



EXAMINING THE INCOME CONVERGENCE AMONG INDIAN STATES: A PANEL DATA APPROACH

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Abstract

After crossing the Hindu growth rate in 1990s the Indian economy has been experiencing a consistent and increasing growth of national gross domestic product both at current and constant prices. This growth in the national level gross domestic product is resulting in a high growth rate of the state domestic product of various states. However, it will be interesting to examine whether there is any convergence in the economic growth of the Indian states or not. The findings of present study indicates the convergence of per capita income in the pre reform period, while in the post reform period it confirms the divergence in per capita income among the Indian states.

Keywords: Convergence, Economic growth, Per capita state domestic product

JEL classification: C01, O11

1. Introductions

In seventh five-year plan, Indian economy has crossed the Hindu growth rate.¹ After the economic and political instability in early nineties, in eighth plan the Indian policy makers had implemented the economic reforms. This resulted in the high economic growth of the economy and it became one of the highly growing economies in the world. The economic development experienced by India especially after 1993-94 is a matter of interest for the researchers. However it will also be interesting to find out that weather there is any convergence in the economic development of the Indian states or not. But whether this growth is for all or it is just for some states this what is the objective of the present study.

¹ The term coined by Prof. Raj Krishna as the stagnated rate of growth of Indian GDP up to 1980.



The neoclassical growth models incorporate the concept of convergence. Solow model (1956) explains the convergence as the process by which comparatively poorer economies will grow faster than the rich economy initially and hence in the long run convergence of the poorer and rich economy will take place. However, the convergence is based on the assumption of diminishing returns to scale of reproducible capital. Furthermore, the comparatively underdeveloped economy possibly experiences the lower shocks of physical capital and this will be resulting in a higher marginal rate of return on capital. Here we may note that the β -convergence of Solow is conditional β -convergence. Conditional β -convergence will be perceptible only if other factors responsible for variation in initial states have been taken into the account. The second concept of convergence is the σ -convergence; it is concerned with the cross-sectional dispersion. If the dispersion of per capita incomes across regions tends to declines over time, the σ -convergence occurs.

Barro and Sala-i-Martin (1995, 1992), and Barro (1991) have discussed the two notion of convergence the β -convergence and the σ -convergence. The first one is the β -convergence having discussed in the literature in two flavours; conditional and unconditional β -convergence. For the sake of simplicity one can understand the β -convergence as an idea that the comparatively poorer economy intends to grow faster than the rich economy and hence the poor will catch up with the rich one in terms of PCI (per capita income) in the long run resulting in the convergence.

The σ -convergence is the second concept of convergence; it is concerns with the cross-sectional dispersion. If the dispersion of per capita incomes across regions tends to declines over time, the σ -convergence occurs. Assuming other things being same, β -convergence eventually lead to σ -convergence. Nevertheless, in case if other things are not equal over time may be because of random disturbances which is subject to b regional specific then β -convergence not necessarily leads to σ -convergence.

This issue of convergence among Indian states has been taken into account in many research papers Nayyer (2008), Gosh (2008) by taking the different approaches of analysis. Most of the researchers have concluded a difference in the rate of growth in the per capita SDP of states resulting into the inequality of resource and opportunity distribution. It has further leads to an unbalanced development in different states.

Gosh (2008), has examined the regional divergence and long run economic growth among fifteen Indian states. He found that due to inter-state variation in human capital, infrastructure, and production structure are causing the divergence in the growth of these states. Study also suggests that the economic reform stated in 1991 has fuelled up the divergence process. The study suggests the need of greater public investment in infrastructure and human capital for underdeveloped states will possibly reduce the divergence by improving the growth rate of underdeveloped states. Jayanthakumaran (2010), applied stochastic and beta convergence tests to examine the convergence or divergence at state level. The paper finds that in the post reform period state-level incomes of almost half of the state are converging with national level income. However, economic growths of the half poorer states are not catching up with national level income. The paper suggests the need for special attention for poorer states before going for further liberalization.



In the literature on convergence most of the studies have been done on the basis of β -convergence and σ -convergence. But in this study we are contributing to the literature by analysing the presence of convergence among the Indian state by using time series methodology such as Panel Unit root test. Firstly, we computed the deviation of state per capita Income from national average of each year. Then we applied the panel unit root tests to check the stationarity of the mean deviated values; stationarity of the panel indicates the presence of convergence in state per capita income, where as nonstationarity indicates divergence of state per capita income. Peculiarity of the present study lies in the fact that it has been conducted by using time series data from 1980-81 to 2008-09. The Data up to the year 1999 has been changed according to the base year 1999-00

2. Data and methodology

The present study is based on the time series data on per capita state domestic products (SDP) (State Domestic Product) of Eighteen Indian states for the period 1980-81 to 2008-09. This date is available in RBI database on Indian economy provided by RBI website. The entire period has been divided in two parts 1980-81 to 1990-91 and 1991-92 to 2008-09. The period 1980-81 to 1990-91 can be referred as the pre-reform period whereas the period 1991-92 to 2008-09 can be referred as the post-reform period. This bifurcation has been done for checking out the differences in the convergence of state per capita income between pre- and post-reform since India achieved a high rate of growth in the post reform period.

We did the analysis for the full period and the sub periods (pre- and post-reform periods as mentioned earlier). For this we used four versions of panel unit root tests such as LLC test (Levin, Lin and Chu 2002), IPS test (suggested by Im, Pesaran and Shin 2003), MW test and PP - Fisher Chi-square test.

First of all, the LLC test used the following adjusted t-statistic:

$$t_{\hat{\alpha}}^* = \frac{t_a - (NT) \hat{S}_N \sigma_{\tilde{\varepsilon}}^{-2} \sigma_{\hat{\alpha}} \mu_T^*}{\sigma_T^*} \quad (1)$$

where \hat{S}_N is the average of individual ratios in the long-run to short-run variance for country i ;

$\sigma_{\tilde{\varepsilon}}$ is the standard deviation of the error term in equation (2); $\sigma_{\hat{\alpha}}$ is the standard deviation of the slope coefficients in equation (2); σ_T^* is the standard deviation adjustment; μ_T^* is the mean adjustment.

Secondly, the IPS test employed a standardized t _bar statistic based on the movement of the Dickey–Fuller distribution:



$$Z_{t_bar} = \frac{\sqrt{N} \{t_bar - N^{-1} \sum_{i=1}^N E(t_{iT})\}}{\sqrt{N^{-1} \sum_{i=1}^N Var(t_{iT})}} \quad (2)$$

where $E(t_{iT})$ is the expected mean of t_{iT} , and $Var(t_{iT})$ is the variance of t_{iT} .

Thirdly, the present study employed other two Fisher type tests developed by Maddala and Wu (1999) and Choi (2001). The MW test (Maddala and Wu 1999) test is based on the combined significance levels (p -values) from the individual unit root tests. According to Maddala and Wu (1999), if the test statistics are continuous the significance levels π_i ($i = 1, 2, \dots, N$) are independent and uniform (0,1) variables. They used the combined p -values, or P_{MW} , which can be expressed as:

$$P_{MW} = -2 \sum_{i=1}^N \log \pi_i \quad (3)$$

where $-2 \sum \log \pi_i$ has a χ^2 distribution with the $2N$ degree of freedom. The Choi (2001) test is based on the following standardized statistic:

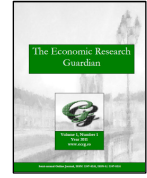
$$Z_{MW} = \frac{\sqrt{N} \{N^{-1} P_{MW} - E[-2 \log(\pi_i)]\}}{\sqrt{Var[-2 \log(\pi_i)]}} \quad (4)$$

Under the cross-sectional independence assumption, this statistic would converge to a standard normal distribution (Hurlin 2004).

3. Results and discussion

The results of all the four panel unit root tests are given in Table I.

The LLC test results indicate that we are unable to reject the unit root null. The LLC test is criticized on the assumption that the ρ to be homogeneous across i ; all the cross sections have a unit root property. By relaxing this assumption we employed the IPS test, by assuming heterogeneous ρ , by averaging the individual unit root test statistics; presence of unit root in all the cross sections as null hypothesis against unit root in some cross-sections. In IPS test, also, we are unable to reject the unit root null; the assumption of ρ is not affecting our results of unit root. Further, we employed the MW test, which uses which uses the combined significance levels and PP-Fisher Chi-square test. Nevertheless, all tests provide the same results that the mean deviation of per capita income of



Indian states poses a unit root. This indicates no sign of convergence of per capita income in Indian states for the period 1981-82 to 2009-10.

Table I - Unit root tests for the full panel of 17 states

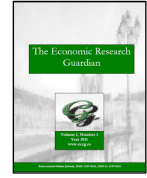
Types of test statistic	Test statistic	P value
LLC test statistic computed in equation (1)	0.14349	0.5570
IPS test statistic computed in equation (2)	-0.04558	0.4818
MW test statistic computed in equation.	39.7905	0.1620
PP - Fisher Chi-square	39.2895	0.1757

Since the government implemented economic reforms in India from 1991 onwards, we divided the study period in to two period's namely pre-reform period (1980-81 to 1990-91) and post-reform period (1991-92 to 2008-09). This is to check whether the divergence of PCI as shown in our first result is valid in both periods or not, i.e., whether the economic reforms affected the convergence or divergence process or not?

The results for the pre- and post-reform periods are given in Table II. The results are interesting as it indicates that the study variables are stationary in the pre-reform period, but during the post reform period they are nonstationary (except for LLC results ,which indicates that the during the post reform period the variables are stationary). This shows that during the pre-reform period, the per capita income of Indian states shown the indications of convergence, but the economic reform implemented in 1991 has a large effect of this process and which made the values diverging.

Table II - Unit root tests for the pre- and post-reform periods

For Pre-reform		
Types of test statistic	Test statistic	P value
LLC test statistic computed in equation (1)	-5.05136	0.0000
IPS test statistic computed in equation (2)	-2.57812	0.0050
ADF - Fisher Chi-square	61.1756	0.0029
PP - Fisher Chi-square	67.3215	0.0006
For Post-reform period		
LLC test statistic computed in equation (1)	-1.76597	0.0387
IPS test statistic computed in equation (2)	-0.40870	0.3414
ADF - Fisher Chi-square	36.0566	0.3726
PP - Fisher Chi-square	40.8987	0.1934



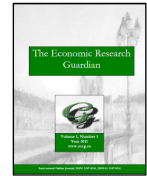
4. Conclusion

In this study, we examined the convergence hypothesis of Per capita income of Indian states for the period 198-81 to 2008-09 and the effect of economic reforms in 1991. For this, we used four different panel unit root test such as LLC test, IPS test, MW test and PP fisher Chi-squire test.

Our results indicates that for the period 1980-81 to 2008-09 the Indian per capita income is not showing any indications of convergence whereas it is diverging since the our panel unit root test results indicates that the mean variations of State per capita income is nonstationary process. To check the effect of Economic reforms in 1991 we divided the period in to two parts- pre-reform (1980-81 to 1990-91), and Post reform (1991-92 to 2008-09) period. We find that the study variable is stationary in the pre-reform period where as it is nonstationary in the post-reform period. This indicates that the per-capita income of Indian states was converging in the pre-reform period and the economic reforms started in 1991 shackled that process and in the post-reform period, the state per capita income is diverging.

References

- Barro R (1991). Economic Growth in a Cross-Section of Countries. *Quarterly Journal of Economics*. 106(2): 407-443.
- Barro R, Sala-i-Martin X (1992). Convergence. *Journal of Political Economy*. 100(2): 223-251.
- Barro R, Sala-i-Martin X (1995). *Economic Growth*, New York: McGraw-Hill.
- Ghosh M (2008). Economic Reforms, Growth and Regional Divergence in India. *Margin: The Journal of Applied Economic Research*. 2(3): 265-285.
- Choi I (2001). Unit root tests for panel data. *Journal of International Money and Finance*. 20(2): 249–272
- Hurlin, C. (2004). Nelson and Plosser revisited: A re-examination using OECD panel data .Document de Recherche No. 2004/23, Laboratoire d'Economie d'Orleans.
- Jayanthakumaran K (2010). Economic Reforms and Income [6] Convergence/Divergence in Regional India. *Indian Economic Review*. 45(1): 29-48.
- Im, K.S., M.H. Pesaran and Y. Shin (2003) .Testing for Unit Roots in Heterogeneous Panels. *Journal of Econometrics*. 115(1):53–74.
- Levin, Andrew, lein,Chin-Fu, and Chu, Chia-Shang james (2002). Unit root tests in panel data: Asymptotic and Finit sample properties *Journal of econometrics*. 108 (1): 1-24



Maddala, G. S., and Wu, S. (1999). A Comparative Study of Unit Root Tests with Panel Data and New Simple Test. *Oxford Bulletin of Economics and Statistics*. 61:631-652

Solow R (1956). A Contribution to the Theory of Economic Growth. *Quarterly Journal of Economics*. 70(1): 65-94.