Sectoral Performance and Regional Disparity: A Study of the Indian States with Special Reference to Agriculture

Banalata Saikia, Chandra Saha Roy and Salim Shah

Research Journal of Agricultural Sciences
An International Journal

P- ISSN: 0976-1675
E- ISSN: 2249-4538

Volume: 13
Issue: 03

Res. Jr. of Agril. Sci. (2022) 13: 766–773

CARAS

Res. Jr. of Agril. Sci. (May-Jun 2022)
13(3): 766–773

ISSN: 0976-1675 (P)
ISSN: 2249-4538 (E)

www.rjas.org

Full Length Research Article

Sectoral Performance and Regional Disparity: A Study of the Indian States with Special Reference to Agriculture

Banalata Saikia*[1], Chandra Saha Roy[2] and Salim Shah[3]

Received: 14 Mar 2022 | Revised accepted: 26 May 2022 | Published online: 09 June 2022

A B S T R A C T

Increasing inter-state disparity across regions is one of the major challenges in Indian agriculture. India being an agro-based economy more than forty per cent of the total population is still engaged in the agriculture sector. The present study tries to examine the growth performance of the agriculture sector in comparison to PCNSDP, industry, and service sectors. Also, examine the sector-wise regional divergence of the 26 Indian states during 1980-81 to 2019-20. The trend line shows a huge inter-state disparity in the sector-wise performance as well as in the growth rate of PCNSDP in the economy. The result of the Gini coefficient shows that the disparity level has increased in the agriculture sector and PCNSDP while it is stagnant in the industry and service sector. Moreover, K-means cluster analysis results show less evidence of convergence tendency among the states over time. Thus, the Central and state governments should implement such schemes for the development of all sectors towards their increase in the share of output and employment in the country's GDP.

***Key words*:** Regional disparity, Sectoral performance, PCNSDP, Gini coefficient, Clustering

Agriculture is the predominant sector in India. So, the overall development of the economy highly depends on the development of agriculture sector. Although, the agriculture sector's contribution to GDP is falling over time, still 41.49 percent (2020) of the total workforce in India are engaged in agriculture sector and the remaining 58.51 percent population are distributed among the industry and service sectors. However, the agricultural sector does not have significant growth, especially for the poorer regions despite having huge macroeconomic policy changes after the economic reforms 1991 [1]. It is observed that poorer states were still lagging behind and the richer states had significant agricultural growth [8]. A low agricultural growth rate leads to widening the inter-state disparities in the growth performance of the economy [6]. There is a significant influence of agricultural performance on reducing inequality and poverty in the economy [4]. Thus, it is important to identify the causes of long-run regional disparities in terms of agriculture as well as industry and service sectors to maintain the balanced regional development of the economy. As regional disparities in the sectoral performance become major causes of regional divergence in terms of per capita NSDP, it is important to measure the agricultural growth performance in comparison to industry, services and PCNSDP across the states of India. Also, checking the convergence tendency in the share of sectoral performance to GDP of the states in this diverge era is one of the most important issues which are a major priority of the present study. The growth rate of agriculture to GDP is significantly declined during the post-reform period relative to the pre-reform for India. All the states show a similar trend in agricultural growth performance. The decreasing growth rate of agricultural performance widens the inter-state disparity among the states [6]. Significant inter-state variations in productivity are observed across the states over time [2]. There is no evidence of convergence or divergence in the case of per-capita agricultural output, whereas a significant divergence in labor productivity is observed after the economic reforms [4]. In terms of total factor productivity (TFP) of the agriculture sector, there is no evidence of convergence across the major states of India [9]. However, there is the tendency of beta convergence in terms of per capita income from agriculture across states [3]. There is increasing regional divergence during the post-reform period among the states due to the lack of infrastructure and different production structures [5]. Significant divergence is observed in the states' per capita income and sectoral levels. But club convergence has been noticed across the aggregate and the sectors [7].

Several studies are found in the existing literature in terms of agricultural performance. The majority of the studies are based on measuring agricultural productivity and land fertility performance. There are few studies on measuring agricultural performance in comparison with PCNSDP and Industry and service sector. Moreover, the study uses recent data periods to check the performance as well as clustering of the states. So, the present study may be an addition to the existing literature. The objectives of the present study are (i) To

* **Banalata Saikia**
✉ saikiabanalata@gmail.com

[1-3] Department of Economics, Tripura University, Suryamaninagar, Agartala - 799 022, Tripura, India

examine the agricultural growth performance of the Indian states. (ii) To analyse the trend of the sectoral performance and tendency of convergence among the Indian states, and (iii) To explore the inequality in terms of agriculture, industry, service, and PCNSDP among the states.

MATERIALS AND METHODS

The present study is based on secondary data collected from the Handbook of Statistics on State Government Finances published by the Reserve Bank of India, Economic and Political Weekly Research Foundation (EPWRF). The study attempts to cover 26 Indian states for a period of 40 years from 1980 - 81 to 2019 - 20. The whole period is subdivided into eight phases i.e., Phase - 1 (1980-81 to 1984-85); Phase - 2 (1985-86 to 1989-90); Phase - 3 (1990-91 to 1994-95); Phase - 4 (1995-96 to 1999-00); Phase - 5 (2000-01 to 2004-05); Phase - 6 (2005-06 to 2009-10); Phase - 7 (2010-11 to 2014-15); Phase - 8 (2015-16 to 2019-20). In the case of PCNSDP and all the sectors, the year 2011 - 12 is taken as a base year.

The present study tries to measure the growth performance of sectoral components of the economy and the per capita net state domestic product (PCNSDP) across the Indian states. Trend analysis has been used for the three sectors in the economy viz. agriculture, industry, service sector, and per capita NSDP over the period from 1980 - 81 to 2019 - 20. Compound Annual Growth Rate is calculated in each of the five-year intervals to check the growth trends of the agriculture, industry, service sectors, and PCNSDP. Moreover, Gini Coefficient has been used for measuring inequality across the states over time. K-Means Cluster analysis has been used to check the tendency of convergence of the states over the eight phases of the study. It is a non-parametric approach of distributional dynamics. K-Means Cluster is a method of demonstration in which the states are found in various groups or clusters and it shows that the states belong to the same cluster or not over time. In the K-means cluster approach, if the same number of states belongs to the same cluster over time, the states tend to converge. Whereas, if the states pertain to another cluster that shows the tendency of divergence across the states. Objectively, we have selected the number of clusters K=3 for the present analysis [10-11].

RESULTS AND DISCUSSION

Table 1 Compound annual growth rate of agriculture (in Lakh)

States	Phase-1 1980-81 to 1984-85	Phase-2 1985-86 to 1989-90	Phase-3 1990-91 to 1994-95	Phase-4 1995-96 to 1999-00	Phase-5 2000-01 to 2004-05	Phase-6 2005-06 to 2009-10	Phase-7 2010-11 to 2014-15	Phase-8 2015-16 to 2019-20
Andhra Pradesh	0.026	0.045	0.021	0.016	0.018	0.050	0.043	0.087
Arunachal Pradesh	0.071	0.039	0.056	-0.014	-0.010	0.025	0.055	-0.016
Assam	0.014	0.017	0.012	-0.003	0.001	0.027	0.033	0.018
Bihar	0.035	-0.009	-0.011	0.030	-0.009	0.034	0.015	0.037
Goa	-0.001	0.064	0.025	0.025	0.030	-0.044	0.020	0.051
Gujrat	0.045	0.045	0.060	-0.014	0.097	-0.001	0.029	0.043
Haryana	0.019	0.027	0.024	0.019	0.019	0.038	0.012	0.051
Himachal Pradesh	-0.019	0.045	0.000	-0.002	0.047	-0.010	0.020	0.019
Jammu & kashmir	-	-	-	0.031	0.037	0.010	-0.019	0.017
Karnataka	0.041	0.043	0.056	0.044	-0.024	0.030	-0.002	0.064
Kerala	-0.006	0.019	0.043	0.005	0.014	-0.015	-0.001	-0.016
Madhya Pradesh	0.010	0.000	0.018	0.030	0.056	0.036	0.084	0.070
Maharashtra	0.008	0.085	0.030	0.026	0.023	0.021	-0.005	0.048
Manipur	0.022	0.006	0.012	0.037	0.047	0.065	0.037	0.109
Meghalaya	0.008	0.008	-0.019	0.050	0.035	0.013	0.069	0.016
Mizoram	-	-	-	-	0.015	0.070	0.164	0.033
Nagaland	-	-	-	0.091	0.079	0.024	0.050	0.018
Odisha	0.003	0.027	0.037	-0.007	0.041	0.032	0.035	0.052
Punjab	0.046	0.035	0.032	0.025	0.015	0.017	0.005	0.029
Rajasthan	0.054	0.051	0.008	0.018	0.056	0.021	0.027	0.046
Skim	-	-	-	-0.036	0.052	0.025	0.088	0.072
Tamil Nadu	0.064	0.030	0.066	0.023	-0.022	0.024	0.043	0.049
Tripura	-0.002	0.046	-0.013	0.041	0.056	0.071	0.059	0.058
Uttar Pradesh	0.019	0.023	0.016	0.031	0.009	0.019	0.015	0.031
Uttarakhand	-	-	-	0.005	0.018	0.024	0.009	0.016
West Bengal	0.038	0.038	0.061	0.028	0.024	0.025	0.018	0.037

Note: Data for the state Meghalaya, Nagaland and Uttar Pradesh are available from 1980-81; for Mizoram 1999-00 and Uttarakhand, data is from 1993-94

Sectoral growth performance and the related trends

Agriculture, industry, and service sector are the three major sectors in the Indian economy. The industry and service sector have a significant contribution to the rising trend of the Indian economy. In 2020 - 21, the share of the service sector to Gross Value Added (GVA) was highest, i.e., 53.89 per cent. The industrial share to GVA is second highest with 25.92 per cent while agriculture sector has only 20.19 per cent share to GVA. Thus, it is observed that the sectoral growth rate is jumped to the service sector with higher output. In case of many

states of India, the industrial sector is backward due to lack of infrastructure and resources. At the same time, the growth trend of the agriculture sector is falling [12].

The trend in agriculture sector: Indian states

Agriculture is one of the prominent sectors in the Indian economy with more than 40 per cent of the total workforce participation. (Table 1) shows the compound annual growth rate of agriculture from 1980 - 81 to 2019 - 20. In Phase - 1, the growth rate is negative in Goa, Himachal Pradesh, Kerala, and Tripura. In Phase - 2 & 3, all select states are having increasing growth rate excepting Bihar, Meghalaya, and Tripura. For Phase - 4 & 5, most of the states have negative growth rate. In Phase - 6 & 7, most of the states have higher growth rate except some having negative growth rates. Except for Arunachal Pradesh and Kerala, all the states have positive growth rates in Phase – 8 [13].

Table 2 Compound annual growth rate of industry (in Lakh)

States	Phase-1 1980-81 to 1984-85	Phase-2 1985-86 to 1989-90	Phase-3 1990-91 to 1994-95	Phase-4 1995-96 to 1999-00	Phase-5 2000-01 to 2004-05	Phase-6 2005-06 to 2009-10	Phase-7 2010-11 to 2014-15	Phase-8 2015-16 to 2019-20
Andhra Pradesh	0.062	0.078	0.060	0.031	0.059	0.062	0.039	0.059
Arunachal Pradesh	0.063	0.066	0.083	0.007	-0.007	0.062	0.393	0.058
Assam	0.061	0.012	0.027	0.015	0.141	0.014	0.040	0.088
Bihar	0.085	0.041	-0.030	0.093	0.008	0.088	0.100	0.077
Goa	0.040	0.076	0.022	0.166	0.059	0.056	0.016	0.094
Gujrat	0.069	0.046	0.082	0.050	0.078	0.093	0.093	0.080
Haryana	0.065	0.055	0.028	0.056	0.060	0.061	0.069	0.054
Himachal Pradesh	0.095	0.128	0.120	0.097	0.040	0.159	0.061	0.079
Jammu & Kashmir	-	-	-	0.027	0.091	0.087	0.008	0.012
Karnataka	0.049	0.083	0.054	0.055	0.074	0.069	0.028	0.058
Kerala	0.018	0.057	0.075	0.018	0.021	0.053	0.029	0.053
Madhya Pradesh	0.023	0.093	0.048	0.055	0.001	0.111	0.004	0.057
Maharashtra	0.017	0.067	0.041	0.036	0.053	0.057	0.037	0.038
Manipur	0.055	0.057	-0.092	0.078	0.024	0.067	0.011	0.007
Meghalaya	0.014	0.075	0.068	0.002	0.142	0.149	-0.070	0.123
Mizoram	-	-	-	-	0.023	0.056	0.076	0.011
Nagaland	-	-	-	-0.248	0.059	0.122	0.031	0.074
Odisha	0.039	0.097	0.047	0.036	0.121	0.122	0.014	0.108
Punjab	0.075	0.067	0.061	0.046	0.021	0.115	0.034	0.035
Rajasthan	0.064	0.060	0.059	0.078	0.021	0.100	0.042	0.020
Skim	-	-	-	0.011	0.037	0.787	0.066	0.082
Tamil Nadu	0.052	0.025	0.047	0.010	0.025	0.088	0.016	0.081
Tripura	0.046	0.061	0.066	0.003	-0.057	0.092	0.119	0.068
Uttar Pradesh	0.076	0.081	0.047	0.026	0.036	0.069	0.011	0.058
Uttarakhand	-	-	-	-0.043	0.088	0.227	0.060	0.048
West Bengal	0.010	0.037	0.030	0.053	0.058	0.074	-0.022	0.075

Note: Data for the state Meghalaya, Nagaland and Uttar Pradesh are available from 1980-81; for Mizoram 1999-00 and Uttarakhand, data is from 1993-94

The trend in industrial sector: Indian states

After the agriculture sector, industry is the second most important sector in the Indian economy with higher GDP contribution, though employment share is less than that of agriculture sector. It is observed from (Table 2) that there is a huge inter-state disparity in terms of growth rate in industrial sector. Though, most of the states show a higher growth rate, in some states, a negative growth rate is also observed over Phase - 1 to Phase - 8. Most of the states show a higher growth rate in the last Phase, i.e., Phase - 8.

The trend in the service sector: Indian states

Since independence, the service sector has played a vital role in the Indian economy. Though the employment share to the total population in this sector is low but the income share to GDP is more than that of agriculture and industrial sector. Now-a-days, the share of employment in the service sector is also increasing day-by-day. Thus, (Table 3) presents the Compound Annual Growth Rate of the Service Sector from 1980 - 81 to 2019 - 20. As like the agriculture and industry sector, there is huge inter-state disparity among the states in case of the service sector. All the states have shown a positive growth rate except Assam in Phase - 2 and Tripura in Phase - 7. Most of the states show an increasing positive growth trend over time [14].

The trend in per capita NSDP: Indian states

Per capita NSDP is one of the important components of the country's economic growth. In the case of PCNSDP, there is huge inter-state disparity in India over time. Disparity level is more in the case of PCNSDP, than all the three sectors in the economy. As mentioned above in the introduction, after the economic reforms (1991), the disparity level is widened among the states. From (Table 4), it is clear that the compound annual growth rate of PCNSDP is very less or negative for most of the states in Phase - 1. In Phase - 2, 3, and 4, it is increasing for most of the states. In Phase - 5, except Kerala, Tamil Nadu, and

West Bengal, all the state's PCNSDP growth rate is degraded. In Phase - 6, the growth rate of PCNSDP is negative in case of Arunachal Pradesh. Most of the states have had an increasing growth rate in Phase - 7 & 8 [15].

Table 3 Compound annual growth rate of service sector (in Lakh)

States	Phase-1 1980-81 to 1984-85	Phase-2 1985-86 to 1989-90	Phase-3 1990-91 to 1994-95	Phase-4 1995-96 to 1999-00	Phase-5 2000-01 to 2004-05	Phase-6 2005-06 to 2009-10	Phase-7 2010-11 to 2014-15	Phase-8 2015-16 to 2019-20
Andhra Pradesh	0.033	0.064	0.052	0.065	0.050	0.039	0.055	0.057
Arunachal Pradesh	0.083	0.080	0.034	0.043	0.049	0.120	0.022	0.117
Assam	0.034	-0.024	0.008	0.091	0.033	0.055	0.056	0.130
Bihar	0.057	0.055	0.032	0.073	0.009	0.046	0.076	0.111
Goa	0.063	0.030	0.024	0.050	0.039	0.115	0.087	0.046
Gujrat	0.047	0.032	0.054	0.098	0.019	0.056	0.068	0.067
Haryana	0.048	0.044	0.032	0.057	0.045	0.122	0.070	0.065
Himachal Pradesh	0.028	0.095	0.025	0.120	0.028	0.076	0.080	0.069
Jammu & Kashmir	-	-	-	0.059	0.053	0.075	0.047	0.074
Karnataka	0.050	0.042	0.048	0.101	0.030	0.065	0.073	0.090
Kerala	0.019	0.014	0.039	0.061	0.034	0.088	0.020	0.076
Madhya Pradesh	0.052	0.045	0.028	0.080	0.014	0.068	0.044	0.073
Maharashtra	0.051	0.058	0.039	0.086	0.025	0.047	0.077	0.077
Manipur	0.060	0.050	0.040	0.076	0.002	0.046	0.123	0.060
Meghalaya	0.037	0.115	0.032	0.052	0.026	0.108	0.049	0.066
Mizoram	-	-	-	-	0.012	0.114	0.038	0.042
Nagaland	-	-	-	0.016	0.056	0.045	0.071	0.094
Odisha	0.027	0.069	0.066	0.094	0.040	0.076	0.002	0.078
Punjab	0.020	0.017	0.019	0.029	0.023	0.072	0.075	0.067
Rajasthan	0.032	0.114	0.059	0.076	0.001	0.098	0.056	0.093
Skim	-	-	-	0.131	0.040	0.088	0.011	0.032
Tamil Nadu	0.043	0.059	0.028	0.055	0.037	0.079	0.054	0.090
Tripura	0.077	0.148	0.082	0.085	0.074	0.055	-0.001	0.091
Uttar Pradesh	0.040	0.090	0.002	0.041	0.033	0.057	0.057	0.076
Uttarakhand	-	-	-	0.043	0.076	0.039	0.096	0.054
West Bengal	0.023	0.027	0.037	0.041	0.046	0.080	0.072	0.085

Note: Data for the state Meghalaya, Nagaland and Uttar Pradesh are available from 1980-81; for Mizoram 1999-00 and Uttarakhand, data is from 1993-94

Table 4 Compound annual growth rate of PCNSDP (in Lakh)

States	Phase-1 1980-81 to 1984-85	Phase-2 1985-86 to 1989-90	Phase-3 1990-91 to 1994-95	Phase-4 1995-96 to 1999-00	Phase-5 2000-01 to 2004-05	Phase-6 2005-06 to 2009-10	Phase-7 2010-11 to 2014-15	Phase-8 2015-16 to 2019-20
Andhra Pradesh	0.018	0.051	0.024	0.032	0.038	0.056	0.032	0.052
Arunachal Pradesh	0.043	0.022	0.035	-0.010	0.056	0.048	0.049	0.034
Assam	0.024	0.001	0.006	0.001	0.023	0.037	0.023	0.044
Bihar	0.032	0.008	-0.015	0.038	0.007	0.070	0.030	0.054
Goa	0.009	0.070	0.029	0.072	0.031	0.033	0.017	0.057
Gujrat	0.034	0.039	0.056	0.027	0.063	0.064	0.060	0.065
Haryana	0.012	0.024	0.009	0.029	0.047	0.063	0.047	0.050
Himachal Pradesh	-0.013	0.048	0.022	0.047	0.038	0.040	0.048	0.047
Jammu & Kashmir	0.007	-0.011	0.011	0.019	0.021	0.034	-0.001	0.032
Karnataka	0.029	0.046	0.041	0.055	0.027	0.049	0.036	0.058
Kerala	-0.005	0.025	0.045	0.033	0.049	0.059	0.039	0.044
Madhya Pradesh	-0.005	0.016	0.006	0.040	0.015	0.056	0.042	0.056
Maharashtra	0.010	0.048	0.037	0.029	0.040	0.059	0.035	0.044
Manipur	0.018	0.011	0.006	0.048	0.033	0.024	0.035	0.031
Meghalaya	0.004	0.025	-0.005	0.036	0.034	0.038	0.003	0.034
Mizoram	-	-	-	-	0.026	0.061	0.069	0.101
Nagaland	0.043	0.037	0.025	-0.020	0.019	0.042	0.037	0.046
Odisha	0.000	0.033	0.029	0.020	0.055	0.047	0.031	0.060
Punjab	0.028	0.028	0.017	0.026	0.014	0.047	0.030	0.035
Rajasthan	0.024	0.051	0.011	0.035	0.030	0.046	0.040	0.027
Skim	-	-	-	0.023	0.048	0.159	0.049	0.056
Tamil Nadu	0.033	0.031	0.048	0.037	0.025	0.068	0.042	0.058
Tripura	-0.007	0.049	0.013	0.069	0.058	0.061	0.079	0.078
Uttar Pradesh	0.012	0.030	0.002	0.015	0.014	0.040	0.023	0.038

Uttarakhand	-	-	-	0.003	0.055	0.099	0.052	0.045
West Bengal	0.013	0.016	0.034	0.045	0.036	0.046	0.017	0.046

Note: Data for the state Meghalaya, Nagaland and Uttar Pradesh are available from 1980-81; for Mizoram 1999-00 and Uttarakhand, data is from 1993-94

Sectoral performance and grouping of the states

The result of the K-means cluster analysis in the agriculture sector is presented in (Table 5). It is observed that in phase - 1, out of 21 states, eleven states belong to cluster 1, only one state i.e., AR in cluster 2 till phase - 5, and nine states are in cluster 3. In phase - 2, 11 states are in cluster 1, and nine are in cluster 3. Out of twenty-five states, ten states belong to cluster 1, and 14 states are in cluster 3 in phase - 3. In phase - 4, 13 states are in cluster 1, and 11 states are in cluster 3. In phase - 5, ten states are in cluster 1 and 14 in cluster 2. In phases - 6 & 7, ten states are in cluster 1, three are in cluster 2 and 12 are in cluster 3. Again, in the last phase, i.e., - 8, ten states are in cluster 1, seven in cluster 2 and eight in cluster 3. Thus, it is clearly observed that only AP, BH, HR, MP, RJ, TR, and UP belongs to the same cluster i.e., cluster 1 in the phase - 1 to 6. Again, in the last two phases, i.e., 7 & 8 AP, BH, HR, MN, UP, and WB, are in the same cluster (cluster 1). In all the phases, AR belongs to cluster 2. In the cluster 3, GA, KN, MH, and TN belong to the same cluster over all phases [16].

Table 5 K-means cluster analysis: Agriculture sector

Cluster	Phase-1	Phase-2	Phase-3	Phase-4	Phase-5	Phase-6	Phase-7	Phase-8
Cluster-1	AP, BH, GT, HR, HP, MP, OD, PN, RJ, TR, UP	AP, BH, HR, KR, MP, OD, PN, RJ, TR, UP, WB	AP, BH, HR, KR, MP, PN, RJ, TR, UP, WB	AP, AS, BH, HR, KR, MP, OD, PN, RJ, TR, UP, UT, WB	AP, BH, HR, MP, NG, PN, RJ, TR, UP, WB	AP, AS, BH, HR, MP, MN, RJ, TR, UP, WB	AP, AS, BH, HR, MN, PN, RJ, TR, UP, WB	AS, BH, HR, HP, JK, MN, ML, OD, UP, WB
Cluster-2	AR	AR	AR	AR	AR	AR, NG, PN	AR, MP, NG	AP, AR, MP, NG, PN, RJ, TR
Cluster-3	AS, GA, KN, KR, MH, MN, ML, TN, WB	AS, GA, GT, HP, KN, MH, MN, ML, TN	AS, GA, GT, HP, JK, KN, MH, MN, ML, NG, OD, SK, TN, UT	GA, GT, HP, JK, KN, MH, MN, ML, NG, SK, TN	AS, GA, GT, HP, JK, KN, KR, MH, MN, ML, OD, SK, TN, UT	GA, GT, HP, JK, KN, KR, MH, ML, OD, SK, TN, UT	GA, GT, HP, JK, KN, KR, MH, ML, OD, SK, TN, UT	GA, GT, KN, KR, MH, SK, TN, UT

Note: Data is not available for JK, NG, SK, UT; Andhra Pradesh (AP); Bihar (BH); Goa (GA); Gujarat (GT); Haryana (HR); Karnataka (KR); Kerala (KL); Madhya Pradesh (MP); Maharashtra (MH); Odisha (OD); Punjab (PN); Rajasthan (RJ); Tamil Nadu (TN); Uttar Pradesh (UP); West Bengal (WB); Arunachal Pradesh (AR); Assam (AS); Himachal Pradesh (HP); Jammu & Kashmir (JK); Manipur (MN), Meghalaya (ML); Mizoram (MZ); Nagaland (NG); Sikkim (SK); Tripura (TR); Uttarakhand (UT)

Source: Calculated based on Handbook of Statistics on State Government Finances, RBI & EPWRF

Table 6 K-means cluster analysis: Industry sector

Cluster	Phase-1	Phase-2	Phase-3	Phase-4	Phase-5	Phase-6	Phase-7	Phase-8
Cluster-1	AP, AS, BH, GT, HR, KN, KR, MP, OD, RJ, WB	AP, AS, BH, KN, KR, MP, OD, PN, RJ, UP, WB	GA	GA	GA	GA	GA, SK, UT	GA, GT, HP, SK, UT
Cluster-2	AR, HP, MN, ML, PN, TR, UP	AR, HP, MN, ML, TR	AP, AR, AS, BH, HP, JK, KR, MP, MN, ML, NG, OD, PN, RJ, SK, TR, UP, WB	AR, AS, BH, JK, MN, ML, NG, OD, PN, RJ, SK, TR	AP, AR, AS, BH, JK, KR, MP, MN, ML, NG, OD, PN, RJ, SK, TR, UP	AP, AR, AS, BH, JK, KR, MP, MN, NG, PN, RJ, SK, TR, UP, WB	AP, AR, AS BH, JK, KR, MP, MN, NG, PN, RJ, TR, UP, WB	AP, AR, BH, JK, KR, MP, MN, ML, NG, RJ, TR
Cluster-3	GA, MH, TN	GA, GT, HR, MH, TN	GT, HR, KN, MH, TN, UT	AP, GT, HR, HP, KN, KR, MP, MH, TN, UP, UT, WB	GT, HR, HP, KN, MH, TN, UT, WB	GT, HR, HP, KN, MH, ML, OD, TN, UT	GT, HR, HP, KN, MH, ML, OD, TN	AS, HR, KN, MH, OD, PN, TN, UP, WB

Note: Data are not available for JK, NG, SK, UT; Andhra Pradesh (AP); Bihar (BH); Goa (GA); Gujarat (GT); Haryana (HR); Karnataka (KR); Kerala (KL); Madhya Pradesh (MP); Maharashtra (MH); Odisha (OD); Punjab (PN); Rajasthan (RJ); Tamil Nadu (TN); Uttar Pradesh (UP); West Bengal (WB); Arunachal Pradesh (AR); Assam (AS); Himachal Pradesh (HP); Jammu & Kashmir (JK); Manipur (MN), Meghalaya (ML); Mizoram (MZ); Nagaland (NG); Sikkim (SK); Tripura (TR); Uttarakhand (UT)

Source: Calculated based on Handbook of Statistics on State Government Finances, RBI & EPWRF

The result of the K-means cluster analysis in the industry sector is presented in (Table 6). It is observed that in phase - 1, out of 21 states, eleven states belong to cluster 1, seven states are in cluster 2, and three states are in cluster 3. In phase - 2, 11 states are in cluster1, five are in cluster 2, and five are in cluster 3. Out of 25 states in phase - 3, 18 states belong to cluster 2, six states are in cluster 3, and one state, i.e., GA, belongs to cluster 1 in phase - 3 to 6. In phase - 4, 12 states are in cluster 2 and

12 are in cluster 3. Sixteen states are in cluster 2 and eight states are in cluster 3 in phase - 5. In phase - 6, 15 states are in cluster 2, and nine states are in cluster 3. In phase - 7, three states are in cluster 1, 14 states in cluster 2 and eight in cluster 3. Five states are in cluster 1, 11 are in cluster 2 and nine are in cluster 3 in phase - 8. Thus, it is clearly observed that only AR, BH, MN, NG, RJ, and TR tend to convergence as all these states belong to the same cluster, i.e., cluster 2 from phase - 3 to 8.

The (Table 7) presents the K-means Cluster analysis result in the service sector to check the tendency of convergence. It is observed that in phase - 1, out of twenty-one states, only three states belong to cluster 1, five states are in cluster 2, and 13 states are in cluster 3. In phase - 2, only two states are in cluster 1, five states are in cluster 2, and 14 are in cluster 3. Whereas, three states belong to cluster 1, five states are in cluster 2 and 17 in cluster 3 for phase - 3. In phase - 4, six states are in cluster 1, only one state belongs to cluster 2, and 18 states are in cluster 3. In phase - 5, 18 states are in cluster 1, six are in cluster 2, and only one is in cluster 3. In phase - 6, nine states are in cluster 1, five are in cluster 2, and 11 are in cluster 3. Again, in phase - 7, eleven states are in cluster 1, four in cluster 2, and ten in cluster 3. In the last phase - 8, ten states belong to cluster 1, four are in cluster 2, and 11 are in cluster 3. Thus, it is clearly observed that only GA, GT, HR, KN, MP, MH, and UP belong to the same cluster, i.e., cluster 1 in the phase - 5 to 8. Again, in cluster 3, AP, AS, and HP are the three states belonging to the same cluster over all phases [17].

Table 7 K-Means cluster analysis: Service sector

Cluster	Phase-1	Phase-2	Phase-3	Phase-4	Phase-5	Phase-6	Phase-7	Phase-8
Cluster-1	KR, MN, PN	KR, MN	BH, KR, PN	AR, BH, KR, MN, NG, TR	AP, AS, GA, GT, HR, HP, JK, KN, MP, MH, ML, OD, PN, RJ, TN, UP, UT, WB	GA, GT, HR, KN, MP, MH, ML, UP, WB	GA, GT, HR, KN, MP, MH, RJ, TN, UP, UT, WB	GA, GT, HR, KN, MP, MH, OD, RJ, UP, UT
Cluster-2	AR, BH, TN, TR, WB	AR, BH, PN, TN, TR	AR, MN, NG, SK, TR	SK	AR, BH, KR, MN, NG, TR	AR, MN, NG, SK, TR	AR, MN, NG, TR	AR, BH, MN, NG
Cluster-3	AP AS, GA, GT, HR, HP, KN, MP, MH, ML, OD, RJ, UP	AP, AS, GA, GT, HR, HP, KN, MP, MH, ML, OD, RJ, UP, WB	AP, AS, GA, GT, HR, HP, JK, KN, MP, MH, ML, OD, RJ, TN, UP, UT, WB	AP, AS, GA, GT, HR, HP, JK, KN, MP, MH, ML, OD, PN, RJ, TN, UP, UT, WB	SK	AP, AS, BH, HP, JK, KR, OD, PN, RJ, TN, UT	AP, AS, BH, HP, JK, KR, ML, OD, PN, SK	AP, AS, HP, JK, KR, ML, PN, SK, TN, TR, WB

Note: Data are not available for JK, NG, SK, UT; Andhra Pradesh (AP); Bihar (BH); Goa (GA); Gujarat (GT); Haryana (HR); Karnataka (KR); Kerala (KL); Madhya Pradesh (MP); Maharashtra (MH); Odisha (OD); Punjab (PN); Rajasthan (RJ); Tamil Nadu (TN); Uttar Pradesh (UP); West Bengal (WB); Arunachal Pradesh (AR); Assam (AS); Himachal Pradesh (HP); Jammu & Kashmir (JK); Manipur (MN), Meghalaya (ML); Mizoram (MZ); Nagaland (NG); Sikkim (SK); Tripura (TR); Uttarakhand (UT)

Source: Calculated based on Handbook of Statistics on State Government Finances, RBI & EPWRF

Table 8 K-means cluster analysis: PCNSDP

Cluster	Phase-1	Phase-2	Phase-3	Phase-4	Phase-5	Phase-6	Phase-7	Phase-8
Cluster-1	AP, AR, BH, GT, MP, MN, ML, OD, RJ, TN, TR, UP, WB	AR, AS, HR, HP, JK, KN, KR, MH, NG, PN	AP, AS, BH, MP, MN, ML, OD, RJ, TR, UP, WB	AR, GT, HR, HP, JK, KN, KR, MH, PN, SK, TN	AS, BH, JK, MP, MN, ML, NG, OD, RJ, TR, UP, WB	AS, BH, JK, MP, MN, ML, NG, OD, RJ, TR, UP, WB	AP, AS, BH, JK, MP, MN, ML, NG, OD, RJ, TR, UP, WB	AP, GT, HR, HP, KN, KR, MH, PN, SK, TN, UT
Cluster-2	AS, HR, HP, JK, KN, KR, MH, NG, PN	GA	GA	GA	AP, AR, GT, HR, HP, KN, KR, MH, PN, SK, TN, UT	AP, AR, GT, HR, HP, KN, KR, MH, PN, SK, TN, UT	AR, GT, HR, HP, KN, KR, MH, PN, SK, TN, UT	AR, AS, BH, JK, MP, MN, ML, NG, OD, RJ, TR, UP, WB
Cluster-3	GA	AP, BH, GT, MP, MN, ML, OD, RJ, TN, TR, UP, WB	AR, GT, HR, HP, JK, KN, KR, MH, NG, PN, SK, TN, UT	AP, AS, BH, MP, MN, ML, NG, OD, RJ, TR, UP, UT, WB	GA	GA	GA	GA

Note: Data are not available for SK, UT; Andhra Pradesh (AP); Bihar (BH); Goa (GA); Gujarat (GT); Haryana (HR); Karnataka (KR); Kerala (KL); Madhya Pradesh (MP); Maharashtra (MH); Odisha (OD); Punjab (PN); Rajasthan (RJ); Tamil Nadu (TN); Uttar Pradesh (UP); West Bengal (WB); Arunachal Pradesh (AR); Assam (AS); Himachal Pradesh (HP); Jammu & Kashmir (JK); Manipur (MN), Meghalaya (ML); Mizoram (MZ); Nagaland (NG); Sikkim (SK); Tripura (TR); Uttarakhand (UT)

Source: Calculated based on Handbook of Statistics on State Government Finances, RBI & EPWRF

The result of K-means Cluster analysis in PCNSDP is presented in (Table 8). It is observed that in phase - 1, out of 23 states, thirteen states belong to cluster 1, nine states are in cluster 2, and only one state is in cluster 3. In phase - 2, ten states are in cluster 1, i.e., GA which belongs to cluster 2 in the three phases - 2, 3 & 4, and 12 states are in cluster 3. Out of twenty-five states, 11 states belong to cluster 1, and 13 states are in cluster 3 in phase – 3 & 4. In phase - 5 & 6, twelve states

are in cluster 1, 12 are in cluster 2, and one i.e., GA belongs to cluster 3. In phase - 7, 13 states are in cluster 1 and 11 in cluster 2. In phase - 7, thirteen states are in cluster 1, and eleven are in cluster 2, and one state i.e., GA is in cluster 3. Again, in the last phase - 8, eleven states are in cluster 1, 13 states in cluster 2 and GA belongs to cluster 3. Thus, it is clearly observed that there is a tendency of divergence among the states. Only ten states, namely, BH, JK, MP, MN, ML, NG, OD, RJ, TR, and UP, tend to converge to some extent belonging to the same cluster, i.e., cluster 1 in the phases - 5 to 8.

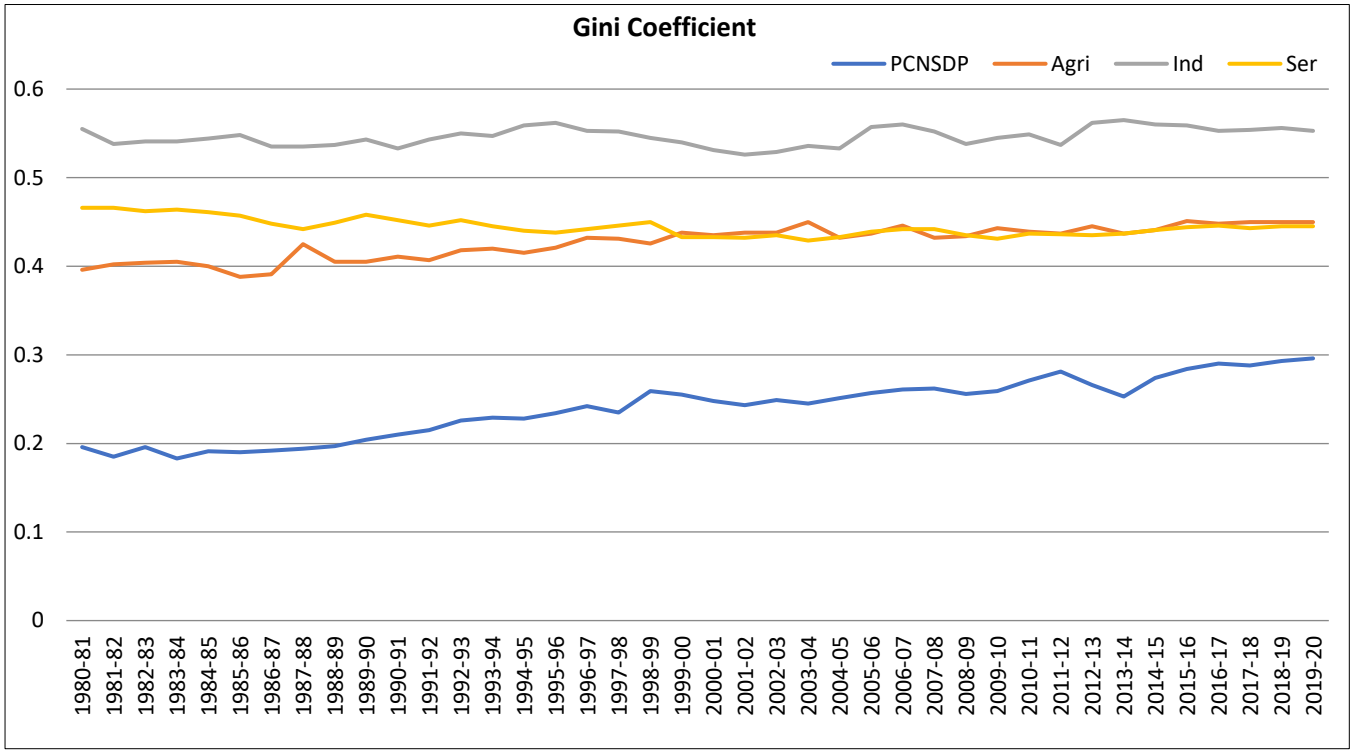

Fig 1 Measuring inequality: Gini Coefficient

Notes: (In case of PCNSDPfor the states MZ, SK and UT; in case of Agri, Ind and Ser the states JK, MZ, NG, SK, UT)
Source: Based on EPWRF data

Trends of inequality for the Indian states

There has been a high inter-state disparity among the states in India since independence. It is clear from the above discussion that the disparity level has been increasing after the economic reforms. So, it is important to measure regional inequality over time. Thus, the results of the Gini Coefficient (Fig 1) clearly demonstrate that inequality among the states in terms of industry and service sectors performance remains more or less stagnant. Whereas, inequality has been rising over time in case of the performance of agriculture and PCNSDP. Thus, it seems that growing inequality in agricultural performance among the states is leading to increasing economic inequality for states. This may happen as agriculture is still happened to be the prominent economic activities for most of the states.

CONCLUSION

The present study has gone for the trend analysis of growth rate in terms of PCNSDP and the three sectors of the economy. It is found that there has been huge inter-state disparity in terms of PCNSDP and also in terms of sectoral performance of the economy over time. Steady progress towards the trend is observed for the high performing states (like GA, GT, WB, HR etc.) whereas there is more volatility in the low-performing states. With the help of K-means cluster analysis, states were grouped in the three clusters over the eight phases. There is less tendency of convergence across the states over time. Only five or six states have shown the tendency of convergence across all the three sectors and in the PCNSD Pover time. Moreover, the Gini coefficient has been used to measure inequality among the states. It is observed that inequality among the states in terms of industry and service sectors' performance remains to be more or less stagnant, whereas inequality has been rising over time in case of the performance of agriculture and PCNSDP. It implies that growing inequality in agricultural performance among the states is leading to increasing economic inequality for states. Thus, the agriculture sector calls for particular policy intervention and improvements to reduce the economic disparity among the states.

LITERATURE CITED

1. Bhalla, SG, Singh G. 2010. Economic liberalization and Indian agriculture: a state-wise analysis. *Economic and Political Weekly* 44(52): 34-44.
2. Chand R, Raju SS, Pandey LM. 2007. Growth crisis in agriculture: severity and options at national and state levels. *Economic and Political Weekly* 42(26): 2528-2533.
3. Chatterjee T. 2016. Spatial convergence and growth in Indian agriculture: 1967–2010. *Journal of Quant. Economics* 15(1): 121-149.
4. Ghosh M. 2006. Regional convergence in Indian agriculture. *Ind. Jr. of Agri. Econ.* 61(4): 610-629.

5. Ghosh M. 2008. Economic reforms, growth and regional divergence in India. *The Journal of Applied Economic Research* 2(3): 265-285.
6. Ghosh M. 2010. Structural breaks and performance in Indian agriculture. *Ind. Jr. of Agri. Econ*. 65(1): 59-79.
7. Ghosh M, Ghoshray A, Malki I. 2013. Regional divergence and club convergence in India. *Economic Modelling* 30: 733-742.
8. Kumar S, Lala AK, Chaudhary RK. 2014. Agricultural growth and economic convergence in Indian agriculture. *Ind. Jr. of Agri. Econ*. 69(2): 211-228.
9. Mukherjee NA, Kuroda Y. 2003. Productivity growth in Indian agriculture: is there evidence of convergence across states? *Agricultural Economics* 29: 43-53.
10. Reddy AA, Reddy GP, Radhika Rani Ch, Reddy AN, Bantilan C. 2014. Regional disparities in rural and agricultural development in undivided Andhra Pradesh, India. Working Paper Series No. 47. Patancheru- 502 324, Telangana, India: International Crops Research Institute for the Semi-Arid Tropics. pp 48.
11. Bhalla GS, Singh G. 2009. Economic liberalization and Indian agriculture: A State wise Analysis. *Economic and Political Weekly* 46: 34-44.
12. Ghosh BK. 2010. Growth and variability in the production of crops in West Bengal Agriculture. *Trends in Agricultural Economics* 3: 135-146.
13. Kumara A, Singhb KM, Sinhac S. 2010. Institutional credit to agriculture sector in India: Status, performance and determinants. *Agricultural Economics Research Review* 23: 253-264.
14. Ghosh M. 2012. Regional economic growth and inequality in India during the pre- and post-reform periods. *Oxford Development Studies* 40(2): 190-212.
15. Ahluwalia MS. 2000. Economic performance of states in post-reforms period. *Economic and Political Weekly* 35(19): 1637-1648.
16. Baddeley M, Mcnay K, Cassen R. 2006. Divergence in India: Income differentials at the state level. *Journal of Development Studies* 42(6): 1000-1022.
17. Bhattacharya BB, Sakthivel S. 2004. Regional growth and disparity in India: comparison of pre- and post-reform decades. *Economic and Political Weekly* 39(10): 1071-1077.