially poor regions tend to grow faster than the initially rich regions and thus catch up to the rich regions. The tests also show that the convergence is not unique with some countries and that it occurs under different administrative systems. Barro and Sala-i-Martin have converted the economic notion of convergence into a well-defined statistical hypothesis. Three concepts of convergence are distinguished in the literature.

1.  $\sigma$ -convergence: The idea of  $\sigma$ -convergence concerns with cross-sectional dispersion of PCI.  $\sigma$ -convergence is said to exist if the dispersion of PCI across regions decreases overtime. The existence of  $\sigma$  convergence implies a tendency of PCI to be equal across regions overtime.
2. Absolute or unconditional convergence: Absolute  $\beta$ -convergence exists if the poorer regions tend to grow faster than the richer ones. It is examined statistically by the cross-sectional regression of annual average growth rate of PCI on the initial level of PCI.
3. Conditional  $\beta$ -convergence: Absolute  $\beta$ -convergence is based on the condition that regions differ in the levels of capital only. But in reality regions differ not only on the levels of capital but also on the level of technology, investment rate, propensity to save, rate of capital depreciation, population growth rate, literacy rate, etc. These basic differences in regions emerge as different steady state for different regions. In such a condition, conditional convergence can be tested holding the steady state of each region constant.

But the convergence theory is not beyond criticism. According to Quah (1993), constant estimate of '2% per year' convergence is a statistical illusion since a collection of random walks estimated in a cross section could deliver such an outcome. Also Quah argues that Barro regressions suffer from 'Galton Fallacy'. It is quite possible that the negative relationship between per capita and growth rate just depicts the stationary distribution, and there may not be any long run tendency of convergence (Ghosh et al. 1998). According to Friedman, convergence is indicated by the diminution of the income variance among countries overtime. Again according to Marjit and Mitra, (1996) the so-called convergence hypothesis is based on the neoclassical specification of the growth process but fail to justify the restricted mobility of resources which leads to protracted convergence. With perfect and extensive resource mobility, convergence should have been instantaneous. The catch up hypothesis asserts that being backward in level of productivity carries a potential for rapid advancement. Actually, in comparison across countries the growth rates

of productivity in any long period tend to be inversely related to the initial levels of productivity. Backwardness carries an opportunity for modernization in disembodied as well as in embodied technology. (Jones 2002). Further, with this hypothesis a lot of debate was there. According to Romer (1980), there is little observable tendency for poorer country to catch up the richer one. Lee and Coulombe (1995) found no evidence of convergence on examining 102 non-oil producing countries over the period 1960–1980. According to them it is very unlikely to have a common equation across all countries. Baumal et al. (1989) brought about the concept of club convergence, i.e. one treats low-income, middle-income and high-income countries separately as a group, convergence can be achieved within each group. Pritchett (1997) observed that the poorer country like Africa was not able to narrow the income gap with the richer economies during 1960–1990 period. He showed a big time divergence between richer and poorer nations for past 150 years.

The ratio of gross domestic product (GDP) per capita of the richest to poorest country increased from 8.7 in 1870 to 38 by 1960 and to 45 by 1990. (Jones 2002). Quah (1996a, 1996b) and Galor (1996) persisted about the formation of the convergence clubs. They found that the world is moving towards a bimodal income distribution into twin peaks of rich and poor countries. Quah evidenced ‘convergence clubs’ at the top and bottom of the income distribution. Rich countries clustering around top mode and poor countries around bottom mode for a long period of time and middle class is vanishing.

## 2.2 Empirical Issues

The theories so far discussed have been very popular and pioneering. Extensive research in India and all over the world have been carried out on the basis of these theories. In recent years convergence is a strong empirical regularity in the process of economic growth across countries and regions (Summer and Heston 1988; Maddison 1991; Barro and Lee 2001). Economic experts of different countries, be it advanced or less advanced, focused on the studies of convergence in the cross-country and cross-regional analysis like the studies on convergence in the USA regions, European regions (Barro and Sala-i-Martin 1991, 1992), Japanese prefectures (Barro and Sala-i-Martin 1991, 1992; Shioji 1997), Australian colonies (Cashin 1995), Canadian provinces (Coulombe and Lee 1993), Sweden (Persson 1997), Spanish regions (de La Fuente 2002; Sanchez and Villaverde 2001), Mexico (Juan-Roman and Rivera-Batiz 1996), Brazil (Magalhães et al. 2000), Africa (Hoefler 2002), China (Yao and Weeks 2000), Ireland (O’Leary 2000), Greece (Petra-kos and Saratsis 2000), Bangladesh (Hossain 2000), Pakistan (Ahmad and Amber 2000), South Pacific countries (Cashin and Loayaza 1995) and Turkey (Gezici and Hewings 2004). It has been estimated empirically that in case of the developed and homogeneous countries, regional convergence can be established with a speed close to 2% per year to narrow down the half of the gap between the initial level of PCI and the steady-state level of per capita income. But in case of developing and less

developed countries with a characterization of strong heterogeneity, it is still now a question when the less developed countries/states will catch up the rich ones. In India also lot of empirical studies are conducted to find out if there is any disparity within Indian states and what are the reasons behind it, are they converging or not and what are the policy prescriptions? There are a lot of literatures examining the regional convergence of PCI, convergence of human development, convergence of infrastructure and also regional convergence of agricultural development.

The evidence of convergence in Europe, USA, Canada and in Japan had strengthened the Solow model but in Indian context the basic premise of the Solovian model, that the region with lower PCI should grow faster, has been challenged by the study in Marjit and Mitra (1996). It has been argued that the central prediction of the neoclassical model, i.e. diminishing returns to capital may not be applicable in the country like India where public intervention and nonmarket factors play a major role. Mentioning the above in their study shows strong statistical evidence in favour of divergence across states of India over the period from 1960–1961 to 1994–1995.

The pioneering work made by Cashin and Sahay (1996) established convergent relationship between growth rate and initial per capita net state domestic product (PCNSDP) of 20 Indian states for the period (1961–1991). To them, beside diminishing returns to capital, the channels through which convergence occur are interregional capital mobility, the diffusion of technology from leader to follower economies, the redistribution of income from relatively rich regions to relatively poor regions of a federal country by its central government and flow of labour from poor to rich regions. They found income convergence at a rate of 1.5% per year and it will take about 45 years to close one half of the gap between any state's initial level of PCI. The speed is slower than the estimated speed of 2% in industrialized countries. Moreover, they formed a measure of per capita state disposable income (SDI) constituting the aggregate state net domestic product (NDP) plus central state grants and showed that the dispersion of SDI is lower than the actual state NDP, i.e. central state grants have a progressive role in equalizing PCI across states.

Another important aspect explained by Cashin and Sahay (1996) is the effect of migration. A strong positive relationship exists between the net immigration and initial state income. Their study found that 10% differential in PCI would raise net immigration to each state by only 0.012% point per year. That means Indian states resemble the weak responsiveness of population movements to income differentials like the regions of Europe whereas, the states of the USA and prefectures of Japan had a strong response of migration to income differentials. Combination of barriers to the mobility of labour, strong local workers unions, lack of housing in fast growing urban areas and most important social, cultural and linguistic barriers to the cross regions are found to be responsible for the response of migration to income differentials in the Indian states.

In this respect one of the important studies was made by Rao et al. (1999). Authors examining the interstate inequalities in the level of income in India for the period of more than last three and a half decades (1965–1966 to 1994–1995) show the

evidence of widening interstate divergence in income levels across the states. The basic proposition of diminishing marginal returns to capital has been questioned as it may be possible that in an economy with large unutilized resources and a poor state of social and physical infrastructure, there will be increasing returns to reproducible capital in the initial stage of development followed by diminishing returns, resulting in an inverted U relationship between economic growth and interregional inequality as assumed by Kuznets (1995). This literature contradicts with the result of convergence of incomes across states by Cashin and Sahay (1996). Private investment and human capital have been identified as the major determinants causing divergence especially after 1980s. According to the authors, the significant positive relationship between public and private investment pose the threat of diverging the growth rate to the skewed distribution of public expenditure causing large flows of investment to more affluent regions in the country. The public expenditure has a critical role in developing social and economic infrastructure and thereby attracting private investment. In this respect the authors emphasized the role of intergovernmental transfers in bringing equality. As an explanation of divergence the authors documented that in spite of the redistributive impact of explicit transfers, the implicit transfer has a major role in creating inequality. Authors find that the positive and significant elasticity coefficient of implicit transfers shows the regressive nature of these transfers. But the progressivity of the transfer system is significantly reduced if implicit transfers are added to the explicit transfers.

Another study by Mathur (2001) analysed several facets of national and regional economic growth since 1950s. He mainly focused on the decade of 80s and 90s and observed a steep acceleration in the coefficient of variation of PCI in the post-reform period 1991–1996. He classified the whole population into low, middle and high income groups and found convergence within the group of middle income countries, whereas divergence for the other two groups.

Most of the studies in the Indian literature except few argue for regional divergence across the Indian states specially after the adoption of New Economic Reform. The measures of absolute  $\beta$ -convergence and  $\sigma$ -convergence show highly significant positive relationship between the growth rate of PCI and its initial level and increasing dispersion in income throughout the different study period in different studies (Rao et al. 1999; Dasgupta et al. 2000; Marjit and Mitra 1996; Ghosh et al. 1998; Nayyar 2008; Aiyer 2001; Ahluwalia 2000). The convergence becomes possible when the determinants causing the income differentiation are accounted for, that is going for conditional convergence. Majority of the article based on neo-classical growth theory establish conditional convergence in real PCI across states of India (Nagaraj et al. 1997; Akkina 1996; Nayyar 2008; Adabar 2005; Trivedi 2002; Bandyopadhyay 2000, 2001). As it is a problem to get accurate data from the basic determinants causing divergence as explained in the neoclassical growth theory that is information on capital stock, savings (investment) and technology across states of the Indian federation, authors usually go for some proxy variables to account for this difference, in the steady states across the states. Different studies opted for different conditional proxy variables, such as public investment (Nayyar 2008; Ghosh and De 1998), private investment (Nayyar 2008; Aiyer 2001), differ-



ent infrastructural indicators (Ghosh et al. 1998; Nagraj et al. 2007; Akkina 1996), physical, social, economic and human development (Ghosh 2006), indicators as a proxy for capital stock, saving, technology and human capital. The study by Nagraj et al. (1997) analysed the role of infrastructure very vividly in achieving convergent growth in income across the states. They not only found absolute divergence in PCI during the period 1970–1994 but also found evidence of conditional convergence when the important infrastructure difference across the states are accounted for. They took 14 infrastructural indicators comprising physical, social and economic arena so that differences in growth of PCI can be accounted for. They used panel data and had taken care of endogeneity problem. In their analysis the speed of convergence was more than 30 % per year during 1970–1994. According to the authors, the persistent income inequalities due to the dispersion of steady-state income levels arises mainly from difference in the structure of production, in infrastructural endowments and in state specific fixed effects (the fixed effects correspond to some non measured political and institutional factors) in growth regressions. This implies conditional convergence may come from productivity or technology catch up or neoclassical type input transition dynamics (see Islam 1995; Caselli et al. 1996; Canova and Albert 1995 for cross country analyses). According to Nagaraj et al. (1997), to bring about long run growth and interstate convergence, efficient policy focus and public investment targeting the appropriate mix of physical, economic and social infrastructural development is necessary in the area where the payoff is highest.

Another relevant study made by Ghosh et al. (1998) established the role of physical infrastructure in explaining divergence in PCNSDP across states. Taking six representative indicators of physical infrastructure, they found divergence in PCI in the Indian states over the period 1961–1962 to 1995–1996. Though from the beginning of the plan period, emphasis had been given on equitable distribution of funds with special emphasis on poorer states, still it fails to bring about the regional balance in infrastructure as well as PCNSDP within the country. In fact, only devolution of funds cannot ensure the ultimate objective, if they are not used efficiently. Akkina (1996) also made the similar type of study taking a wider range of variables such as per capita power consumption, power shortages, literacy rate, percent of income arising from industry and services and railroads per thousand of square km.

Further, Dasgupta et al. (2000) studied the economic performance of the Indian states in their PCNSDP for the time period 1960–1961 to 1995–1996. As examined by Nagaraj et al. (1997) that convergence is attained related to state specific steady states, Dasgupta et al. (2000) did not find any definite way of establishing the state specific steady states. In their study the authors found a clear trend of divergence of growth rates across states in terms of PCNSDP but convergence in the share of the different sectors in SDP. Though  $\sigma$ -convergence was observed in service sector but no  $\sigma$ - and  $\beta$ -convergence is found for PCNSDP across states during the mentioned time period. Constructing the rank correlation matrix, this study shows the stability of state's performance with respect to its own average and national average over the study period indicating a widening of interstate gap over the whole period. This study poses importance on the role of agricultural sector in explaining the growth differentials across states.

In the literature of convergence of PCI across the Indian states the mixture of efficient role of both public and private investment has been given importance. It has been proved that except the inequitable role of public investment and infrastructure development by state government, the intervention of private investment plays a major role in creating inequality across states. Many studies such as Rao et al. (1999), Ahluwalia (2000) and Nayyar (2008) put emphasis on the role of private investment.

Nayyar (2008) in his study, in a panel data framework taking 16 states for the period (1978–1979 to 2002–2003), established conditional convergence in real PCI across states where the conditional variables are public investment, private investment and proxies for human capital. He used both fixed effect and generalized method of moments (GMM) methods for testing conditional convergence of PCNSDP. The speed of convergence is much higher in GMM technique (0.186) than fixed effect method. He found strong evidence of absolute  $\beta$ -divergence both by cross section and panel data framework and also found increasing dispersion of per capita real income across states overtime, i.e.  $\sigma$ -divergence. According to him, the Indian states are not following a single steady-state path rather they are converging to different steady states. The increasing interstate disparities in the levels of private and public investment are prominent whereas the equalizing impact of central–state government transfers is insignificant. Actually, according to the author, the main policy driven variable is per capita public investment. By effectively framing policies and efficiently using public investment in building human capital as well as ensuring private investment with the help of federal transfer can enhance the growth prospects of the overall economy. Similarly, Aiyer (2001) following panel data regression technique and using least squares dummy variable (LSDV) estimation method for a sample of 19 states over the period (1971–1996), established conditional convergence in PCI after observing absolute divergence. He took into account proxy for the variables like private capital and human capital. The speed of convergence increased when these variables were taken into account.

In an elaborate analysis Ahluwalia (2000) studied the extent of interstate differences in the pace of economic growth for the period (1986–1987 to 1997–1998) for 14 major Indian states. This study found variation in private investment ratio which is positively and significantly correlated with variations in growth. To Ahluwalia, critical drivers of growth are private investment and improvement in factor productivity. Individual state must focus policies so that private investment can be stimulated and also compete with other state to attract investment. In giving a policy suggestion for enhancing growth of the overall economy, author stressed on the quality of governance. Many important aspects like irrigation, health, education, electricity, power, etc depend on the performance of the state government; all the state government should concentrate on improving the efficiency of resource use and quality of governance. Good governance can be created by proper evaluation and effectiveness of public sector programme, curbing corruption, improving law and order situation specially in remote or more backward areas, creating decentralized control, absorbing more people's participation and overall maintaining a busi-



ness friendly environment so that more and more investment can be attracted from the private entrepreneurs.

Along with this line Kalirajan and Takahiro (2002) studied the convergence hypothesis in Indian perspective following Hayami's notion that better institutional set up can provide better growth prospects in an economy. Hayami (1997) in his study shows that country specific factors such as governance, institutions and culture play a dominant role in determining growth path of a country. Economists provide empirical evidence to show specifically that a country's economic performance as well as its distribution to members is positively related to the quality of that country's institutions (Knack and Keefer 1995; Chong and Calderon 2000). Taking this aspect, Kalirajan and Takahiro (2002) examined the influence of institutional set up on growth rate of the Indian states and also tried to establish a link between the quality of institutions and interregional income inequality by testing the convergence of PCI across the states in India for the period 1970–1992 taking the share of agriculture as institutional component. The result of PCI divergence is associated with the inefficiency and poor quality institutions and organization. In this study, the authors argue that in an economy with large unutilized resources and a poor state of social and physical infrastructure due to poor quality of institutions, there will be increasing returns to reproducible capital in the initial stages of development creating an inverted U shape relationship between the quality of institutions and income inequality (Chong and Calderon 2000). In this respect, in an another study Singh and Srinivasan (2002) made an innovative analysis taking the role of capital as an explanation for PCI growth divergence in 1998–1999 over that in 1990–1991. They selected three financial variables like foreign direct investment (FDI) approvals per capita during the decade 1991–2000, per capita bank credit as a proxy for private investment in 1990 and credit-deposit ratio in 1990. They suggested complementarity between domestic and foreign capital flows.

Apart from infrastructure and private investment, urbanization and market oriented reform may be one of the important determinants of growth explained by Bajpai and Sach (1996). Authors found very weak force of convergence both for absolute and conditional convergence. They mention several possibilities for the lack of convergence, such as (1) the geographical difference are larger in India and China than in the states of the USA, Europe and Japan, (2) population movements in India do respond very slowly to income differentials, (3) policies of the national and regional governments prevented convergence in India and China, (4) economic convergence is slower at lower levels of economic development as in India (or China).

Sach et al. (2002) differentiated states in the category of more reform oriented and less reform oriented states. It has been observed that except Andhra Pradesh more reform oriented states achieved faster rate of growth. To them coastal states are more favoured zone in attracting FDI and also more urbanized. Urbanization is likely to play a key determinant for explaining growth differential across states as a 10% point higher rate of urbanization is associated with 1.3% points a year higher annual growth. Except coastal areas high productivity of agriculture also has an important role in furthering growth and development.

Like the convergence studies of PCI in India, the regional disparities of human development across states of India has also been studied by many researchers. Among these studies one of the detailed study was made by Dholakia (2003). Dholakia, in his study 'Regional Disparity in Economic and Human Development in India' examined the trend in regional disparity in the economic and human development in India over the past two decades. He showed that the regional disparity in average PCI does not show any significant trend in regional disparity over the two decades. According to him large sample coverage of 20–28 states rather than of 14 states (as used in most studies) reveals an accurate findings of unchanged disparity in PCI. He also examined the disparity in human development and its indicators for past two decades for 15 states as well as 26 states depending on the availability of data. A highly significant and declining trend in regional disparity in Human Development Index (HDI) is observed during 1981–1991 and 1991–2001 for 15 states. But the significance level declined when the number of states increased to 26. This study shows that 7 out of 9 human development indicators and 12 out of 16 related social and human development indicators during 1981–1991 show a marked decline in disparities in human development. The author went for a causality test between PCI growth and HDI and its indicators. He found a two-way causality between human development and economic development. It was observed that human development indicators require 8 years to improve PCI whereas in the reverse causality PCI positively influence HDI within 2 years. Thus, the author stressed on policy implications for achieving high economic growth as the emphasis on economic growth is likely to address the issue of twin disparities in income and human development in the shortest time. The responsibility of reducing regional disparity should be borne by states as they are best placed to choose their development strategies. Some other notable studies that are available on this issue in Indian context are Ghosh (2006), Majumdar (2005), Gaur (2010), Roy and Bhattacharya (2009) and Noorbakhsh (2003). Ghosh (2006), in his study contrary to Dholakia (2003), confirmed the existence of a two-way nexus between economic growth and human development and suggested that human development improving programmes should be given priority in any economic reform for achieving sustainable economic and human development. He, in his study, evaluated the relative performance of 15 major Indian states on human development and PCNSDP during 1981–2001 and found strong evidence of regional convergence in all the measures of human wellbeing despite considerable divergence in PCI. With a cross-section analysis he showed that social sector expenditure has played an important role in achieving regional convergence in human development through its positive effects on literacy rate, expectation of life at birth and Human Development Index. Performing a causality test between economic growth to human development and human development to economic growth, he proved that there has been a two-way causality between economic growth and human development giving rise to the possibilities of virtuous cycle, vicious cycle, lopsided economic growth and lopsided human development. The movement from lopsided human development path to virtuous cycle of development process demands a large-scale investment in human development indicators or human wellbeing for achieving both high economic growth and human

development. Contrary to Dholakia, author stresses that states need not wait until they attain high level of economic growth before undertaking large investment for expansion of education and health services. Improved human development is most likely to ensure high economic growth, which would eventually move the states from vicious to virtuous cycle of development. In another study, Gaur (2010) shows that except education, average deprivation in terms of PCNSDP and expenditure on medical and public health for 20 states has risen significantly during the period 1980–2005. For Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh (BIMARU) states and for the hill states the deprivation index in terms of the above mentioned indicators were found higher during the period 1980–2002. Majumdar (2005) also shows an improvement in educational opportunities and deterioration in the medical and health standards among the states in post-reform period. According to him, regional variation in HDI seems to decline over the period 1970–2001 but has intensified specially in the post-reform period; the hierarchical position of the states has remained more or less similar over the period. Roy and Bhattacharya (2009) shows absolute  $\beta$ -convergence in HDI but insignificant  $\alpha$ -convergence during 1981–2001. Noorbakhsh (2003) on the other hand evidenced both  $\beta$ - and  $\sigma$ -divergence in human wellbeing in the major Indian states during 1981–2001.

Agricultural development influences the level of economic development in a country like India. The regional income disparity may be explained by the disparity in agricultural development across states of India. In this connection, Ghosh (2006) tried to examine the regional disparities in agricultural development across 15 major states in India during 1960–1961 to 2001–2002. He tested the  $\alpha$ - and  $\beta$ -convergence (absolute and conditional) in land productivity, labour productivity and per capita agricultural output across the states particularly after the dissemination of new high yield variety (HYV) technology and the implementation of large scale economic reform. In this study he proved significant  $\beta$ -divergence in labour productivity instead of insignificant  $\beta$ -convergence/divergence in land productivity and per capita agricultural output whereas strong  $\sigma$ -divergence has been observed in case of labour productivity and per capita agricultural output. Using the conditional factors like human capital (rural literacy), physical capital (tractor and pumpset) and rural infrastructure (irrigation facilities) the author proved that the abovementioned factors had significant role in explaining  $\beta$ -convergence/divergence in land and labour productivity and per capita agricultural output, and they have significant effects on the transitional growth rates and steady state levels of the three measures of agricultural development. According to him, the variations in the steady-state levels of the three measures of agricultural development could be largely due to variations in the levels of these conditioning variables across the states. The author also tested the unit root analysis using the Phillips–Pherron methods for examining the club convergence in time series framework. The results of the unit root test for convergence shows that while nine states share a common steady state path with ‘all India’, the remaining six states have been following steady state path, that is different from ‘all India’ path. According to the author, these six states are thus driving the regional divergence in agricultural development.

In a related study of Bhide and Shand (2000), the role of agricultural productivity and share of agriculture on PCI growth along with some infrastructural variables and human capital have been analysed. The study exhibits a comparative framework for distribution of National Skills Development Program (NSDP) on different sectors for each state. Using the panel data framework for 15 states over three time periods, 1972–1982, 1982–1990 and 1992–1995, the author proved that agricultural growth has positive impacts on industrial growth and service sector growth. Moreover, agricultural growth is affected positively by land productivity in agriculture and negatively by the share of agriculture. In this connection the authors found a stark differentiation between progressive and backward states.

## 2.3 Methodological Issues

In convergence literature different techniques are used to analyse convergence in a cross-section of economies. The estimate of rate of conditional convergence in a single cross-sectional analysis over a period of time may suffer from at least three problems. First, reduction of all available information; second, single cross-section regression suffers from omitted variable bias; third, one or more of the regressors may be endogenous in nature (Hoeffler 2002). The single cross-section estimator Ordinary Least Square (OLS) gives consistent estimates as long as the state-specific individual effect is captured by random disturbance term and assumed to be uncorrelated with explanatory variables. However, there are various techniques to control the unobserved state-specific effects, e.g. minimum distance (MD) approach, LSDV approach (Islam 1995), first difference GMM (Arellano and Bond 1991), system of GMM (Blundell and Bond 1998; Easterly and Levine 2001; Hoeffler 2002; Wooldridge 2002). When controlling for unobserved state-specific effects, the most important issue, which would arise is whether the technological effect is treated to be ‘fixed’ or ‘random’.

Caselli et al. (1996) argue that almost all existing cross-country regressions, either based on cross-section, or panel data techniques, have been estimated inconsistently. Without accounting for the omitted variable bias and endogeneity of regressors, the speed of convergence is potentially biased and inconsistent. Caselli et al. (1996) tries to sort out these two problems by applying a GMM estimator in a dynamic panel growth regression to obtain the rate of convergence and other growth parameters. Arellano and Bond (1991) shows that first difference GMM estimator can be applied in a panel data regression with fixed effects and a lagged dependent variable. If the data set is ‘small T and large N’, a standard fixed effects estimator may be subject to a rather considerable bias. In small sample weak instruments can produce biased coefficients since consistency of the GMM estimator depends on the validity of the instruments (Easterly and Levine 2001).

Further, Barro and Sala-i-Martin (2003) highlight one potential problem with the fixed effect to study the growth convergence that the existence of business cycle tends to bias upward the estimates of speeds of convergence.

## 2.4 Unit Root Test

To avoid the limitations of cross-sectional regression method, a new concept of convergence has been applied using time series methodology. The use of time series to examine convergence of PCI of a country was advocated by Quah (1992), Bernard and Durlauf (1996), Li and Papell (1999) and Cheung and Pascual (2004). Under the time series framework, convergence requires real per capita output differentials across regions to be stationary. That means levels of per capita output are not diverging overtime (Bernard and Durlauf 1995 1996; Li and Papell 1999; Evans 1998). This methodology treats the differences in country's per capita output across country as transitory and as the forecast horizon grows the difference between any pair of countries converges to zero.

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