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Performance of Manufacturing Industries: Interstate Disparities in India

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Abstract

In this paper, empirical analyses have been made on interstate disparity with respect to performance of manufacturing industries in Indian states based on 2-digit level ASI data (1987 classification) in the factory sector over a period from 1981 to 1998. A cluster development exercise clearly distinguishes the good and bad performing states during the selected time period. Empirical findings of the study reveal that the Central Government's plan for removing interstate disparity by implementing various measures have not been successful.

1. Introduction

1.1 Industry, the key sector of an economy, is often said to have served as an engine of growth. In the literature on growth and development, economists established the relationship between industrial growth and overall growth of the economy of a country. Growth laws of Nicholas Kaldor (1958) which were widely tested in developed and developing countries using both cross-section and time series data have shown a strong positive correlation between growth of manufacturing output and growth of GDP. Regional imbalance in industrial growth adversely affects the overall growth trajectory of an economy. This is why development strategies focus on rapid industrialization. But then, industrialization never proceeds independently of the specific institutional and historical context (Morris and Adelman, 1988; Zysman, 1994). Industrial growth rates depend mostly on the forms of government intervention both at state and central level. Again, satisfactory growth of manufacturing output in a state does not necessarily mean that the state has reaped the benefits of industrial development. When rate of investment serves as a positive catalyst to the growth of industrial output and the process generates sufficient scope for employment, then the state may be said to have reaped the benefit of industrial development. Since independence the primary objective of planned industrial development, is to simultaneously increase the growth rate of industrial output and reduce regional disparities. However, the widening gap in SDP across the states raises questions on the achievement of such goals.

1.2 So far, the strategic planning for development appears to be inadequate for addressing the problems of disparity amongst the Indian states. There are several studies on the growth and interstate disparities with respect to state domestic product (SDP) and various other human development indices (Marjit and Mitra, 1996; Rao and others, 1999; Maity, Dasgupta, Mukherjee and others, 2000; Singh, Bhandari and Others, 2003; Bhattacharya, Sakthivel, 2004). There are papers addressing the performance of industry groups at all India level under varying trade regimes and during varying periods

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(Ahluwalia, 1985, 1991; Goldar, 1986; Balakrishnan and Suresh Babu, 2003; Siddharthan and Lal 2003; Das, 2004 and Others). Some others analysed the performance of northern states with reference to SDP (Joseph, 2004). The economy of West Bengal with respect to various parameters was also studied (Khasnobis, 2008). No empirical analyses have, however, been made on interstate disparities with respect to performance of manufacturing industries.

1.3 This paper makes an attempt to investigate this unaddressed issue by empirical analysis based on 2-digit level ASI data (1987 classification) on the factory sector. We begin our study by selecting major industrial states of India. We then proceed to check whether there exists some sort of homogeneity or heterogeneity amongst the major Indian states with reference to performance of manufacturing industries based on commonly used productivity measures, namely, factory productivity (value of output per factory, FP), material productivity (ex-factory value of products and by-products per unit of input, MP), labour productivity (value of output per worker, LP) and capital productivity (value of output per unit of invested capital, CP). These analyses are performed with reference to convergence and divergence hypothesis.

1.4 We submit that we have not addressed a few important issues in this paper. First, impact of the policy approach adopted by the individual state governments on the performance of industries in the respective states. Second, detailed organization of specific industries and their role in determining the nature of performance and third, macroeconomic aspects of industrial behaviour. The study covers the period from 1981 to 1998. Rationale is to evaluate performance of major states in India for a decade before and almost a decade after 1991 when economic reforms were introduced. It appears that measures taken and industrial policies adopted by the Central government from time to time has not been effective in doing away with interstate disparity with respect to industrial performance of Indian states.

2. Data Used in This Study

2.1 We develop our exercise based on the ASI data of the factory sector. Productivity measures have been derived from ASI-given categories, such as, value of output, value of input, invested capital, ex-factory value of products and by-products, number of factories and number of workers etc. All the variables except the number of workers and factories are deflated by WPI with 1981 as the base year. There are, however, certain limitations while directly using WPI as the deflator. As for classification of industries, ASI follows the NIC, which is based on nature of activities. These activities range from manufacturing to processing/repairing services, whereas WPI is constructed with a view to capturing price movements based on nature of commodities and final demand. In a nutshell, while the ASI classification is based on activities, the WPI is based on nature of commodities. Identifying the nature of commodities grouped under the ASI activity based classification is difficult, if not impossible. This problem is more severe at three digit level. At best, one can approximate commodities based on the nature of economic activities which prompted us to use the WPI only. This is one of the limitations of this study. The ASI data for 18 successive years indicate that there are 14 major states in India that account for more than 90% to the total value of output, invested capital and

number of workers. These states are: West Bengal, Bihar, Orissa, Maharashtra, Tamilnadu, Kerala, Karnataka, Gujarat, Punjab, Haryana, Rajasthan, Andhra Pradesh (AP), Madhya Pradesh (MP) and Uttar Pradesh (UP). We felt that the importance of a particular state in India with respect to its industrial performance can best be captured in terms of these three parameters.

3. Analysis of Growth and Dispersion

3.1 Apparently, there exists heterogeneity in performance of the major states with respect to their industrial performance. If one looks at the contribution of 14 major states in the total value of output of the country (Table 1) over the reference period (1981-1998) and yearwise ranking (Table 2) of the states (highest rank is one and lowest rank is 14) on the basis of percentage share in the value of output of manufacturing industries, heterogeneity amongst the 14 major states would be evident.

3.2 Some states consistently held high rank whereas some other states consistently held low rank (Table 2). Some states whose ranks were in the median level in the beginning of the period shifted their position over the years. This strengthens our *prima-facie* opinion about the heterogeneity amongst the Indian states. But then, such presumption has to be vindicated by a statistical analysis, namely, sigma (σ) and beta (β) convergence and divergence analysis. The concept of σ convergence focuses attention on the dispersion of the value of the parameters in question over a cross section of some comparable units (in our case, 14 major states in India) over a period of time. The units are said to satisfy the condition of σ convergence if the dispersion decreases over time. The reverse pattern would imply the existence of σ divergence among the comparable units. The concept of β convergence is different. β convergence is said to exist when there is negative relationship between the rates of growth enjoyed by a cross section of comparable units and the level of their selected parameters at a given initial point of time. In case the slope is positive, it would indicate β divergence.

3.3 In our study, selected parameters are four productivity measures, namely, factory productivity (FP), material productivity (MP), labour productivity (LP) and capital productivity (CP). The summary results of σ and β convergence analyses are given in Table 3.

3.4 The result that emerges from σ convergence analysis is that the 14 representative states in India diverged from one another in terms of FP and LP. The reasons for σ divergence in terms of FP is mainly due to number of factories in the Indian states has significantly diverged over the reference period; the states having less number of factories in the initial year (1981) could not catch up the pace of growth in the number of factories in the states having more number of factories in 1981. σ divergence in terms of LP is mainly due to both value of output and number of workers diverging over the reference period. In terms of other two productivity measures, namely, CP and MP, they converge to each other. The flipside is that the estimated co-efficients are not statistically significant with respect to the three parameters, namely, MP, LP and CP (level of significance and adjusted R^2 being poor). The scenario is, however, different with respect

to another parameter, namely, FP in which case there is no statistical evidence in favour of the hypothesis that the CV was declining over time. A deeper look into the results of σ convergence analyses would indicate that 14 major states in India though technically converging with each other with respect to MP and CP, the co-efficients are so insignificant that would seem not to converge over a period of 18 years.

3.5 Results of β convergence as given in Table 3 indicate that there is a (weak) tendency of β convergence in the states with respect to all the four parameters, namely, FP, MP, LP and CP. The year 1981 may be a weak indicator of initial conditions in the sense that a state might not be performing well in 1981. As such, the results of β convergence analyses may not be a full proof one. In order to avoid such bias, we have considered mean of the parameters for the first five years as the benchmark value for each of the productivity measures. We then performed an alternative exercise. The results of such an alternative β convergence analysis also indicate a case of weak β convergence with respect to FP, MP and CP and very weak divergence with respect to LP. This might be due to wide divergence in growth rates among two distinct groups - slow growing states and the fast growing states with respect to three out of four selected parameters. The rest of the major states might have concentrated at the median level which is why overall β_1 is insignificant. Even if they have improved their performance, the gap between these two groups in terms of industrial performance did not significantly come closer to each other over time. However, this phenomenon appears to remain concentrated in only a select set of states which is why the overall pace of convergence was found to be weak in the selected group of 14 states in India. In any case, the analysis that we have so far performed does not provide us a robust support in favour of the argument that there exists heterogeneity or homogeneity amongst the major Indian states with reference to the selected parameters. This might be due to existence of a strong cluster at the median level. A disaggregated analysis might lay bare the underlying scenario in a better way.

3.6 The analyses we propose to perform now are: rank analysis, scatter plot and cluster analysis. Table 4 summarises the mean and Coefficient of Variation (CV) of the four selected parameters. Ranks of 14 major states with respect to mean and CV for each parameter are calculated based on the data given in Table 4. We then constructed a scatter plot with respect to the 14 representative states with average rank score with respect to a chosen parameter on the horizontal axis and rank in terms of the measure of volatility (i.e., CV) on the vertical axis. The idea was to analyse performance of any state simultaneously in terms of a score on individual value of a parameter and the associated dispersion of the concerned parameter. The states placed in A_1 quadrant are consistently good performer (high value of mean with low value of CV). States placed in A_2 are inconsistently good performer (high value of mean with high CV). States placed in A_3 are consistently bad performer (low value of mean with low CV). States placed in A_4 are inconsistently bad performer (low value of mean with high CV).

3.7 The scatter plots for four parameters are shown in Table 5, 6, 7 and 8. Summary results of scatter plot analysis are given in Table 9. As we get from Table 4 to 8, performance of 14 major states for a period of 18 years in terms of four selected parameters had been fluctuating. However, there are states like Maharashtra, Madhya

Pradesh, Haryana and Bihar in which the overall performance appears to be relatively good. There are states like Andhra Pradesh, Kerala, Punjab and Rajasthan in which the overall performance is relatively bad. Summary results of scatter plot analyses (Table 9) indicate that Indian states are scattered with respect to FP, MP and LP. However, with respect to CP, almost equal number of states is either consistently good performing or bad performing. This is not the scenario with respect to other three parameters. For example, Bihar is consistently good performing state with respect to LP and FP. Haryana is a consistently good performing state with respect to CP and LP. Maharashtra is a consistently good performing state with respect to CP and FP. Tamilnadu and Karnataka are consistently good performing state with respect to CP and MP. Gujarat, Punjab and Kerala is consistently good performing state with respect to CP. Rajasthan has shown good performance consistently with respect to MP only. On the other hand, Uttar Pradesh is consistently bad performing state with respect to three parameters, namely, LP, CP and FP out of four selected parameters. Andhra Pradesh had been consistently bad performer with respect to CP and MP. Karnataka had been consistently bad performer with respect to LP and FP. To sum up, we obtained two important findings. First, behaviour of the states is heterogeneous with respect to the selected four parameters. This strengthens our observations derived from the results of convergence analysis. Second, following the scatter plot, 14 major states of India can be broadly classified into two categories , namely, good performer (i.e., those placed in A_1 and A_2) and bad performer (i.e., those placed in A_3 and A_4). But validity of such observations can be strengthened from the results of cluster analysis that we propose to perform next.

4. Cluster Analysis

4.1 The act of segregating units into two heterogeneous groups (namely, 'good performing' and 'bad performing') can be performed by the standard statistical method of cluster analysis. Our purpose is to check whether the status of states ('good performing' and 'bad performing') as identified by the rank and scatter plot analysis remains unaltered when the exercise is performed in terms of the cluster analysis. We performed this analysis with one of the non-hierarchical clustering techniques, namely, K-means method. Under this method, an object is assigned to a cluster for which its distance (Euclidean distance) to the cluster mean is the smallest. Average of each of the three productivity measures, namely, LP, CP and MP over 18 years time period were calculated for each of the 14 major states. These were considered as variables for clustering the major states in India[2].

4.2 The database used for forming the two clusters are given in Table 10. The results of the exercise are reported in Table 11 and Table 12. The results of the cluster analysis indicate that 14 major states could be divided into two clusters – cluster 1 (bad performing) and cluster 2 (good performing). There were five states in cluster 1 and nine states in cluster 2. As the average value of centorid of cluster 2 (1.77) is more than average value of

[2] We have not considered FP as one of the variables in cluster analysis. Higher average value of FP compared to average value of other three parameters would have given biased result. the problem could have been avoided by standarisation of variables. But then, that often disturbs the natural relationship between the variables. Moreover, the data is not very large in our case and our object was to have two clusters.

centroid of cluster 1 (1.51), we can say that five states in cluster 1, namely, West Bengal, Andhra Pradesh, Kerala, Karnataka and Tamilnadu are 'bad performing' states and other nine states, namely, Bihar, Orissa, Maharashtra, Madhya Pradesh, Uttar Pradesh, Punjab, Haryana, Gujarat and Rajasthan in cluster 2 are 'good performing' states. We analysed the output data further and observed that amongst the five 'bad performing' states, average value of the three parameters for the three states, namely, Andhra Pradesh (1.31), West Bengal (1.40) and Kerala (1.53) is much less than that of other two states, namely, Karnataka and Tamilndau. These must be the worst of the cluster of 'bad performing' states. On similar counts, Maharashtra, Gujarat and Haryana are the best of the 'good performing' states. The results that we obtain from the cluster analysis almost match the outcome of our earlier analyses, namely, rank analysis and scatter plot analyses.

5. Conclusion

5.1 We have been able to show that there exists heterogeneity in the major Indian states with respect to performance of manufacturing industries. We have also segregated these states into two groups, namely 'good performing' states and 'bad performing' states. As one knows, justifying the divergence and convergence amongst the Indian states with respect to their industrial performance involves exhaustive analysis of performance of major industries in the respective state at disaggregate level. The present study is, needless to say, limited in scope especially since the primary focus is on 2-digit level ASI data (1987 classification) on the factory sector. Further research is needed to know the reasons for some states performing well and some other states performing badly.

Table 1: Average Percentage Share in the Total Value of Output of the Country

Major States	Avg % share in value of output	Minimum share		Maximum share	
		%	Year	%	Year
Maharashtra	21.79	19.76	1991-92	23.50	1980-81
Gujarat	11.40	10.20	1990-91	12.87	1997-98
Tamilnadu	10.47	8.44	1992-93	11.64	1994-95
Uttar Pradesh	8.59	6.16	1980-81	9.75	1990-91
West Bengal	6.76	4.68	1995-96	9.77	1980-81
Andhra Pradesh	6.20	4.74	1980-81	7.26	1994-95
Madhya Pradesh	5.11	4.00	1980-81	6.24	1995-96
Bihar	4.91	3.29	1995-96	6.35	1982-83
Karnataka	4.45	4.01	1985-86	5.17	1997-98
Punjab	4.34	3.88	1997-98	5.28	1989-90
Haryana	3.36	1.58	1991-92	4.23	1996-97
Rajasthan	3.03	2.43	1984-85 and 1982-83	3.50	1996-97
Kerala	2.63	1.81	1994-95	3.41	1980-81
Orissa	1.84	1.45	1982-83	2.36	1988-89

Table 2: Yearwise Ranking of Major States Over 18 Years Period With Respect to Percentage Share in Value of Output

Major States	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Maharashtra	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gujarat	2	2	2	2	2	2	2	2	2	2	3	3	2	2	3	2	2	2
Tamilnadu	3	3	3	3	3	3	3	3	3	3	2	2	4	3	2	3	3	3
Uttar Pradesh	5	5	5	5	4	5	4	4	4	4	4	4	3	4	4	4	4	4
West Bengal	4	4	4	4	5	4	5	5	5	5	6	6	7	7	7	7	8	8
Andhra Pradesh	7	7	7	7	6	6	6	6	6	6	5	5	5	5	5	5	5	5
Madhya Pradesh	10	9	8	8	8	8	8	8	8	7	7	7	6	6	6	6	6	6
Bihar	6	6	6	6	7	7	7	7	7	9	8	9	10	8	11	12	11	11
Karnataka	8	10	9	9	9	10	10	10	10	10	10	8	8	10	8	8	7	7
Punjab	9	8	10	10	10	9	9	9	9	8	9	10	9	9	9	10	10	10
Haryana	12	12	11	11	11	11	11	11	11	11	11	14	11	11	10	9	9	9
Rajasthan	13	13	13	12	12.5	12	12	12	12	12	12	11	12	12.5	12	11	12	12
Kerala	11	11	12	13	12.5	13	13	13	13	13	13	12	13	12.5	14	13	13	13
Orissa	14	14	14	14	14	14	14	14	14	14	14	13	14	14	13	14	14	14

Table 3: Summary Results of Test of σ and β Convergence among Representative States According to Selected Parameters

	Sigma convergence		Beta convergence			
Productivity ratios	Co-eff.	C/D	Co-eff. (with 1981 as base year)	C/D	Co-eff. (with 5 yrs avg as base year)	C/D
FP	+0.004 (0.004)	D	-0.356 (0.144)	C	-0.113 (0.587)	C
MP	-0.001 (0.689)	C	-0.015 (0.42)	C	-0.005 (0.726)	C
LP	+0.002 (0.14)	D	-0.01 (0.77)	C	+0.0003 (0.99)	D
CP	-0.0016 (0.22)	C	-0.0265 (0.065)	C	-0.028 (0.077)	C

Notes: 'C' means Convergence and 'D' means Divergence. Figures in parenthesis show the F value

Table 4: Mean and CVs of Selected Parameters of Representative States and All States in India

Major States	FP		MP		LP		CP	
	Mean	CV	Mean	CV	Mean	CV	Mean	CV
West Bengal	147.28	0.17	1.56	0.03	1.39	0.25	1.24	0.16
Bihar	172.00	0.32	1.80	0.06	2.42	0.32	1.04	0.17
Orissa	166.93	0.41	1.93	0.14	2.07	0.36	0.75	0.11
Maharashtra	178.14	0.29	1.51	0.02	3.20	0.36	1.67	0.05
Madhya Pradesh	191.12	0.44	1.76	0.06	2.53	0.41	1.02	0.21
Andhra Pradesh	58.76	0.33	1.51	0.07	1.21	0.32	1.21	0.15
Uttar Pradesh	129.97	0.36	1.49	0.03	2.05	0.47	1.14	0.15
Tamilnadu	96.95	0.22	1.54	0.04	1.81	0.26	1.60	0.06
Gujarat	137.03	0.37	1.48	0.05	2.77	0.40	1.54	0.11
Haryana	148.46	0.44	1.34	0.25	2.64	0.34	1.63	0.13
Punjab	98.64	0.33	1.41	0.03	2.06	0.24	1.42	0.07
Rajasthan	118.90	0.29	1.53	0.04	2.30	0.43	1.20	0.18
Karnataka	105.92	0.42	1.60	0.02	1.90	0.37	1.44	0.10
Kerala	97.14	0.22	1.44	0.06	1.56	0.35	1.60	0.13
All India	**122.63**	**0.30**	**1.53**	**0.02**	**2.12**	**0.34**	**1.36**	**0.03**

Table 5: Scatter Plot with Respect to Factory Productivity (FP)

Major States	Rank (Mean)	Rank (CV)
West Bengal	6	1
Bihar	3	6
Orissa	4	11
Maharashtra	2	4.5
Madhya Pradesh	1	13.5
Andhra Pradesh	14	7.5
Uttar Pradesh	8	9
Punjab	11	7.5
Haryana	5	13.5
Gujarat	7	10
Rajasthan	9	4.5
Kerala	12	2.5
Karnataka	10	12
Tamilnadu	13	2.5

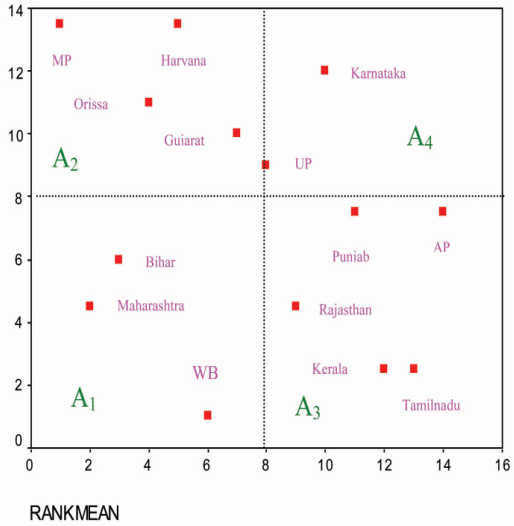

Table 6: Scatter Plot with Respect to Material Productivity (MP)

Major States	Rank (Mean)	Rank (CV)
West Bengal	5	4
Bihar	2	10
Orissa	1	13
Maharashtra	8.5	1.5
Madhya Pradesh	3	10
Andhra Pradesh	8.5	12
Uttar Pradesh	10	4
Punjab	13	4
Haryana	14	14
Gujarat	11	8
Rajasthan	7	6.5
Kerala	12	10
Karnataka	4	1.5
Tamilnadu	6	6.5

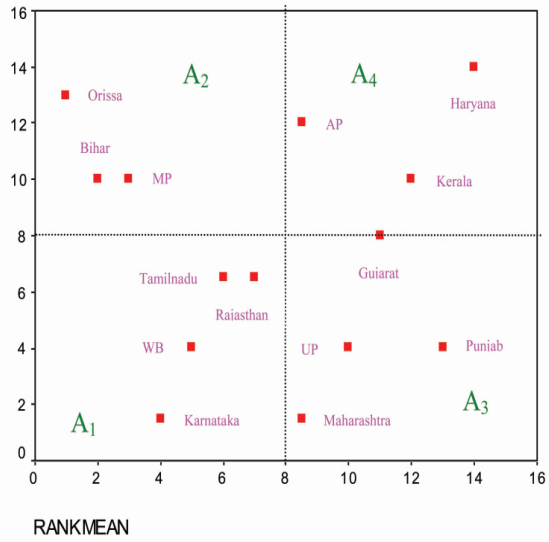

Table 7: Scatter Plot with Respect to Labour Productivity (LP)

Major States	Rank (Mean)	Rank (CV)
West Bengal	13	2
Bihar	5	4.5
Orissa	7	8.5
Maharashtra	1	8.5
Madhya Pradesh	4	12
Andhra Pradesh	14	4.5
Uttar Pradesh	9	14
Punjab	8	1
Haryana	3	6
Gujarat	2	11
Rajasthan	6	13
Kerala	12	7
Karnataka	10	10
Tamilnadu	11	3

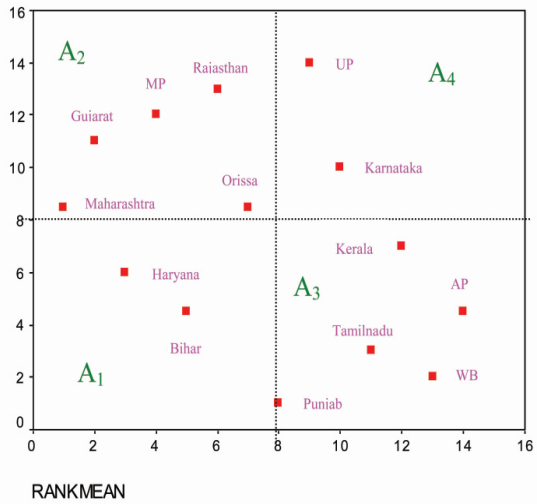

Table 8: Scatter Plot with Respect Capital Productivity (CP)

Major States	Rank (Mean)	Rank (CV)
West Bengal	8	11
Bihar	12	12
Orissa	14	5.5
Maharashtra	1	1
Madhya Pradesh	13	14
Andhra Pradesh	9	9.5
Uttar Pradesh	11	9.5
Punjab	7	3
Haryana	2	7.5
Gujarat	5	5.5
Rajasthan	10	13
Kerala	3.5	7.5
Karnataka	6	4
Tamilnadu	3.5	2

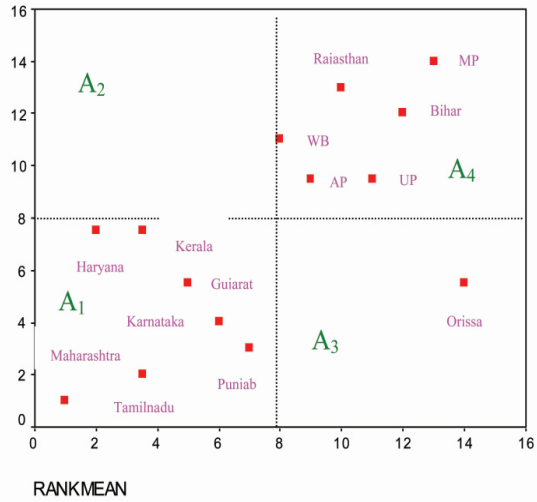

Table 9: Summary Results of Scatter Plot

	A_1	A_2	A_3	A_4
FP	Bihar, Maharashtra, West Bengal	MP, Haryana, Orissa, Gujarat	AP, Rajasthan, Kerala, Tamilnadu, Punjab	Karnataka, UP
MP	West Bengal, Tamilnadu, Rajasthan, Karnataka	Orissa, Bihar, MP	UP, Punjab, Maharashtra	AP, Kerala, Gujarat, Haryana
LP	Bihar, Haryana	Maharashtra, Gujarat, MP, Rajasthan, Orissa	Kerala, Tamilnadu, AP, Punjab, West Bengal	UP, Karnataka
CP	Maharashtra, Tamilnadu, Karnataka, Gujarat, Punjab, Kerala, Haryana		Orissa	Rajasthan, AP, MP, Bihar, UP, WB

Table 10: Data Source for Cluster Analysis

Major states	Avg. LP	Avg. CP	Avg. MP
West Bengal	1.39	1.24	1.56
Bihar	2.42	1.04	1.80
Orissa	2.07	0.75	1.93
Maharashtra	3.20	1.67	1.51
Madhya Pradesh	2.53	1.02	1.76
Andhra Pradesh	1.21	1.21	1.51
Uttar Pradesh	2.05	1.14	1.49
Punjab	2.06	1.42	1.41
Haryana	2.64	1.63	1.34
Gujarat	2.77	1.54	1.48
Rajasthan	2.30	1.20	1.53
Kerala	1.56	1.60	1.44
Karnataka	1.90	1.44	1.60
Tamilnadu	1.81	1.60	1.54

Table 11: Classification Through Cluster Analysis (Two Clusters)

Major states	Distance from cluster 1	Distance from Cluster 2	Cluster membership
West Bengal	0.28	1.06	Cluster 1
Bihar	1.06	0.32	Cluster 2
Orissa	0.93	0.73	Cluster 2
Maharashtra	1.67	0.85	Cluster 2
Madhya Pradesh	1.07	0.32	Cluster 2
Andhra Pradesh	0.42	1.55	Cluster 1
Uttar Pradesh	0.56	0.43	Cluster 2
Punjab	0.50	0.45	Cluster 2
Haryana	1.11	0.47	Cluster 2
Gujarat	1.20	0.43	Cluster 2
Rajasthan	0.76	0.17	Cluster 2
Kerala	0.20	0.96	Cluster 1
Karnataka	0.34	0.70	Cluster 1
Tamilnadu	0.30	0.72	Cluster 1

Table 12: Centroids of Cluster 1 and Cluster 2

Productivity ratio	Cluster 1	Cluster 2
Avg L.P.	1.57	2.45
Avg C.P.	1.42	1.27
Avg M.P.	1.53	1.58
Average Value of Centroids	1.51	1.77

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