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Indicators of Banking Development: Statewise Analysis

K. G. K. Subba Rao*

Introduction

EVER since the nationalisation of major scheduled commercial banks in July 1969, banking policy was reoriented, encompassing the socio-economic objectives laid down in successive five year Plans. These measures are aimed at reduction in inequality of incomes, prevention of concentration of economic power and reducing inter-regional disparities. The role of commercial banks too became prominent in promotional aspects and there was a gradual switchover from the traditional concept of commercial banking to one of social banking. One important measure taken in this context was the branch expansion policy with relatively greater thrust on development of branches in rural and semi-urban areas. Further, credit policy was geared to encourage the flow of credit to priority sectors such as agriculture, small-scale industry, etc., which did not receive adequate attention in the pre-nationalisation period. Targets for advances to priority sectors as a whole and also for the weaker sections thereof were laid down, with special emphasis on the economic uplift of this strata of population in rural areas. Targets were also set for the credit-deposit (CD) ratio in respect of rural and semi-urban branches to ensure that deposits mobilised by the branches in these areas were not siphoned off to urban/metropolitan areas. In this changing scenario of the banking sector, there has been an erosion of profitability of commercial banks in view of the high servicing cost of small accounts, the relatively low return on advances earmarked for priority sectors, and the high administrative costs associated with opening of branches in rural areas. The portfolio of advances for lending at commercial rates of interest is restricted to a relatively small proportion of their

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resources, after meeting the statutory requirements like the cash reserve ratio (CRR) and the statutory liquidity ratio (SLR) and lendings to priority sectors.

The rate of growth of deposits or bank credit *per se* is not an appropriate measure of banking development and a multitude of factors such as the geographical spread of bank branches, functional indicators with reference to priority sectors, growth of deposits in rural areas, etc., are to be considered in the context of the socio-economic objectives. As such, a composite measure covering various factors will have to be worked out. The technique of factor analysis could be advantageously used for the purpose; this technique is used to represent a given set of indicators into a smaller set of factors, which convey all the essential information of the original set of observations and substantial part of the total variance of all indicators. Divatia and Venkatachalam applied this analysis for evaluating the performance of public sector banks[2]. An important aspect of the policy measures in the banking sector introduced from time to time has been to reduce inter-state disparities in banking development, in the context of rural development and reducing regional imbalances. In this paper, an attempt is made to examine banking development in various states, taking into consideration the relevant indicators in respect of social objectives, spatial as well as functional, and compile a composite score/rank in respect of each state, using the methodology under reference. Section I of the paper is devoted to a general description of the performance of commercial banks in the post-nationalisation period. Section II presents the indicators and the methodology adopted for the study and Section III provides the results of the Factor Analysis. Section IV gives a summary of observations.

I

As a prelude to the study, it would be necessary to examine the trends of important indicators of commercial banks since nationalisation. The relevant data are provided in Table 1.

It may be observed that in the post-nationalisation period, the number of bank branches increased from 8,262 in 1969 to 53,287 in June 1986, at a compound growth rate of 11.6 per cent. The average population served per branch declined sharply from 64,000

Table 1: Important Indicators of Progress of Commercial Banks

Item	June 1969	June 1977	June 1978	June 1979	June 1980	June 1981	June 1982	June 1983	June 1984	June 1985	June 1986
1. Number of offices in India	8262	24802	28016	30202	32419	35707	39177	42079	45332	51385	53287
(a) Rural	1833	9537	11806	13337	15105	17656	20401	22686	25380	30185	29703
(b) Semi-urban	3342	7248	7628	7889	8122	8471	8809	9081	9326	9816	10585
(c) Urban	1584	4542	4843	5037	5178	5454	5693	5917	6116	6578	7209
(d) Metropolitan	1503	3475	3739	3939	4014	4126	4274	4395	4510	4806	5790
2. Population per office (in thousands)	64	25	23	22	21	19	18	17	16	15	14
3. Deposits of scheduled commercial banks in India (Rs. crores)	4646	18903	23313	28671	33377	40549	46128	54039	64620	77075	91454
4. Credit of scheduled commercial banks in India (Rs. crores)	3599	13491	15694	19116	22068	26551	30180	36006	43613	50921	57025
5. Scheduled commercial banks advances to priority sector (Rs. crores)	504	3488	4491	5906	7278	9444	10975	12783	16303	19829	22844
6. Share of priority sector advances in total non-food credit of scheduled commercial banks (per cent)	15.0	31.8	34.6	36.6	37.0	38.8	40.1	39.4	42.5	44.9	45.0
7. Deposits as percentage of National Income (at current prices)	15.5	26.3	29.4	33.3	35.8	35.9	36.2	38.5	38.4	41.7	44.8
8. Per capita deposits of scheduled commercial banks (Rs.)	88	299	361	434	494	587	654	750	878	1026	1194
9. Per capita credit of scheduled commercial banks (Rs.)	68	214	243	290	327	385	428	500	593	678	744

Source: Basic Statistical Returns on Banking Statistics—Volume-II—Reserve Bank of India, June 1987.

in 1969 to about 14,000 in 1986, as a result of the opening of new branches in hitherto unbanked centres. Branches in rural and semi-urban areas as percentage of total bank branches increased from about 63 per cent in 1969 to about 76 per cent in 1986. Rural branches alone accounted for about 56 per cent of the total number of branches in 1986, as against 22 per cent in 1969. The deposits of commercial banks increased from Rs. 4,646 crores in 1969 to Rs. 91,454 crores in 1986, showing a compound growth rate of 19.2 per cent, while the compound growth of credit was 17.7 per cent during the same period. The share of priority sector advances in total bank credit increased from 15 per cent to about 45 per cent in 1986. Against this scenario, it will be relevant to examine the banking indicators in respect of each state and assess the performance in the overall perspective of socio-economic objectives.

II

A set of 10 indicators, which will highlight the banking development in each of the states in the context of socio-economic objectives, is chosen for the present study. The indicators can be broadly classified into three groups, covering (A) business indicators in terms of deposits and credit, (B) spatial spread of bank branches and (C) credit deployment with reference to priority sectors. Under the first group, the following indicators are covered:

Group A:

a) Per capita Deposits (Rs.)
b) Per capita Advances (Rs.)
c) Credit (Utilisation)—Deposit Ratio
d) Ratio of Rural & Semi-urban Deposits to Aggregate Deposits
e) Ratio of Rural & Semi-urban Credit to Aggregate Credit

Among these, the credit (utilisation)—deposit (CD) ratio is chosen as one of the indicators, as it denotes the extent of credit absorption in a particular state and further reflects the flight of deposits from one state to the other states. A high ratio will indicate the high degree of absorption of credit. In this context, it is felt appropriate to take the credit utilisation-deposit ratio (as distinguished from credit sanction-deposit ratio), as loans sanctioned by a bank branch in a particular state do not necessarily go for financing economic activities in that state. The share of deposits of each state in total deposits and share of credit of each state in total credit are also considered as

important in assessing the banking development. As such, these indicators are included in Group (A), in place of the two indicators (a) and (b) and the analysis carried out with modified variables also.

Group B:

The following indicators are covered, which will give an idea of the geographical or spatial spread of bank branches, particularly in rural areas.

a) Number of bank branches per lakh of population
b) Number of bank branches per lakh of Rural population
c) Number of bank branches per lakh of Urban population.

Under Group C the following indicators are considered:

Group C: Social Objectives—Sectoral

a) Percentage share of Agriculture in priority sector advances
b) Percentage share of Small-Scale Industries in priority sector advances

The priority sector indicators under Group C, are considered important, because of the growing involvement of commercial banks in channelling the institutional credit to the priority sectors in the post-nationalisation period. The 10 indicators mentioned above are taken into consideration in working out the composite score of performance in the terminal year 1986. However, it is also necessary to consider the growth rates of relevant indicators over the time period of post-nationalisation for assessing banking development. For this purpose, the compound growth rates over this period are worked out. The indicators and the period covered are given below:

Group A: Functional

1. Per capita deposits	June '85/Dec. '70
2. Per capita credit	June '85/Dec. '70
3. Rural and semi-urban deposits	Sept. '86/Dec. '72
4. Rural and semi-urban credit	Sept. '86/Dec. '72

Group B: Spatial

1. Total No. of branches	Sept. '86/Dec. '72
2. No. of branches in rural and semi-urban areas	Sept. '86/Dec. '72

Group C: Sectoral

1. Total advances to agriculture June '85/Dec. '72
2. Total advances to small scale industries June '85/Dec. '72

The data on the required indicators for different states are collected from official sources, viz., (1) Basic statistical returns on banking statistics, published by Reserve Bank of India. (2) Statistical statements relating to banks in India, published by Reserve Bank of India and (3) Basic statistics relating to Indian economy, published by the Centre for Monitoring Indian Economy (CMIE). The data on the indicators are collected for the years 1969 and 1986, the former representing the position at the time of nationalisation. In case of some indicators, the data are available only from one or two years later than 1969 and as such, the reference year is not strictly the same year. This will not, however, vitiate the results of the study. In order to assess the banking development at different points of time, it may be desirable to take two or three intermediate years also within the time span considered for working out the growth rates. This is, however, not attempted in the present exercise.

Based on the indicators listed above, Factor Analysis can be applied either at the group level or at the over-all level, taking into consideration all the factors. The former approach appears to be more meaningful than evolving an efficiency measure at the composite level as there may not be strict correspondence in grading of the states based on factor scores in each of the groups. For example, in a particular state, the growth of deposits/credit per capita may be on the high side, but credit deployment to priority sectors may be somewhat low. Pooling all the indicators will obscure the divergence among the groups. In the ultimate analysis, if the focus is on the measurement of overall development, a possible course would be to combine the group rankings by giving equal weightage.

III

Results

Considering the performance index of the states with reference to the indicators for 1986 alone, it may be observed that the variation explained by the first principal component was about 62 per cent for the first group and over 70 per cent for each of the other two groups. When the indicators in the first group are revised taking into

consideration the share of each state in the total deposits/credit, about 73 per cent of the total variation of the factors is explained by the first principal component. As such, the modified group is taken into consideration for interpretation of results (Tables 2 and 3).

It may be observed from the rankings for each group in Table 3 that there has been considerable divergence in the ranks of the states in different groups, which were arranged in the order of factor scores. Thus the five states, viz., Maharashtra, West Bengal, Tamil Nadu, Karnataka and Uttar Pradesh get the first five ranks in Group A. By and large, this pattern is observed even if only the share of each state in total deposits/credit alone is considered among the variables in Group A, and thus the two indicators seem to be dominant in influencing the ranks of the states in Group A (Appendix 2). In Group B, Punjab, Kerala, Karnataka and Gujarat get the top four ranks, while in Group C, Punjab, Orissa, Andhra Pradesh and Rajasthan have the high ranks. In the composite ranking, Punjab, Karnataka, Andhra Pradesh and Rajasthan get the better ranks. At the other extreme, Kerala, West Bengal, Bihar and Assam are assigned relatively low ranks from the point of view of overall performance.

For a proper assessment of the relative performance of each of the states, it is necessary to consider not only the levels attained, but also the growth of different characteristics over a period of time. Table 4 provides the information in this regard. The first principal component accounted for 70 per cent in the first group and more than 90 per cent in the second and third groups. It is interesting to note that the composite ranking of each state is influenced by ranking under group A. Quite contrary to the one time point position, the picture that emerges by considering growth rates of selected indicators is entirely different. Thus, the states, Orissa, Madhya Pradesh and Rajasthan emerge as important states under composite ranking, while Maharashtra and Gujarat are relegated to the lower rung. This is supported by the data on growth rates in respect of each of the indicators under reference (Appendix 3). However, if the absolute increase in deposits/credit only is considered for the purpose, Maharashtra, West Bengal, Uttar Pradesh and Tamil Nadu emerged as the relatively important states[3] A possible explanation for the relatively low ranks in respect of states like Maharashtra and Gujarat may be that the levels of various indicators may be very high in the initial year, i e.,

Table 2: Ranking of States with Reference to Banking Development 1985-86

Sr. No.	State	Functional		Spatial		Sectoral		Total of Ranks	Rank
		Factor Score	Rank	Factor Score	Rank	Factor Score	Rank		
1.	Andhra Pradesh	46.92	7	47.73	8	70.48	3	18	3
2.	Assam	18.42	14	18.88	15	37.90	11	40	15
3.	Bihar	13.39	15	30.56	13	67.49	5	33	14
4.	Gujarat	57.99	5	59.00	4	29.54	13	22	7.5
5.	Haryana	45.92	8	54.46	5	65.54	6	19	4
6.	Karnataka	63.54	4	78.66	3	52.96	9	16	2
7.	Kerala	30.79	10	85.58	2	42.46	10	22	7.5
8.	Madhya Pradesh	29.73	11	40.90	10	62.88	7	28	11
9.	Maharashtra	138.98	1	43.88	9	4.80	15	25	9
10.	Orissa	26.21	13	38.22	11	71.90	2	26	10
11.	Punjab	56.25	6	94.52	1	73.43	1	8	1
12.	Rajasthan	34.35	9	47.87	7	68.27	4	20	5
13.	Tamil Nadu	74.87	3	49.07	6	37.72	12	21	6
14.	Uttar Pradesh	28.71	12	34.80	12	59.49	8	32	13
15.	West Bengal	83.94	2	25.86	14	5.14	14	30	12
	Factor Loading	0.7447		0.9906		0.9295			
		0.9226		0.8348		0.8527			
		0.3989		0.6476		−0.7959			
		−0.8451							
		−0.9040							
Eigen value		3.0963		2.0976		2.2245			
Percentage variation explained		61.92		69.92		74.15			

Table 3: Ranking of States with Reference to Banking Development 1985-86
(Revised Version)

Sr. No.	State	Functional		Spatial		Sectoral		Total of Ranks	Rank
		Factor Score	Rank	Factor Score	Rank	Factor Score	Rank		
1.	Andhra Pradesh	51.34	7	47.73	8	70.48	3	18	3
2.	Assam	15.86	15	18.88	15	37.90	11	41	15
3.	Bihar	.95	13	30.56	13	67.49	5	31	14
4.	Gujarat	53.10	6	59.00	4	29.54	13	23	7
5.	Haryana	27.17	10	54.46	5	65.54	6	21	5.5
6.	Karnataka	59.68	4	78.66	3	52.96	9	16	2
7.	Kerala	17.26	14	85.58	2	42.46	10	26	12
8.	Madhya Pradesh	35.50	8	40.90	10	62.88	7	25	9.5
9.	Maharashtra	157.68	1	43.88	9	4.80	15	25	9.5
10.	Orissa	23.86	12	38.22	11	71.90	2	25	9.5
11.	Punjab	25.85	11	94.52	1	73.43	1	13	1
12.	Rajasthan	33.72	9	47.87	7	68.27	4	20	4
13.	Tamil Nadu	75.44	3	49.07	6	37.72	12	21	5.5
14.	Uttar Pradesh	53.11	5	34.80	12	59.49	8	25	9.5
15.	West Bengal	96.49	2	25.86	14	5.14	14	30	13
	Factor Loading	0.9164		0.9906		0.9295			
		0.9544		0.8348		0.8527			
		0.2647		0.6476		-0.7959			
		-0.9515							
		-0.9475							
Eigen value		3.6238		2.0976		2.2245			
Percentage variation explained		72.47		69.92		74.15			

Table 4: Ranking of States with reference to Banking Development (Compound Growth Rates)

Sr. No.	State	Functional		Spatial		Sectoral		Total of Ranks	Rank
		Factor Score	Rank	Factor Score	Rank	Factor Score	Rank		
1.	Andhra Pradesh	82.49	2	50.38	8	57.65	6	16	4
2.	Assam	57.06	7	72.50	3	1.33	15	25	7.5
3.	Bihar	37.63	11	81.59	2	60.98	4	17	5.5
4.	Gujarat	(-)1.29	15	23.40	15	38.58	13	43	15
5.	Haryana	37.86	10	38.46	9	54.30	8	27	10
6.	Karnataka	28.14	12	31.54	12	47.21	10	34	13
7.	Kerala	61.59	5	33.75	11	48.15	9	25	7.5
8.	Madhya Pradesh	78.97	3	63.93	5	65.16	2	10	2
9.	Maharashtra	15.46	14	34.93	10	39.00	12	36	14
10.	Orissa	107.13	1	86.74	1	82.84	1	3	1
11.	Punjab	55.01	8	31.39	13	60.06	5	26	9
12.	Rajasthan	73.57	4	52.60	7	64.06	3	14	3
13.	Tamil Nadu	39.21	9	27.24	14	40.72	10	33	11.5
14.	Uttar Pradesh	57.59	6	64.18	4	56.67	7	17	5.5
15.	West Bengal	19.59	13	57.38	6	33.28	14	33	11.5
	Factor Loading	0.8827		0.9936		0.9479			
		0.7989		0.9936		0.9479			
		0.8822							
		0.7670							
Eigen value		2.7838		1.9744		1.7970			
Percentage variation explained		69.59		98.72		89.85			

even at the time of nationalisation, and as such the growth rates may not show a significant rise. The relatively high pace of development in some of the backward states may be due to branch licensing policy with thrust on rural/semi-urban areas and unbanked centres in underdeveloped regions in the post-nationalisation period.

In a study by Kannan[4], the inter-state disparities in banking development were analysed with the same technique on the basis of only three indicators, viz., 1) population per bank office, 2) per capita credit, and 3) per capita deposits, for the three reference years 1969, 1975 and 1984. Kannan's analysis is confined only to the three factors indicated above, which are not truly representative of the nature of banking development since nationalisation. On the other hand, the present study gives importance to policy-oriented factors such as the spatial spread of rural and semi-urban branches, and the deployment of credit to key priority sectors, which assumed considerable importance in the post-nationalisation period. Further, it is necessary to classify the variables into homogeneous groups and carry out the analysis for each group instead of taking all the variables in one set; the latter is sure to vitiate the pattern of ranking.

As for the changes over time, the method employed in this study is based on growth rates in the relevant variables whereas, Kannan has presented the banking development indices for three reference points. The analysis based on growth rates has been able to capture the subtle changes in banking development taking place in favour of the states with low base in the initial years. On the other hand, Kannan's results reveal no significant variation in the ranking pattern of the states over the three reference periods 1969, 1975, 1984, essentially because (a) his study is based on only three insufficiently representative variables, and (b) the methodology using stock variables fails to capture the significant structural changes. The importance of these changes lies particularly in the spatial spread of banking and the sectoral deployment of credit.

It would be of interest to examine the correspondence in the ranks of the states obtained according to average ratios at one time point and also the growth rates over the time period under consideration. The relevant graphs for each of the groups and also for the composite group are enclosed. The points (states) which are nearer to the origin are the states which are having relatively high ranks from

the twin criteria, while those away from the origin indicate the position in the lower rung. Clustering of points around the line of equality indicates close association, while the points far way from this line indicate considerable divergence in the ranks according to the two criteria. The correspondence of ranks is observed to be more in evidence, when sectoral indicators are considered. In the case of indicators in the other two groups (functional and spatial), there does not seem to be any positive association. The ranks of the states in different groups using 1) average ratio and 2) growth rates, together with the rank correlation coefficients are presented in Table 5. When the group of sectoral indicators is considered, the rank correlation between the two variables works out to 0.84 and is significant. In respect of the other two groups (functional and spatial), the rank correlations are negative and significant. Thus the results indicate that the states assigned high ranks according to the average ratios might have got lower ranks, when growth rates over a period of time are considered. The close correspondence in the sectoral indicators may be possibly due to the fact that targets for priority sectors were laid down from time to time which the banks are supposed to achieve and as such, *inter se* ranking of the states may not get vitiated, even if the growth rates are considered. For measuring the overall concentration and dispersion of various characteristics, the Herfindahl Index is used which can be written as

$$HI = \frac{\Sigma X_j^2}{(\Sigma X_j)^2} \qquad (j = 1, \ldots, m)$$

The value of HI lies between 1 and $\frac{1}{m}$. The value of unity depicts complete concentration and $\frac{1}{m}$ complete dispersion. A decline in the coefficient of variation of each of the indicators among the states in the two years 1969 and 1986 will give an idea of the reduction in the imbalances in respect of each indicator over the years. Among the indicators under the functional group, the coefficient of variation declined substantially in case of per capita deposits (from 77 per cent to 58 per cent) and per capita credit (from 93 per cent to 64 per cent). The reduction in the coefficient was not so pronounced in the case of rural and semi-urban deposits/credit, which are the other two variables in Group (A). Similarly, the coefficient of variation remained broadly the same, when geographical spread of bank branches is concerned. With reference to sectoral indicators, it is

Table 5: Ranks According to Average Ratio and Compound Growth Rate

Sr. No.	State	Groups	Functional		Spatial		Sectoral		Composite	
			A	B	A	B	A	B	A	B
1.	Andhra Pradesh		7	2	8	8	3	6	3	4
2.	Assam		15	7	15	3	11	15	15	7.5
3.	Bihar		13	11	13	2	5	4	14	5.5
4.	Gujarat		6	15	4	15	13	13	7	15
5.	Haryana		10	10	5	9	6	8	5.5	10
6.	Karnataka		4	12	3	12	9	10	2	13
7.	Kerala		14	5	2	11	10	9	12	7.5
8.	Madhya Pradesh		8	3	10	5	7	2	9.5	2
9.	Maharashtra		1	14	9	10	15	12	9.5	14
10.	Orissa		12	1	11	1	2	1	9.5	1
11.	Punjab		11	8	1	13	1	5	1	9
12.	Rajasthan		9	4	7	7	4	3	4	3
13.	Tamil Nadu		3	9	6	14	12	10	5.5	11.5
14.	Uttar Pradesh		5	6	12	4	8	7	9.5	5.5
15.	West Bengal		2	13	14	6	14	14	13	11.5
	Rank Correlation		−0.4750*		−0.8321*		0.8411*		0.1125+	

A -Based on average ratios.
B -Based on compound growth rate.
* -Significant at 5 per cent level.
+ -Not significant.

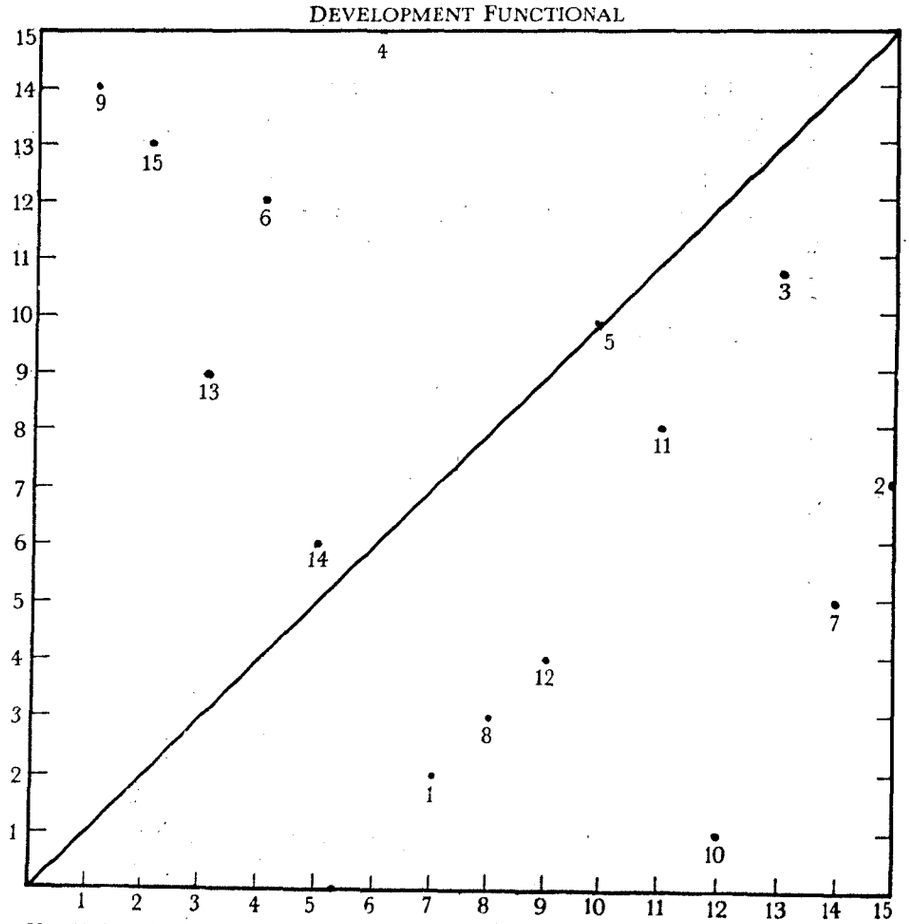
observed that the coefficient of variation declined considerably in each of the indicators. Thus it would appear that the imbalances in respect of the various indicators under consideration, in particular, the per capita deposits and per capita credit and the deployment of credit to the priority sectors, have declined and they are more evenly distributed among the states in the post-nationalisation period These were also corroborated by the decline in the HI index (Appendix 3).

IV

The main findings of the study are summarised below:

1) Considering the performance index of the states with reference to indicators in 1986 alone, it is observed that there is considerable

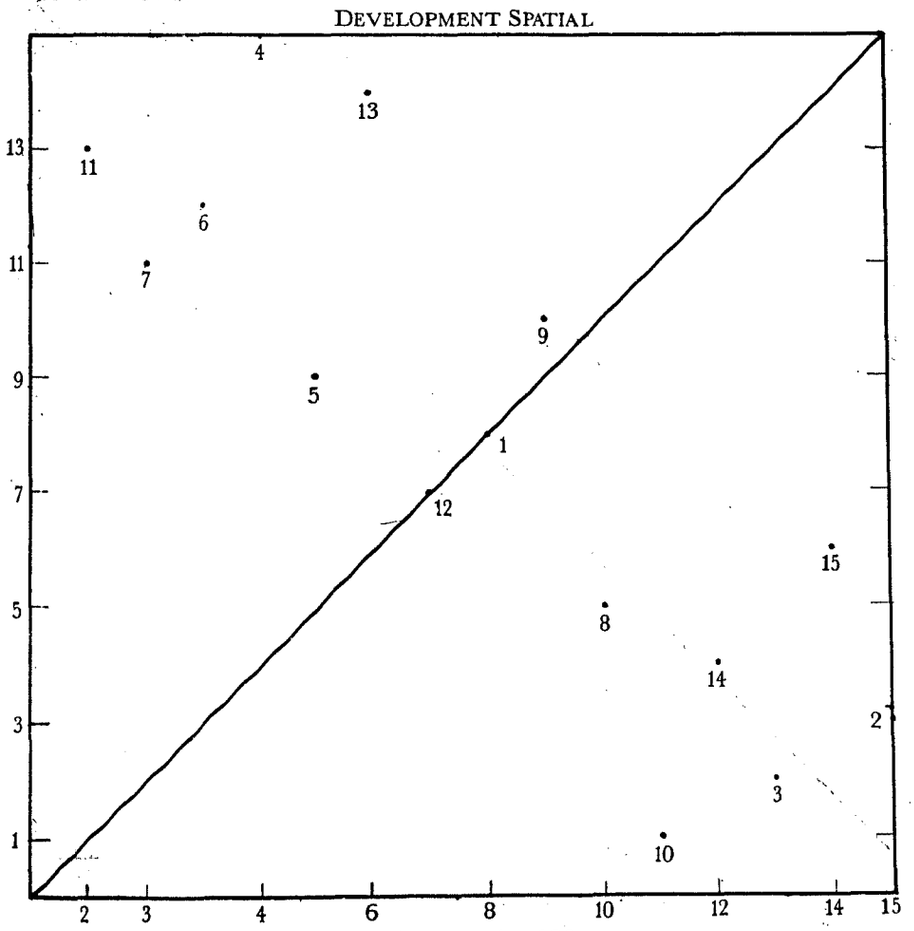
GRAPH 1: RANKING OF STATES WITH RESPECT TO BANKING DEVELOPMENT FUNCTIONAL



X AXIS - Ranks according to performance in 1986
Y AXIS - Ranks according to Growth Rates

variation in the ranks of the states, when the groups of business indicators, spatial spread of bank branches and sectoral credit deployment are considered separately. When the group of business indicators in terms of deposits and credit are considered, the five states, viz., Maharashtra, West Bengal, Tamil Nadu, Karnataka and Uttar Pradesh get the first five ranks. As regards the spatial spread of bank branches, the four States, viz., Punjab, Kerala, Karnataka and Gujarat get the top scores. With regard to the sectoral indicators, Punjab, Orissa, Andhra Pradesh and Rajasthan have the high ranks. When the composite scores are considered at the terminal year, Punjab, Karnataka, Andhra Pradesh and Rajasthan get the top ranks. At the other extreme, Kerala, West Bengal, Bihar and Assam get the lower ranks.

GRAPH II: RANKING OF STATES WITH RESPECT TO BANKING DEVELOPMENT SPATIAL

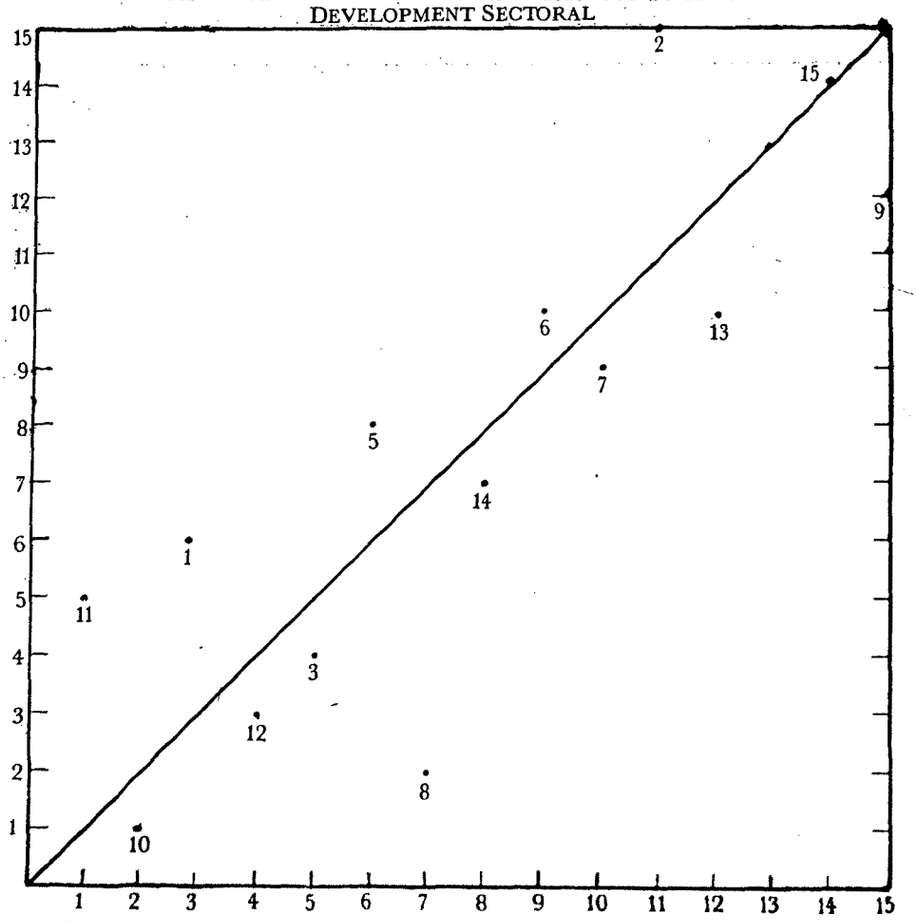


X AXIS - Ranks according to performance in 1986
Y AXIS - Ranks according to Growth Rates

2) When scores are worked out according to growth rates, the composite index shows that Orissa, Madhya Pradesh and Rajasthan emerge as important states, while Maharashtra and Gujarat are in the lower rung. The high score in some of the backward states may be due to their low base in the initial period and relatively high pace of development in those states following the emphasis on development of rural/semi-urban branches in these states. The low ranks in respect of states like Maharashtra and Gujarat may be due to the fact that the levels of various indicators were relatively high even in initial year, and as such growth rates did not show a significant rise

3) The states getting high scores based on the average ratios are having low ranks, when functional and spatial indicators with

GRAPH III: RANKING OF STATES WITH RESPECT TO BANKING DEVELOPMENT SECTORAL



X AXIS - Ranks according to performance in 1986
Y AXIS - Ranks according to Growth Rates

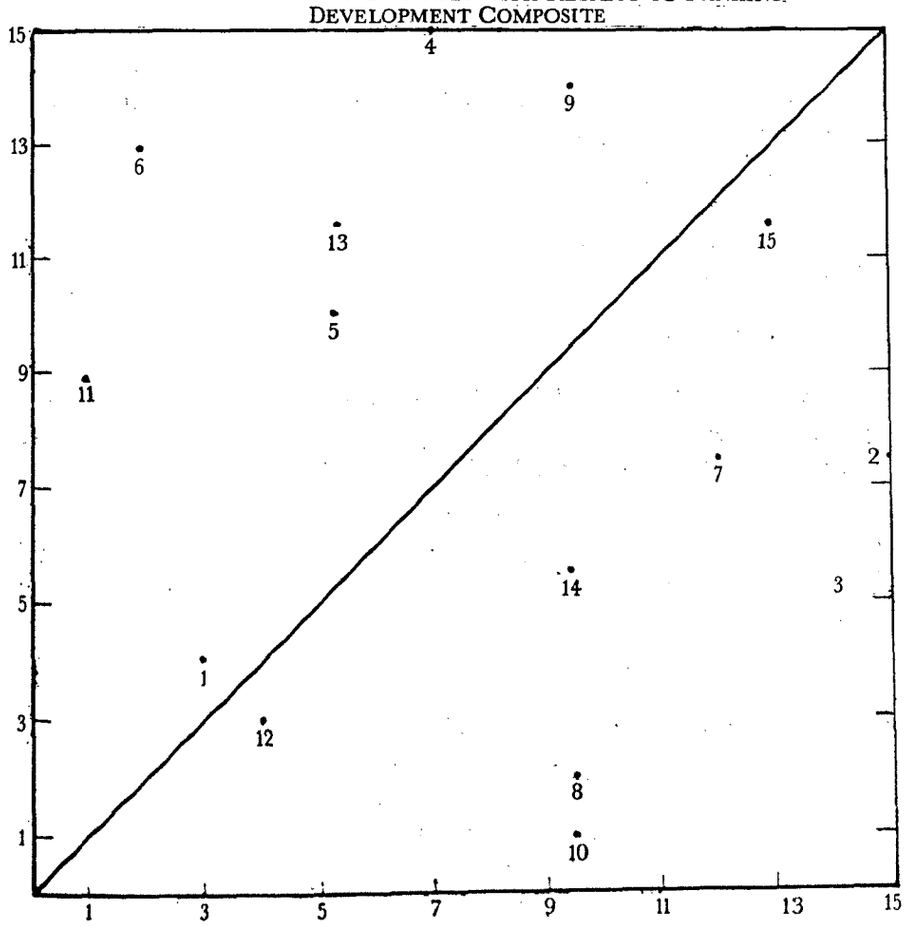
reference to growth rates are considered. When sectoral indicators are considered, there is high positive correlation.

4) There has been substantial reduction in coefficient of variation among the states, in the post-nationalisation period, when per capita deposits/credit and sectoral deployment of credit are considered. This will indicate that the imbalances among the states were narrowed down over the time period.

APPENDIX 1

Consider a set of variables $X_1, X_2, \ldots, X_k$. Let the corresponding standardised variables (i.e. deviations of the Xs from the mean values divided by standard deviation) be $Z_1, Z_2, \ldots, Z_k$. We replace

GRAPH IV: RANKING OF STATES WITH RESPECT TO BANKING DEVELOPMENT COMPOSITE



X AXIS - Ranks according to performance in 1986
Y AXIS - Ranks according to Growth Rates

these standardised variables by principal factors, which are linear combination of the Zs.

$$F_1 = a_{11}Z_1 + a_{12}Z_2 + \ldots + a_{1k}Z_k$$
$$F_2 = a_{21}Z_1 + a_{22}Z_2 + \ldots + a_{2k}Z_k$$
$$\vdots$$
$$F_k = a_{k1}Z_1 + a_{k2}Z_2 + \ldots + a_{kk}Z_k$$

or in matrix notation, we may write as $[F] = [A]\,[Z]$

The problem is to estimate the coefficients a_{ij}s (called factor loadings). Let R be the correlation matrix between Z_is

$$|R| = \begin{vmatrix} 1 & r_{12} \ldots & r_{1k} \\ r_{21} & 1 \ldots & r_{2k} \\ \cdot & \vdots & \\ r_{k1} & r_{k2} \ldots & 1 \end{vmatrix}$$

The system of linear equations which yields the first and largest component is $[R]\,[A] = [\lambda A]$

or, $[R - \lambda I][A] = 0$@ ,

The system of linear homogeneous equations can have non-trivial solutions only if the determinant equation becomes zero

i.e. if $|R - \lambda I| = 0$

Let λ_1 be the largest root. Corresponding to this largest root (called as eigen value or latent root or characteristic root), the associated vector representing the factor loadings can be derived. Similarly for the next largest root, the corresponding factor loading vector can be worked out. Generally it will suffice to work out two latent roots which will explain a major part of the variance of the explanatory variables. The percentage contribution of each principal factor in total variance of the standardised X_is is given by $\frac{\lambda_1}{k}$ where k is the number of variables. The standardised variables matrix multiplied by factor loading matrix will give the factor scores.

@ For a derivation of this equation, reference may be made to:

1. Harmann H. H. (1976): Modern Factor Analysis, Chicago, University of Chicago press
2. Chatfield C. and Collins A. J. (1980): Introduction to Multivariate Analysis, Chapman and Hall.

Appendix 2: Basic Data on Indicators of Commercial Banks

State / Indicator (Period)	Per Capita Deposit (Rs.)	Per Capita Advances (Rs.)	Credit Deposit Ratio	Ratio of Rural and Semi-Urban to Total		Number of Branches Per Lakh of Population	Number of Bank Offices Per Lakh of Population		Percentage share of			Percentage Share of	
				Deposit (Rs.)	Credit (Rs.)		Rural	Urban	Priority Sector Advances to Aggregate Advances	Agriculture to Total Priority Sector	SSI to Total Priority Sector	Deposits to Total Deposits	Advances to Total Advances
(1)	June 1985 (2)	June 1985 (3)	Mar. 1985 (4)	Sept. 1986 (5)	Sept. 1986 (6)	Sept. 1985 (7)	Sept. 1985 (8)	Sept. 1985 (9)	June 1985 (10)	June 1985 (11)	June 1985 (12)	Sept. 1986 (13)	Sept. 1986 (14)
1. Andhra Pradesh	782	612	78.7	45.1	49.2	7.0	5.8	10.6	56.70	56.35	29.68	5.603	6.934
2. Assam	418	222	68.1	59.4	56.2	4.1	3.0	13.3	44.30	23.09	22.77	1.140	0.953
3. Bihar	454	189	44.2	54.6	58.9	5.4	4.8	8.9	57.20	45.78	22.61	4.593	2.798
4. Gujarat	1345	735	57.9	43.9	39.8	8.2	6.2	12.2	46.30	33.99	44.73	6.220	5.392
5. Haryana	987	668	95.0	55.5	54.1	7.6	5.9	12.6	69.70	47.94	36.39	1.831	1.796
6. Karnataka	943	817	84.4	38.7	41.0	9.6	8.0	13.1	45.50	46.35	30.61	4.920	6.672
7. Kerala	1132	776	66.6	70.1	60.3	9.9	5.5	27.4	49.50	35.51	34.27	4.029	3.897
8. Madhya Pradesh	478	299	63.9	48.1	50.7	6.4	5.8	8.1	56.90	44.18	25.89	3.637	3.330
9. Maharashtra	2089	1897	92.2	11.8	8.7	7.1	5.1	10.4	21.10	29.89	49.21	18.269	24.202
10. Orissa	311	288	85.3	53.5	56.3	6.0	5.2	10.3	58.00	48.24	20.79	1.165	1.659
11. Punjab	2270	1012	59.6	61.0	57.2	10.9	8.8	15.9	70.30	52.25	32.43	5.156	3.562
12. Rajasthan	517	365	73.8	49.8	48.7	6.9	6.7	7.3	56.20	49.28	24.55	2.589	2.582
13. Tamil Nadu	957	944	91.9	37.0	31.7	7.5	5.2	12.1	39.30	43.05	39.58	6.281	9.397
14. Uttar Pradesh	643	316	51.9	47.2	52.5	5.9	5.0	9.1	58.60	44.10	30.87	10.177	6.898
15. West Bengal	1367	710	51.1	22.3	14.0	5.5	3.6	10.2	23.20	27.43	47.90	10.594	8.245

Sources: For items under columns 2, 3, 7, 8 & 9—Basic Statistics relating to Indian Economy—published by CMIE.
" " " " 4 —Reserve Bank of India Bulletin—May '87 issue
5, 6, 13 & 14—Banking Statistics—Quarterly Handbook—Sept. '86—published by RBI.
10, 11 & 12 —Half yearly returns on priority sector advances—RBI.

Appendix 3: Mean, Coefficient of Variation and Herfindahl Index of Selected Indicators

States / Indicators / Year	(A) Per Capita Deposit (Rs.)			(B) Per Capita Advances (Rs.)			(C) Rural & Semi-Urban Deposit (Rs. lakhs)			(D) Rural & Semi-Urban Credit (Rs. lakhs)		
	Dec. '70	June '85	Annual Compd. Growth Rate (%)	Dec. '70	June '85	Annual Compd. Growth Rate (%)	Dec. '72	Sept. '86	Annual Compd. Growth Rate (%)	Dec. '72	Sept. '86	Annual Compd. Growth Rate (%)
1. Andhra Pradesh	45	782	21.763	49	612	19.021	10719	237374	25.267	9455	204252	25.042
2. Assam	33	418	19.137	15	222	20.423	4732	63630	20.804	1642	32055	24.124
3. Bihar	41	454	18.037	14	189	19.661	22335	235952	18.703	6789	98628	21.485
4. Gujarat	191	1345	14.409	113	735	13.785	31317	256724	16.533	10084	128413	20.327
5. Haryana	77	987	19.234	46	668	20.265	9358	95539	18.408	5267	58141	19.083
6. Karnataka	103	943	16.499	80	817	17.380	15392	178850	19.528	11652	163878	21.199
7. Kerala	89	1132	19.171	61	776	19.172	14853	268611	23.436	7953	140655	23.236
8. Madhya Pradesh	36	478	19.524	23	299	19.350	8086	164586	24.502	3153	101024	28.678
9. Maharashtra	288	2089	14.643	262	1897	14.629	17247	202708	19.627	8479	126632	21.730
10. Orissa	21	311	20.428	11	288	25.254	2764	58668	24.882	1101	55867	33.054
11. Punjab	201	2270	18.198	70	1012	20.228	22383	295533	20.644	5376	121901	25.483
12. Rajasthan	42	517	18.902	23	365	21.003	6411	121343	23.845	2908	75304	26.701
13. Tamil Nadu	85	957	18.173	113	944	15.765	14898	218781	21.581	12307	178033	21.448
14. Uttar Pradesh	57	643	18.188	30	316	17.631	27397	451570	22.606	8754	216769	26.289
15. West Bengal	189	1367	14.621	177	710	10.054	16348	221649	20.877	2712	68941	26.531
Mean	99.87	979.53		72.47	656.67		14949.33	204767.87		6508.80	118032.87	
Std. dev.	77.104	569.28		67.71	421.97		8008.91	96915.16		3530.99	53751.41	
Coeff. of variation (%)	77.21	58.12		93.44	64.26		53.57	47.33		54.25	45.53	
Herfindahl Index	0.106	0.089		0.125	0.094		0.086	0.082		0.086	0.080	

Sources: For items under columns (A), (B) — Basic Statistics Relating to the Indian Economy—CMIE publication.
For items under columns (C), (D) & (E) :— Banking Statistics Dec. '72, and Quarterly Handbook on Banking Statistics—RBI publications.

Appendix 3: Mean, Coefficient of Variation and Herfindahl Index of Selected Indicators *(Concluded)*

State \ Indicators / Year	(E) Total No. of Bank Branches			(F) Rural & Semi-Urban Bank Branches			(G) Bank Credit to Agriculture (Rs. '000s)			(H) Bank Credit to Small-Scale Industry (Rs. '000s)		
	Dec. '72	Sept. '86	Annual Compd. Growth Rate (%)	Dec. '72	Sept. '86	Annual Compd. Growth Rate (%)	Dec. '72	June '85	Annual Compd. Growth Rate (%)	Dec. '72	June '85	Annual Compd. Growth Rate (%
1. Andhra Pradesh	1047	4130	10.496	738	3211	11.286	447442	10153800	28.372	394460	5348100	23.190
2. Assam	152	972	14.447	132	873	14.728	270073	527300	5.498	113619	520000	11.697
3. Bihar	574	4232	15.638	457	3792	16.636	73056	3589700	36.556	151745	1772600	21.731
4. Gujarat	1297	3091	6.520	969	2194	6.124	403485	4251000	20.729	618542	5595300	19.266
5. Haryana	321	1110	9.443	289	854	8.199	72173	3166400	35.324	248642	2403500	19.901
6. Karnataka	1422	3927	7.667	1037	2891	7.742	493005	7082100	23.761	423959	4677900	21.176
7. Kerala	947	2725	7.990	778	2290	8.168	186004	3450700	26.320	317536	3330400	20.686
8. Madhya Pradesh	728	3737	12.633	545	3192	13.718	103832	4189500	34.421	170468	2455000	23.786
9. Maharashtra	1795	4913	7.598	861	2831	9.042	707579	7696700	21.038	1394820	12670700	19.306
10. Orissa	217	1735	16.322	164	1543	17.707	16523	2112500	47.413	52840	910300	25.573
11. Punjab	721	2005	7.722	565	1552	7.626	109492	6250400	38.204	361553	3880800	20.909
12. Rajasthan	637	2683	11.024	504	2246	11.480	112133	3733600	32.371	125571	1859600	24.063
13. Tamil Nadu	1588	3927	6.806	1025	2659	7.179	581398	8205300	23.586	850263	7543100	19.080
14. Uttar Pradesh	1443	7332	12.550	990	5930	13.904	464716	9122900	26.892	464449	6387500	23.330
15. West Bengal	830	3415	10.835	394	2226	13.421	577509	3012200	14.126	562712	5259200	19.578
Mean	914.60	3270.27		629.87	2552.27		307894.67	5102940.00		416745.27	4307600.00	
Std. dev.	491.47	1660.56		299.72	1214.18		219990.95	2704476.35		335712.22	3000229.50	
Coeff. of variation (%)	53.74	50.78		47.59	47.57		71.45	53.00		80.56	69.65	
Herfindahl Index	0.086	0.084		0.082	0.082		0.101	0.085		0.110	0.099	

Sources: For Dec. '72 data in columns (G), (H) —Banking Statistics Dec. 1972.
For Sept. '86 " " (F) . . . —Banking Statistics—Quarterly Handbook—Sept. 1986.
For Dec. '72 " " (F) . . . —Statistical Tables relating to banks in India—Dec. 1972
For June '85 " " (G), (H) —Half-yearly returns on priority sector advances—RBI

Notes

1 The technique of Factor Analysis is briefly summarised in Appendix 1.

2 Divatia V. V. and Venkatachalam T. R., 'Operational Efficiency and Profitability of Public Sector Banks', *Reserve Bank of India Staff Occasional Papers*, June, 1978.

3 Reference may be made to RBI *Report on Currency and Finance*: 1985-86 (Vol. I).

4 Kannan R., 'Banking Development and Regional Disparities', October-December 1987 (Vol. 35 No. 2) *The Indian Economic Journal* (Special Number on Monetary Economics)

5 This can be derived as under:
The variance of m observations is given by

$$\sigma^2 = \frac{1}{m}\Sigma (X_j - \bar{X})^2 > 0$$

$$= \left(\frac{1}{m}\Sigma X_j^2 - \bar{X}^2\right) > 0$$

$$= \frac{1}{m}\Sigma X_j^2 - \frac{\Sigma X_j}{m} \times \frac{\Sigma X_j}{m} > 0$$

$$\text{i.e. } \frac{1}{m}\Sigma X_j^2 > \frac{1}{m^2}(\Sigma X_j)^2$$

$$\text{Or } \frac{\Sigma X_j^2}{(\Sigma X_j)^2} > \frac{1}{m}$$

$$\text{Further } (\Sigma X_j)^2 = \Sigma X_j^2 + \Sigma\Sigma X_i X_j \qquad X_i, X_j \neq 0$$

$$\text{i.e. } (\Sigma X_j)^2 > \Sigma X_j^2$$

$$\text{or } \frac{\Sigma X_j^2}{(\Sigma X_j)^2} < 1$$

$$\text{Thus } \frac{1}{m} < H < 1$$

References

1) Chatfield C., and Collins A. J. (1980): *Introduction to Multivariate Analysis* (Chapman and Hall, London)
2) Divatia V. V., and Venkatachalam T. R. (1978): "Operational Efficiency and Profitability of Public Sector Banks", *Reserve Bank of India Staff Occasional Papers*, June 1978.
3) Harmann H. H. (1976): *Modern Factor Analysis* (Univeristy of Chicago Press, Chicago)
4) Kannan R.: "Banking Development and Regional Disparities", *The Indian Economic Journal* (Special Number on Monetary Economics) 'October-December 1987' (Vol. 35, No. 2).
5) Rangarajan C. (1974): "Banking Development since Nationalisation and Reduction in Disparities", *Sankhya*, Vol. 36, Series C.
6) Rangarajan C. (1982): *Innovations in Banking* (Oxford and IBH Publishing House, New Delhi).

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Physical Performance of Sugar Industry

M. Y. Khan*

Introduction

THE sugar industry occupies an important place in the economy of India. It provides employment to more than 2 lakh persons. A special feature of the industry along with *khandsari* and *gur* manufactures is that it works in close relationship with the cultivators and indirectly creates employment opportunities in sugar cultivation for more than 20 lakh farmers scattered all over the country. The growth of the sugar industry both in terms of the number of units and production was rapid, particularly in the 1970s and 1980s. Nearly a half of the units working in 1985-86 were of recent origin having been set up after 1970-71. The production of sugar more than doubled from 37.4 lakh tonnes in 1970-71 to 85.0 lakh tonnes in 1986-87. However, the industry, inspite of having attained a high level of production, suffers from instability in output growth and capacity utilisation. In this study an attempt is made to analyse the physical performance of the Indian sugar industry since the early 1950s. The study is divided into four sections. Section I makes a survey of various Commission and Committee reports on the industry and summarises their major recommendations; it also sets out the objectives, methodology and scope of the study. Section II presents a brief review of the physical performance of the industry at all-India and State levels. Section III presents a comparative performance of sugar units in private and co-operative sectors. The main conclusions emerging from the study are given in Section. IV.

I

A Survey of Studies on the Industry

The performance of the sugar industry in general, or some of its individual aspects, has been the subject of enquiry by several

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Government Commissions and Committees since the early 1930's. The first study was by the then Tariff Board in 1931 in connection with the laying down of criteria and procedures for granting protection to the industry. During 1931-50, besides the Tariff Board, the Technical Sugar Committee (1949) headed by T. Vijayaraghavacharya enquired into the cost of sugarcane production and progress of cane research and development with a view to increasing the recovery of sugar and reduction in its cost of production. The Sugar Enquiry Committee (1950) headed by Ganga Nath examined various aspects relating to the growth of the industry including its cost structure. Later on, Government of India, appointed a Fact Finding Committee (1958) to investigate and examine the status of *khandsari* sugar vis-a-vis the sugar industry and the extent of diversion of cane to *khandsari* in factory zones and to recommend steps to meet this situation.

In 1963 the Government of India appointed a *Committee on Rehabilitation and Modernisation of Sugar Factories in India* under the Chairmanship of S. N. Gundu Rao to examine the problems of the old and uneconomic units in the industry. The Committee's terms of reference were:

(i) provision of facilities for development of sugarcane cultivation; (ii) determination of the economic size of a sugar factory; (iii) assessment of the need for rehabilitation, modernisation and expansion of uneconomic units; (iv) estimation of the industry's financial requirements and provision of incentives; (v) the location of new units, and (vi) continuance or otherwise of the Government policy on control on sugar. The Committee recommended a number of measures for improving the per acre yield of sugarcane such as, (i) compactness of the factory area; (ii) distribution of good seeds; (iii) provisions of irrigation, fertiliser and plant protection and (iv) propagation of suitable varieties of cane. According to the Committee, every factory was to be allowed a farm of 500 acres to 2,000 acres of its own to utilise for research and development of cane. Regarding the crushing capacity of the industry, the Committee was of the view "that a capacity of 1,500 tonnes would be fairly economic capacity under the conditions prevailing at present in India. While, therefore, this 1,500 tonnes should be the minimum target for expanding the existing units, the new units would have a starting capacity of 1,500 or 2,000 tonnes with provision for expansion up to 3,000 — 4,000 tonnes". For rehabilitation and modernisation, the Committee recommended

an amount of Rs. 90 crores for 165 sugar factories. The Committee recommended a "Sugar Industry Fund" with the help of a levy at a certain rate imposed uniformly all over the country on the sugar consumers in the internal market and collected along with the excise duty. This was meant for reimbursement to the factories to meet the cost of depreciation on their actual additional investment for rehabilitation and modernisation. A revolving fund of Rs. 20 crores was also recommended to grant loans for 12 years for the purchase of machinery at zero interest rate for the first 3 years and thereafter at a rate of 1 per cent above the Bank Rate. The Committee stressed the scrapping of the old units and the setting up of new ones and extending some special incentives, such as development rebate of 40 per cent in place of 20 per cent, exemption from purchase tax for a period of 3 years and lifting of controls till the weak and high-cost units were rehabilitated and modernised. The Committee was of the view that the approach to the problem of location should be based on productivity, cost of production and production potentials.

The Sugar Enquiry Commission (1965) headed by S. R. Sen was asked to make recommendations on the issues such as (i) the desirability of the industry bearing a portion of the loss on exports and its extent, how the same should be recovered from sugar factories, and the feasibility of enacting a new legislation for the purpose, (ii) how the loss on exports should be recouped from consumers, either by a special levy or by passing it on to domestic consumers in the form of higher price for sugar, and (iii) economy in the manufacture of raw sugar with reference to the actual cost of production. The S. R. Sen Commission was assigned the task of examining the *Report of the Committee on Rehabilitation and Modernisation of Sugar Factories in India.* The Commission recommended a buffer stock policy so that sugar could be accumulated when its price fell below a minimum and it could be sold by depleting stocks when its price rose above a specified maximum; this, the Commission was of the view, would enable the industry to pay a minimum price to cane growers without incurring any loss. The size of buffer stock was placed at 12 lakh tonnes. The Commission recommended additional capacity creation of the order of 12.5 lakh tonnes and 18 lakh tonnes during the Fourth and Fifth Plan periods, respectively. The Commission also suggested a minimum size for a unit at 1,250 tonnes per year with a provision for expansion upto 2,000 tonnes. The Com-

mission did not favour very large units and observed thus: "A large size factory of 2,000 tonnes or more would require an area of nearly 20 thousand acres to feed it in sub-tropical belt". The Commission was not in favour of the continuance of uneconomic units and recommended their merger with healthy units or shifting to areas better suited to sugar cultivation. For setting up new factories, the Commission endorsed the Government policy of restricting them to the co-operative sector except for those regions/areas where co-operative or government sectors were not in a position to set up new units; in such regions/areas, the private sector could be allowed to create capacity by setting up new units.

In September 1970, Government of India appointed the Sugar Industry Enquiry Commission under the Chairmanship of Deep Narain Sinha with comprehensive terms of reference: (i) to study the working of sugar industry in all its aspects, with particular reference to the conditions of its plants and machinery, (ii) to examine the inadequacies in the performance of the industry and the causes thereof, to pinpoint the causes for a large number of sick sugar units, (iii) to study the progress and the working of sugar mills in the co-operative sector, (iv) to identify the factors responsible for large fluctuations in sugarcane production and its processing into *gur, khandsari* and sugar and to make suggestions for securing stable conditions and balanced development in all these areas, and (v) to suggest a viable relationship between sugarcane suppliers and the owners of sugar mills with particular reference to the supply of sugarcane and the payment of cane price. In respect of the problem of instability of sugarcane supply, the Commission suggested that Government should announce remunerative sugarcane prices and sugarcane cultivators should enter into agreement with sugar mills to produce sugarcane in accordance with the requirements of factories and supply sugarcane to them according to the agreement. The erratic supply of cane to factories could be greatly stabilised if cane growers could be held to abide by their agreements for supply of cane in the years of shortage. The Commission also recommended a close relationship between farmers and sugar factories and the promotion of sugarcane farms by the sugar factories by providing research facilities. Regarding capacity expansion, the Commission recommended that crushing capacity should be increased to 6.24 lakh tonnes per day by 1985-86 from 3.16 lakh tonnes in 1970-71 and stressed that licences to new sugar

factories should be issued after examining the availability of cane, and the setting up of new units in areas where cane potential was very little should be discouraged. The Commission also suggested that the existing units should be expanded up to 3,000 - 4,000 tonnes of daily cane crushing capacity and the expansion of existing units up to 2,000 tonnes of cane per day should be exempted from licensing-restriction.

In 1974, the Government of India constituted yet another Committee under the Chairmanship of S. V. Sampath (i) to examine the cost of establishing a new sugar factory of 1,250 tonnes daily cane crushing capacity and suggest ways and means of reducing the total cost of such project, (ii) to suggest minimum economic size of a new sugar factory in the context of increasing cost of construction, plant and machinery, and (iii) to suggest various incentives and other measures for making new sugar factories economically viable. The Sampath Committee recommended varying proportions of quotas of sugar for free sale, with the ratio of free sale sugar increasing "disproportionately" to the percentage of recovery and proportionately to the cost of plant and machinery. The share of sugar for open market sale was thus to vary from 40 per cent to 100 per cent depending on the percentage of recovery and cost of plant and machinery. The factory with the lowest recovery and the highest cost got the highest (100 per cent) quota for free sale.

In 1980, the Government of India set up a High Level Committee under the chairmanship of L. Kumar, to make a detailed study of the cost structure of the industry and to make necessary recommendations regarding levy price, etc. The Committee recommended new levy prices based on the statutory cane prices (from July 1975, the Government was fixing the levy prices based on actual cane prices paid by the factories and on the realisation from open market sales of sugar). The High Level Committee reiterated the importance of creating a buffer stock. It recommended the creation of Sugar Development Fund (SDF) also so that the sugar factories may be provided with seed capital to avail of institutional finance for rehabilitation and modernisation. In pursuance of the recommendations of the High Level Committee, the Government of India, under the Sugar Development Fund Act, 1982, set up a Fund by transferring the proceeds of sugar cess collected under the Sugar Cess Act, 1982, for rehabilitation/modernisation of sugar industry, development of

sugarcane by the sugar industry and for grants to establish institutions for research projects aimed at the development of sugar industry. In November 1982, the Act was amended to cover finance for building up buffer stock of sugar. As on December 31, 1986, the Fund had resources of Rs. 361 crores. Upto December 1986, an amount of Rs 23.4 crores was paid to sugar factories as charges for holding buffer stocks and Rs 16.78 crores was sanctioned for sugarcane development and modernisation and rehabilitation.

The industry has also been the subject of enquiry by many research scholars.[1] Amongst them, an early study is that of P.C. Joshi who argued that fluctuations in the area under sugarcane and instability in sugar output emanate from the fixation of minimum sugarcane price. Joshi suggested many remedies for the chronic instability of sugarcane and sugar production. To quote him, "The basic cause of periodic fluctuations in the area under sugarcane and in sugar output resides in the fact that the fixation of the minimum sugarcane price prevents sugarcane farmers from adopting the supply of sugarcane to the demand of sugar, while because of sugar price control or artificial stimulants to 'maximise' sugar output, sugar production either seriously falls short of demand or overshoots it".[2]

Sanjay Baru's study[3] looks into the problems of sugar industry from the angle of the economies of scale and modernisation. An important conclusion of the study is, "while significant mill-level economies of scale do operate in the sugar industry, such economies are not always exploited due to specific historical, institutional and locational barriers which act as fetters on capacity expansion". According to Sanjay Baru, sugar mills resort to diversification into other areas to avoid sickness and to overcome their inability to exploit scale economies. Besides, *State Bank of India Monthly Review* (April and May 1986) carried a fairly comprehensive review of the industry.

It may be stated that the Commissions and Committees generally studied the industry from the point of view of cost structure as they were asked to recommend the price fixing formula so that Government could fix a fair sugar price. The physical performance of the industry was not given sufficient attention in these studies. The growth of the industry over a long period and its implications were not looked into elaborately by any except the 1974 Sugar Industry Enquiry Commission.

Scope and Methodology

A detailed review of the earlier reports and studies mentioned above reveals that problems of the industry primarily have been instability of sugar production, inadequate capacity expansion, lack of modernisation and sickness in sugar units. This study attempts to investigate whether the sugar industry continues to face instability. The various Commissions and Committees have observed that uncertainty in the supply of cane to sugar factories need to be removed so that sugar industry does not face large ups and downs in its production. The present study also looks into this problem. The study therefore addresses itself to the issues relating to the behaviour of sugar production, capacity utilisation and expansion of installed capacity. The industry's performance is also assessed in relation to the targets of production and installed capacity created under the various Five Year Plans. In brief, we intend to assess mainly the physical performance of the industry.

The analysis has been attempted both at all-India level and States level. The data on installed capacity and sugar production are taken from various issues of *Indian Sugar* and *The Indian Sugar Year Book* published by the Indian Sugar Mills Association. The figures for comparing the performance of co-operative sector with that of private sector are collected from *Co-operative Sugar* published by the National Federation of Co-operative Sugar Factories (New Delhi). The growth rates are the compound growth rates. Instability in sugar production and cane production is measured by co-efficient of variation.

II

Physical Performance of Sugar Industry

1. *Growth of Installed Capacity*

The annual compound growth rates of installed capacity are presented in Table 1. The installed capacity at 17.8 lakh tonnes at the end of the First Five Year Plan rose to 24.5 lakh tonnes by the end of the Second Plan (1960-61) and to 77.8 lakh tonnes by end-June 1987. The capacity increased at a compound growth of 1.3 per cent during the First Plan; it expanded at a much higher rate of 6.5 per cent during the Second Plan. During the Third Plan, the industry was able to add 4.8 lakh tonnes of production capacity as compared with 6.7 lakh tonnes during the Second Plan. As a result, the

growth of capacity was only 3.6 per cent during the Third Plan. During the period of the first three plans, the Government of India did not favour large increases in the capacity of food processing industries. From 1952, the development of the sugar industry along with the other industries was regulated by the Government of India under the provisions of Industries (Development & Regulation) Act, 1951. The substantial expansion and setting up of new units were controlled through the licensing system. In November 1966, however, Government allowed the industries to expand without obtaining its licence up to 25 per cent of installed capacity attained by way of balancing equipments. The expansion of existing capacity, in addition to the above facility, was allowed without a licence, provided the value of investment in fixed assets did not exceed Rs. 1 crore. These facilities got reflected in the higher growth rate achieved by the sugar industry during the Fourth Plan period when the growth of capacity was 8.0 per cent per annum. However, after the Fourth Plan, the rate of growth of capacity again started declining. During the Fifth Plan, the capacity increased at the rate of 6.8 per cent which declined to 4.3 per cent during the Sixth Plan. During the first two years of the Seventh Plan, capacity expansion was only at the rate of 2.6 per cent per annum.

One of the factors contributing to the decline in the growth rates of industry was the continuous losses incurred by the industry. According to the Reserve Bank of India's studies on *Finances of Medium and Large Public Limited Companies*, profits after tax as a percentage of net worth were negative for sugar companies in 1975-76 and 1978-79. The profit after tax ratio was 0.7 per cent in 1977-78 and 3.4 per cent in 1979-80. During 1983-84 and 1984-85 again the industry incurred losses. Only in 1976-77, profits after tax as percentage of net worth stood at 9.0 per cent.

It may be recalled that the Sugar Industry Enquiry Commission (1974) had observed in this connection thus: "It will be seen that the private limited, partnership and proprietary group, even with comparatively low capital cost have given a very poor performance. The co-operative sector has not been able to earn adequate profits as most of these factories were established after 1960 with high capital cost involving a large depreciation and heavy interest charges, not offset by savings in wages or increased efficiency."[4] The picture has not changed since then. Yet another factor inhibiting the growth of the industry has

been the diversion of resources from sugar industry to more profitable areas. This combined with non-availability of adequate supply of cane have discouraged the increase in capacity, leading to setting up of mills of small capacity. *The Report of the Committee on Take-over of Sugar Mills* pointed out that the business houses in UP were 'diverting resources' outside the sugar mill industry (and indeed outside the State of UP) "instead of investing the same for renovation or expansion of the sugar mills".[5] The same point has been again reinforced in another study "A striking finding of the study is that sugar units

Table 1: Growth of Installed Capacity

(In lakh tonnes)

Period of Five Year Plans	During Five Year Plans			
	Targets	Licensed Capacity	Actual Installed Capacity	Achievement as Percentage of Target
1	2	3	4	5
First Five Year Plan (1950-51 to 1955-56)	20.3	—	17.8 (1.3)	87.7
Second Five Year Plan (1956-57 to 1960-61)	25.4	28.8	24.5 (6.5)	96.5
Third Five Year Plan (1961-62 to 1965-66)	35.6	43.4	29.3 (3.6)	82.3
Fourth Five Year Plan (1969-70 to 1973-74)	53.0	53.0	43.0 (8.0)	81.1
Fifth Five Year Plan (1974-75 to 1978-79)	60.0	N.A.	59.9 (6.8)	98.5
Sixth Five Year Plan (1980-81 to 1984-85)	80.0	85.1	73.9 (4.3)	92.3
Seventh Five Year Plan (1985-86 to 1989-90)	107.0	95.9	77.8 (2.6) (End-June 1987)	—

Note : Figures in brackets are compound growth rates during the Five Year Plans.

Source: 1. For the First Plan to Fifth Plan, see Ministry of Agriculture (Government of India), *Report of Sugar Industry Enquiry Commission (1974)*.

2. a) For the Sixth Plan and Seventh Plan targets; see Planning Commission (Government of India) documents of Five Year Plans, Planning Commission, (Government of India) and

b) For Licenced and installed capacity see RBI, *Report on Currency and Finance, 1985-86 and 1986-87.*

have not used a good part of their resources for creating productive capacity and diverted a substantial amount to invest in financial assets during the year 1974-75 to 1984-85 and earned income by way of interest and dividend".[6]

To the extent, restrictions on capacity creation have hindered the growth of the industry, the Government has adopted a pragmatic approach, because the fast rising trend in consumption of sugar in recent years warranted adequate growth of capacity. The Planning Commission in its Seventh Plan document has observed that "pragmatic approach needs to be adopted in creating additional capacity in the sugar industry. Due consideration should be given for expansion of the existing units so that they could reach optimum capacity and diversify their activities to utilise by-products".[7] As a follow-up of the above recommendations, Government of India have permitted expansion of per day crushing capacity of an existing unit up to five thousand tonnes. However, this step alone is not considered enough to remove the shortage in installed capacity. The high cost of plants and machinery has been discouraging the expansion of capacity. According to a study,[8] the minimum project cost of sugar increased from Rs. 1,086 per tonne in 1967-68 to Rs. 3,229 per tonne in 1977-78. The maximum project cost was estimated as Rs. 1,282 per tonne and Rs. 4,028 per tonne for the respective years. The latter project cost increased to Rs. 6,700 per tonne in 1984-85. The Planning Commission's Working Group on Sugar for the Seventh Plan estimated that 81 new units with a capacity of 1,500 TCD (crushing capacity per day in tonnes) each will have to be set up and 15 factories will need expansion to reach the target involving an investment of Rs. 810 crores and Rs. 324 crores, respectively. This concern about the rising cost has been voiced in the Seventh Plan document which observed that "steep escalation in the project cost has rendered establishment of new projects and expansion unviable. A review of the incentive scheme for sugar factories is called for. Another problem which requires to be tackled on a priority basis during the Seventh Plan is the modernisation/rehabilitation of uneconomic/sick units".[9]

2. *Production Targets and Achievements*

The uneven nature of sugar production is depicted in the 36 Year series presented in Statement I. Generally, this industry witnesses

a production cycle with 2 to 3 years of positive growth followed by 1 to 2 years of absolute fall. As per the Planwise data in Table 2, the level of sugar production achieved at the end of each

Table 2: Growth of Sugar Production During the Five Year Plans

(Lakhs Tonnes)

Plan Period	Production Target	Actual Production at the End of Each Plan	Highest Level of Production During the Plan	Annual Compound Growth Rate of Sugar Output	Lowest Level of Sugar Production During the Plan
1	2	3	4	5	6
First Five Year Plan					
1950-51 to 1955-56	15.2	18.6	18.6 (1955-56)	10.8	14.6
Second Five Year Plan					
1956-57 to 1960-61	22.9	30.3	30.3 (1960-61)	10.5	23.0
Third Five Year Plan					
1961-62 to 1965-66	35.0	35.3	35.3 (1965-66)	3.2	28.3
Fourth Five Year Plan					
1969-70 to 1973-74	47.0	39.5	42.6 (1969-70)	2.1	37.9
Fifth Five Year Plan					
1974-75 to 1978-79	57.0	58.4	64.6 (1977-78)	8.2	52.4
Sixth Five Year Plan					
1980-81 to 1984-85	76.4	61.4	84.4 (1981-82)	9.8	63.2
Seventh Five Year Plan					
1985-86 to 1989-90	102.0	70.1 (1985-86) 85.0 (1986-87)*	—	—	—

* *Provisional*

Notes : The brackets under column 4 show the years in which highest level of production was achieved during the Plan period.

Sources: For targets, see 1. Planning Commission, Government of India, documents of various Five Year Plans and, 2. *Report of Sugar Industry Commission (1974)*, Ministry of Agriculture, Government of India.
For production, *Indian Sugar*, Indian Sugar Mills Association, New Delhi.

of the Five Year Plans shows that the industry was able to reach the targetted production during the first three Plans. The target fixed for the Fourth Plan could not be reached due to inadequate supply of sugarcane. The production target for the Fifth Plan was set at 57 lakh tonnes; though the target was exceeded in 1977-78 at 64.6 lakh tonnes, it declined to 58.4 lakh tonnes in 1978-79, the last year of Fifth Plan. During the Sixth Plan, the production target of 76.4 lakh tonnes was pierced through in the second year of the Plan (1981-82) at 84.4 lakh tonnes but the production fell to 61.4 lakh tonnes by its last year, 1984-85. The sugar production target for the Seventh Plan was fixed at 102 lakh tonnes. With considerable departure from the past in regard to price controls on cane and levy sugar and liberal expansion permitted for the existing units, this target is likely to be achieved; even the historical production cycle may be diluted.[10] The sugar output has recorded increases during the last three years (3.8 per cent in 1984-85, 14.2 per cent in 1985-86 and 21.2 per cent in 1986-87). The industry produced 85.0 lakh tonnes of sugar in 1986-87

3. *Instability in sugar production*

The analysis of sugar production, however, reveals that industry has continued to record instability in its performance. One of the factors generally cited as the ultimate source of instability in the production of sugar is the recurring fluctuations in the area under sugarcane crop. In this paper an attempt is made to see whether instability in sugar production has decreased over the years and whether instability has been higher or lower in sugar production than that in the area under sugarcane crop or sugarcane production. To analyse this aspect, coefficients of variation in sugar production, area under sugarcane crop and cane production presented in Table 3, have been used. It

Table 3. Trends in Co-efficient of Variation in Area under Sugarcane Crops Sugarcane and Sugar Production

(In Percentage)

Period	Area Under Cane Crop	Cane Production	Sugar Production
1950-51 to 1970-71	17.4	23.7	36.9
1971-72 to 1985-86	9.3	14.3	29.4

can be seen that the value of co-efficient of variation in case of sugar production during the period, 1950-51 to 1970-71 at 36.3 per cent was higher than that in the area under cane crop at 17.4 per cent and cane production at 23.7 per cent. However, during 1971-72 to 1985-86 sugar production reflected greater stability than that in the earlier period as the value of co-efficient declined to 29.4 per cent. The improvement was accompanied by sharp reductions in the instability in area under sugarcane and cane production. The co-efficients of variation in their case decreased to 9.3 per cent and to 14.3 per cent, respectively from those during 1950-51 to 1970-71. The co-efficients of variation, however, show higher degree of variability in sugar production than that shown by area under sugarcane crop and cane production during both the periods. The analysis of co-efficient of variation shows that sugar production is much more unstable than the harvested area under sugarcane. The higher instability in sugar production implies that besides the fluctuation in area under sugarcane and cane production, there are a few other factors also which influence the performance of sugar industry. Important amongst these are: minimum prices for cane fixed by Government, prices actually offered and paid by sugar factories and *gur* and *khandsari* manufacturers, system and organisation of cane supplies, cane arrears, execution of agreements between farmers and factories and fulfilment of such agreements and contiguity between sugarcane farmers and sugar factories.

The incentives to farmers after periods of scarcity of sugar and to sugar factories during the period of bumper sugarcane crop and stiff competition for sugarcane during the season of scarcity from *gur* and *khandsari* manufacturers are some of the more prominent factors which lead to instability in sugar output and are discussed in this paper.[11] Government of India fixes minimum statutory cane price to protect the incomes of farmers or to encourage the larger area under sugarcane after the season of scarcity. As the price of sugarcane is revised upward frequently to a comparatively attractive level, cane cultivators respond to it by bringing more area under sugarcane crop. Government provides fiscal incentives to sugar factories during the season of large sugarcane crop with a view to maximising the output of sugar and to avoiding a sugarcane glut in the open market. As a result, sugar production exceeds the demand. This process cannot continue indefinitely and leads to two consequences.

First, the sugarcane price starts declining in the open market and secondly, sugar starts piling up in factories leading to a decline in the prices of sugar in the same season.

In such a situation farmers react by shifting the area from sugarcane to other crops. But the response of farmers towards the substitution of cane crop for other crops is partial because of the expectation that the factories will continue to crush the same quantity of sugarcane in the next season. As such, the excess supply of sugarcane gets carried over to the next season, while the demand for cane from sugar factories lags behind the production. The inevitable course for sugar factories in the wake of carrying over large stocks is to cut down production. The consequence of this is that the farmers, unable to sell their entire production of sugarcane to sugar factories, turn to *gur* and *khandsari* producers who operate in a buyers' market and purchase cane at low prices. This downward movement in sugarcane price in open market is followed by a shrinkage in the area under cane for the next season leading to shortage in cane availability and severe competition from *gur* and *khandsari* producers who are able to offer higher price than that offered by the sugar factories. Sugar factories are not in a position to compete with *gur* and *khandsari* producers because the former are obliged to sell a part of their sugar production at levy prices. It can be seen from Table 4 (columns 5 and 6) that during the year in which sugarcane production declined, percentage utilisation of cane by sugar factories also declined except for 1972-73 and 1978-79 when sugar price control was lifted. The large diversion of cane takes place to *gur* and *khandsari* during trough years. The sugar factories, therefore, inevitably have to be content with lower supplies of sugarcane. The lower level of production of sugar during the season of shortage of cane again pushes up the sugar prices. The rise in sugar prices prompts the Govt. to again revise upward the sugarcane prices resulting in more area being brought under sugarcane. The increase in sugarcane price as revised by the Government and upward movement in *gur* and *khandsari* prices again encourage the farmers to increase the production of sugarcane for the next season. The Sugar Enquiry Commission was also critical of this situation as early as in 1965. The Commission came to the conclusion that "although in an important sense the imbalances in the industry have been caused by the fluctuations in the size of the cane crop, they have often been aggravated by the policy measures that followed them.

Outstanding amongst the defects of the present system of control is its partial character in the sense that it applies to sugar but leaves *gur* and *khandsari* free. By controlling sugar prices at a level determined, in the main, by the minimum price of sugarcane, it makes the minimum price a fixed price, thereby snapping the capacity of sugar industry to compete with *gur* and *khandsari* for the limited cane

Table 4: Capacity Utilization Ratio and Capacity Increase in Sugar Industry

Year	Installed Capacity (In Lakh Tonnes)	Capacity Utilization Ratio (In Percent)	Growth of Installed Capacity (Increase/ Decrease in Percentage)	Percentage Increase/ Decrease in Sugarcane Production	Percentage of Cane Utilization by Sugar Factories
1960-61	24.5	123.7	—	+21.0	28.0
1961-62	25.2	108.5	2.8	+ 5.9	26.9
1962-63	26.9	79.5	6.7	-11.6	22.6
1963-64	28.7	89.1	7.0	+13.4	24.7
1964-65	30.5	105.8	6.3	+17.1	27.4
1965-66	29.3	109.5	5.6	+ 1.6	29.4
1966-67	33.8	63.0	4.7	-25.1	23.3
1967-68	34.7	64.7	2.7	+ 2.9	23.7
1968-69	36.1	153.9	4.1	+30.6	32.1
1969-70	35.6	119.8	—	+ 8.3	33.8
1970-71	37.0	101.1	4.1	- 6.4	30.2
1971-72	39.2	79.3	5.9	-10.1	27.3
1972-73	41.5	93.2	6.0	+ 9.9	32.4
1973-74	43.1	91.7	3.7	+12.8	30.7
1974-75	45.0	106.5	4.5	+ 2.5	33.6
1975-76	46.8	91.0	4.1	- 2.6	29.3
1976-77	51.7	93.7	10.3	+ 8.8	31.9
1977-78	55.7	115.9	7.9	+15.7	37.0
1978-79	59.1	98.9	6.0	- 4.3	39.5
1979-80	59.8	64.6	1.1	- 4.0	30.6
1980-81	63.1	81.5	5.7	+19.7	33.5
1981-82	64.6	130.7	2.3	+20.8	47.6
1982-83	65.7	125.4	1.7	+ 1.7	43.7
1983-84	68.8	86.4	4.8	- 6.6	33.4
1984-85	74.0	83.2	2.6	- 2.2	35.3
1985-86	77.8	91.5	4.1	1.9	40.0
1986-87	78.6	108.5	3.4	6.9	—

Source: *Indian Sugar Year Book* (various issues), Indian Sugar Mills Association (New Delhi)

supplies".[12] With a view to removing these anamolies, the Commission (1965) recommended that (i) reserved areas should be made more compact, (ii) existing *khandsari* units and power crushers should be completely excluded from reserved areas or adequate supply should be provided to both the sugar factories concerned and *khandsari* units, (iii) all the *khandsari* units and power crushers should be licensed and entry of new units of *khandsari* and power crusher within the 15 to 20 kms. area of sugar factory should be banned and (iv) Government should levy excise duty or some other suitable levy on *khandsari* units and power crushers to restrict their paying capacity at a higher price than that paid by sugar factories and to shift *khandsari* and power crusher units from reserved area. However, these recommendations have not been implemented fully in all states and a competitive relationship between sugar factories and *khandsari* units still continues with the same consequences.

The Sugar Industry Enquiry Commission (1974), recommended for binding agreements between farmers and factories also. If farmers are legally bound not to divert sugarcane to *gur* and *khandsari* units during the period of shortage, the uncertainty of cane availability for sugar factories can be removed.

In almost all States, agreements between farmers and sugar factories exist in varying forms, but their implementation has been weak except in a few States like Maharashtra. In Maharashtra a farmer can loose the membership of his co-operative sugar factory, if he fails to supply cane to and diverts it instead to *gur* and *khandsari* units. In other States like U.P., penalty on non-fulfilment of the agreement is nominal. Although supplies of cane to sugar factories come under the perview of Government agencies, they are not able to control the diversion of cane as the number of farmers is very large and they are spread over long distances from the sugar factories.

Many suggestions have surfaced so as to resolve this conflict. First, the statutory sugarcane pricing may be extended to *gur* and *khandsari* to minimise the fluctuations in the supply of cane to sugar factories. Secondly, cane arrears with sugar factories may be avoided. The diversion of cane from factories takes place due to delays in payment to farmers by sugar factories also. At the end of February 1988, cane arrears were around Rs. 60 crores.[13] The farmers, therefore, prefer to supply cane to *gur* and *khandsari* to receive quick payments.

4. *Capacity Utilisation*

The data on installed capacity, utilisation ratios and annual increases in capacity are presented in Table 4. As referred to earlier, the production capacity of sugar units is estimated on the basis of 22 hours of working per day. Moreover, there is a possibility of under reporting of the capacity. Again during years of sharp increase in sugarcane production, sugar factories work more than 22 hours per day due to the encouragement received by way of fiscal incentives from Government. As a result, capacity utilisation ratio works out to more than 100 per cent in some years.

5. *State Level Performance*

The performance of capacity build-up and capacity utilisation varied from State to State. Table 5 presents a summary picture of installed capacity, State-wise capacity build-up, average capacity utilisation ratios and growth rates of sugarcane and sugar production for the period 1960-61 to 1986-87. Percentage additions to capacity in individual years (State-wise) are presented in Statement II, while statement III gives capacity utilisation ratios. Maharashtra topped the list in capacity addition with more than 20 lakh tonnes compared to U.P. which added just over 8 lakh tonnes. A large portion of new installed capacity has also gone to four other States, namely, Andhra Pradesh, Gujarat, Karnataka and Tamil Nadu which together accounted for more than 32 per cent of the total installed capacity in the country at the end of 1986-87. While Karnataka, Andhra Pradesh and Tamil Nadu together added new capacities to the extent of 17 lakh tonnes, Gujarat acquired 5 lakh tonnes. On the other hand other States like Bihar, Haryana/Punjab and Rajasthan made relatively negligible additions to their existing capacities during this period.

In terms of the State-wise distribution of capacity, two conspicuous changes are the share of Maharashtra moving up from 18.1 per cent in 1960-61 to 32.6 per cent in 1986-87 and that of Uttar Pradesh declining from 41.8 per cent to 23.8 per cent. In Bihar and West Bengal, installed capacity was reduced in 1986-87 as compared to 1960-61.

As regards capacity utilisation, the major sugar producing States, viz., Maharashtra, Uttar Pradesh, Karnataka, Andhra Pradesh and

Tamil Nadu, showed on average, a high level of capacity utilisation between 90 and above 100 per cent. Among the other States which produce about 20 per cent of total sugar output, Haryana/Punjab, Rajasthan and Orissa reported capacity utilisation between 90 per cent and above 100 per cent. The capacity utilisation was very low in West Bengal at 49.6 per cent. Assam and Bihar also utilised capacity between 67 and 70 per cent. The low capacity utilisation in some of the States was obviously due to inadequate cane supplies. The growth rates in Table 5 in respect of installed capacity and sugarcane production revealed that the growth of installed capacity did not take place in accordance with the growth of sugarcane and capacity utilisations. For instance in Gujarat, sugarcane production during 1960-61 to 1986-87, increased at a rate of 5.7 per cent per annum but the installed capacity was increased by about 12 per cent. In Karnataka sugarcane production increased by 3.7 per cent and the capacity utilisation ratio was 91 per cent. In Maharashtra, Haryana/Punjab and Rajasthan, the capacity utilisation ratio was above 100 per cent; however, there was no corresponding increase in the installed capacity.

The Sugar Enquiry Commission (1965) had observed that "instances have been brought to the notice of the Commission of undesirable extra economic consideration having influenced the location of some factories either in unfavourable areas or near an existing factory."[14] The mismatching between growth of installed capacity, cane production and capacity utilisation warrant a long term planning of capacity expansion and corresponding increase in cane production, taking into account the growth of demand for sugar and for other sweetening agents manufactured from sugarcane.

6. *Growth in the Average Size of Sugar Units*

In the history of sugar industry, the Committee on Rehabilitation and Modernisation of Sugar Factories in India (1963), was the first to seriously study the aspect of economic size of a sugar unit. It might be recalled that this Committee had recommended a minimum economic size of 1,500 tonnes of cane crushing a day for the expansion of a unit and above 1,500 to 2,000 tonnes for a new unit with provisions for expansion upto 3,000 to 4,000 tonnes. The Committee defined that "an economic unit is one in which there is a scope for reducing its cost of production". The Committee further recommended that in

Table 5: Average Capacity Utilisation Ratio and Annual Compound Growth Rates of Capacity, Sugarcane Production and Sugar Output 1960-61 to 1986-87

(In Per Cent)

States	Installed Capacity in Lakh Tonnes*		Capacity Utilisation Ratios	Annual Compound Growth Rates			Coefficients of Variation	
	1961	1987		Installed Capacity	Sugarcane Production	Sugar Output	Sugarcane Production	Sugar Production
1	2	3	4	5	6	7	8	9
Major States								
1. Maharashtra	4.44 (18.1)	25.61 (32.6)	109.9	7.0	2.1	5.8	26.2	55.0
2. Uttar Pradesh	10.23 (41.8)	18.66 (23.8)	99.5	2.3	1.7	2.3	12.2	25.9
3. Karnataka	1.19 (4.9)	7.92 (10.1)	90.8	7.6	3.7	16.4	30.2	54.5
4. Andhra Pradesh	1.44 (5.9)	5.71 (7.3)	90.2	5.4	1.0	4.2	18.5	32.2
5. Tamil Nadu	1.25 (5.1)	6.81 (8.7)	92.6	6.7	4.9	7.5	29.3	53.7
Other States								
6. Assam	0.10 (0.4)	0.32 (0.4)	67.5	4.6	3.2	−6.3	21.8	39.7
7. Bihar	3.57 (14.6)	3.48 (4.4)	70.0	−0.1	−2.6	−1.3	14.8	31.0
8. Gujarat	0.28 (1.14)	5.12 (6.5)	85.1	11.8	5.7	1.6	50.6	84.6
9. Haryana/Punjab	1.04 (4.3)	2.76 (2.0)	125.0	3.8	3.2	10.0	16.6	48.0
10. Rajasthan	0.13 (0.5)	0.27 (0.3)	108.5	2.9	2.0	3.6	26.7	56.8
11. Orissa	0.03 (0.1)	0.22 (0.7)	90.0	8.0	5.5	0.4	20.9	50.3
12. West Bengal	0.17 (0.7)	0.15 (0.2)	49.6	0.5	−3.9	−5.4	25.5	57.8
All India	24.47	78.56		4.6	1.9	4.0		

* Figures in brackets are percentage to totals.

Source: Indian Sugar Year Book, Indian Sugar Mills Association, New Delhi.

the light of this approach in our efforts to assess the scope for reducing production cost, most of the units would be more or less uneconomic. The Committee was of the view that the economic capacity is not static. In a free economy capacity rises at a faster rate.

The definition of an economic unit, however, was again examined by the Sugar Enquiry Commission (1965). The Commission was of the view that the efficiency of a unit depended on managerial efficiency and many other factors. The Commission recommended 1,250 tonnes per day as the minimum economic size of a factory with provision for expansion up to 2,000 tonnes. It observed that the economies of scale, which result from having larger units and captive by-product plants, are well known. These will, however, have to be weighed against certain disadvantages peculiar to the industry which depends on a raw material that is perishable and is produced by a large number of small farmers.[15] In the opinion of the Commission, large size factory of 2,000 tonnes or more would require an area of 20 thousands acres to feed the factory with cane in the sub-tropical belt.

However, the economic size of unit is not a static concept. The economic size depends among other things on availability of inputs and the size of market for sugar. This is reflected in the latest licensing policy of the Government of India announced in December 1986. According to the policy, with a view to taking advantage of the economies of scale as well as facilities of modern technology subject to the availability of sugarcane, the sugar units would now be licensed for an initial capacity of 2,500 tonnes of crushing capacity per day and not 1,250 tonnes. Expansion in existing capacity would be allowed up to 3,500 tonnes per day. Moreover, capacity can be expanded upto 5,000 tonnes, given the availability of sugarcane by way of increase in production through a rise in productivity.

Size Profile of the Industry

Sanjay Baru made a State-wise by size-wise analysis of 286 sugar mills according to their crushing capacity in 1980 (See Table 6). As per his study a large number of units (187 out of 286) had below 1,500 tonnes crushing capacity per day. About 14 per cent of sugar mills had crushing capacity below 1,000 tonnes per day and more than 50 per cent of the units were of medium size with capacity

ranging between 1,000 to 1,500 tonnes per day. A large number of medium size units were located in Uttar Pradesh (41), Maharashtra (49), Bihar (12) and Andhra Pradesh (13). On the other hand, the low-size sugar mills were concentrated in Uttar Pradesh (20) and Bihar (9). Of the large size units (99), the crushing capacity of 39 units ranged between 1,500 tonnes and 2,000 tonnes and that of 28 units between 2,000 tonnes and 3,000 tonnes. There were 32 units of crushing capacity above 3,000 tonnes. It would be seen that one-third of large units were located in Uttar Pradesh and one-fourth in Maharashtra. These units were generally established in the 1970's to obtain economies of scale.

The State-wise average size of units can be analysed in terms of capacity of production also. At the all-India level, the average sugar production capacity has risen over the years. In 1960-61, the average size of sugar unit at the all-India level was 14.0 thousand tonnes per annum (Table 7). In 1970's, a large number of big size units were set up and the average size of sugar units increased to 17.7 thousand tonnes per annum in 1970-71 and 22 thousand tonnes in 1986-87. The size of unit varied among the states. The average size of units in 1986-87 was 42.6 thousand tonnes in Gujarat, 27.2 to 33.0 thousand tonnes in Karnataka, Maharashtra and Tamil Nadu and 14 to 18

Table 6: State-wise Distribution of Sugar Mills in Major Sugar Producing States According to Crushing Capacity

States	Size in Tonnes of Crushing Capacity Per Day			
	1-1000	1000-1500	1501-2000	2001 and above
1	2	3	4	5
Uttar Pradesh	20	41	10	19
Bihar	9	12	6	—
Punjab	3	4	—	1
Haryana	—	2	2	—
Gujarat	—	10	1	3
Maharashtra	3	49	11	16
Tamil Nadu	1	11	4	6
Andhra Pradesh	4	13	4	6
Karnataka	1	13	1	6
Total	41	146	39	60

Source: Baru, Sanjay "Scale, Locations and Diversification—Sugar Mills Industry in India", *Economic and Political Weekly*, May 28, 1988.

thousand tonnes in Assam, Andhra Pradesh, Haryana/Punjab, Uttar Pradesh and West Bengal. However, the size of units was relatively small in Madhya Pradesh, Orissa and Rajasthan ranging between 7 to 8 thousand tonnes.

Table 7: Average Size of Sugar Units

(In Thousand Tonnes)

State	1960-61	1970-71	1986-87
1	2	3	4
Assam	10.0	5.0	16.0
Andhra Pradesh	12.0	14.9	18.4
Bihar	17.0	13.6	13.3
Gujarat	14.0	26.1	42.6
Haryana/Punjab	17.3	12.8	14.5
Karnataka	14.9	22.2	33.0
Madhya Pradesh	9.6	6.5	8.0
Maharashtra	27.2	24.6	28.1
Nagaland	—	—	12.0
Orissa	0.3	6.0	7.3
Rajasthan	11.0	7.3	9.0
Tamil Nadu	10.4	20.8	27.2
Uttar Pradesh	14.6	17.3	18.1
West Bengal	11.0	15.0	17.5
All India	14.1	17.7	22.0

Source: 1. *Indian Sugar Year Book 1983-84*, Indian Sugar Mills Association, New Delhi.

2. *Sugar Cooperative*, National Federation of Cooperative Sugar Factories Ltd. (New Delhi).

The factors which have acted against some of the sugar mills expanding generally to an economic size or setting up new large unit are two. First, in many areas sugarcane is not available in adequate quantity in a given hinterland. If the sugarcane has to be transported from long distance, the sugarcane dries up leading to lower recovery rate. Secondly, the sugar units have diversified their activities by entering into cement, chemicals etc., leaving the sugar industry starved of investment.

7. *Changes in Quality of Sugar*

The quality improvement in sugar output can be seen by examining the advancement made in colour grades and grain size. According

to the Indian Sugar Standards till 1983-84, there were two major grades of colour and 5 grades of grain size. The colour grades were 29 and 30 and for the grain size, the grades were A, B, C, D and E. Table 8 gives the percentage distribution of sugar output according to colour grade and grain size. According to colour grades, improvement has been substantial. In 1960-61, as much as 96.9 per cent of output was graded as 29 colour grade and the industry was not manufacturing any quantity of 30 colour grade. In 1970-71, 90.9 per cent of sugar output was graded as 30 colour and in 1985-86, this percentage had further risen to 97.6. As regards grain-size grades, grain A Standard represents the boldest grain and grain D and E the small. The size of sugar showed average improvement during 1960-61 to 1965-66 as the percentage of E and D grades were falling

Table 8: Distribution of Sugar Output According to Colour and Grain Size
(In Per Cent)

	Percentage Distribution of Sugar Output According to Colour					Percentage Distribuiton of Sugar Output According to Grain Size					
	ISS COLOUR					ISS GRAIN SIZE					
	27	28	29	30	Ungraded	A	B	C	D	E	Ungraded
1960-61	0.1	2.7	96.9	—	0.3	4.7	8.0	24.2	39.3	22.9	0.3
1965-66	n	2.8	30.5	66.5	0.2	0.7	4.8	42.6	36.9	14.7	0.2
1970-71	—	—	8.7	90.9	0.4	1.3	6.4	34.1	40.9	16.9	0.4
1975-76	—	—	6.0	93.6	0.4	0.8	3.4	31.4	49.3	14.6	0.4
1976-77	—	—	3.4	96.2	0.4	0.6	4.2	27.5	48.8	18.5	0.4
1977-78	—	—	10.7	88.9	0.4	0.5	4.3	25.7	49.5	19.7	0.4
1978-79	—	—	5.0	94.6	0.5	0.5	4.3	25.7	49.5	19.7	0.4
1979-80	—	—	5.7	93.7	0.4	0.7	4.9	31.8	46.5	15.4	0.4
1980-81	—	—	2.3	97.2	0.5	0.3	3.7	27.4	52.1	16.0	0.5
1981-82	—	—	4.4	95.2	0.4	0.2	3.1	25.1	51.4	18.8	0.4
1982-83	—	—	2.9	96.7	0.4	0.1	3.7	26.0	51.5	15.3	0.4
1983-84	—	—	2.8	96.3	0.9	0.1	4.2	32.0	47.3	12.7	0.9
						L		M		S	
1984-85	—	—	1.9	97.6	0.5	4.0		32.5		60.8	
1985-86	—	—	1.8	97.6	0.6	1.2		34.6		61.8	

Means not available, n stands for negligible.

Source: 1. *Indian Sugar Year Book*, (Various Issues), Indian Sugar Mills Association (New Delhi).

and that of C grade was rising. However, there was a marginal fall in the shares of A and B grade sugar. On an average, improvement in the size and colour of sugar occured during 1960-61 to 1965-66. During 1965-66 to 1982-83, the percentage share of sugar output in A and B grades declined as compared to increases in the shares of D and C grades. In 1983-84, the share of B grade increased by 0.9 percentage point whereas share of C grade increased by 6 percentage points. The share of E grade declined from 17 per cnt in 1960-61 to 10 per cent in 1983-84. However, from 1984-85 onwards, sugar is graded in three grain sizes, viz., large (L), medium (M) and small (S). In 1984-85 share of S grain size was 62.5 per cent and that of M grain 34.6 per cent. L grain size accounted for 4.1 per cent.

III

Comparison of Private and Co-operative Sectors

An important post-independence development in the sugar industry has been the setting up of sugar factories in the co-operative sector due to the Government policy of giving preference to this sector in the matter of licensing. As a result of this policy, applications from joint-stock companies for licences were considered only for areas where co-operatives could not be organised. The policy had a favourable impact on the expansion of industry in the co-operative sector. A comparative performance of sugar units in the co-operative and private sectors is given in Table 9. However, private sector includes Government sugar mills also. As the number of Government mills is small and the comparable figures are not available for earlier years, the analysis relating to Government sector was not done separately.

1. Faster Growth of Capacity in Co-opertive Sector

The above policy preference is duly reflected in a faster growth of the co-operative sugar sector. During 1960-61 to 1970-71, 43 units were set up in the co-operative sector as against the closure of 1 unit in the private sector. As a result, the number of private sector units declined from 144 to 143 during the period. During the last fifteen-year period from 1970-71 to 1985-86, 133 units were set up in the co-operative sector and 23 new units were set up in the private sector. In the same period 11 units were closed in the private sector leading to a net increase of only 12 units.

Installed capacity in the co-operative sector increased from 5.9 lakh tonnes in 1960-61 to about 43 lakh tonnes in 1985-86. In the private sector, capacity increased from 16.6 lakh tonnes to 33.2 lakh tonnes during the same period. In terms of annual additions to capacity, during 1960-61 to 1970-71, capacity grew at the rate of 8.6 per cent per annum in the co-operative sector and at 3.6 per cent

Table 9: Production and Installed Capacity in Private and Co-operative Sectors

Year	No. of Factories		Production		Installed Capacity	
	Co-operative sector	Private & other sectors£	Co-operative sector (In Lakhs tonnes)	Private & other sectors£ (In Lakhs tonnes)	Co-operative sector	Private & other sectors£
1	2	3	4*	5*	6*	7*
1960-61	30	144	4.5	25.8	5.9	16.6
			(75.8)	(155.5)	(14.8)	(17.9)
1970-71	73	143	12.6	24.8	13.4	23.6
			(94.1)	(105.0)	(17.3)	(16.5)
1980-81	149	166	29.0	22.5	33.1	30.1
			(87.8)	(74.7)	(22.2)	(18.1)
1981-82	153	167	46.0	38.3	33.7	30.8
			(136.5)	(124.4)	(22.1)	(18.5)
1982-83	156	164	45.1	37.2	34.6	31.0
			(130.2)	(119.9)	(22.2)	(18.9)
1983-84	160	165	31.9	27.3	36.9	31.9
			(86.4)	(85.6)	(23.0)	(19.3)
1984-85	178	160	36.4	25.1	40.7	32.2
			(89.4)	(78.2)	(22.8)	(20.1)
1985-86	186	155	41.1	29.0	42.8	33.2
			(96.1)	(87.5)	(23.0)	(21.4)
	No. of factories added(+)& closed(−)		**Compound Growth rates**			
During 1960-61 to 1970-71	+43	−1	11.0	−0.39	8.6	3.6
1970-71 to 1980-81	+96	+23	8.7	−0.98	9.4	2.5
1980-81 to 1985-86	+37	−11	7.2	2.6	2.6	2.0

Notes: £ Other sector represents essentially a small number of Govt. units.

* Figures in brackets under column 4 and 5 relate to capacity utilisation in percent and under column 6 and 7, average size per unit in thousand tonnes.

Source: Various issues of *Co-operative Sugar*, National Federation of Co-operative Sugar Factories Ltd.

per annum in the private sector. During the periods 1970-71 to 1980-81 and 1980-81 to 1985-86 also the growth of capacity was higher in the co-operative sector. An interesting feature of sugar industry is that the average size of a unit was larger in the co-operative sector than in the private sector.

2. *Co-operatives come to Dominate Sugar Production*

The level of sugar production in the co-operative sector showed a marked increase. During the periods 1960-61 to 1970-71 and 1970-71 to 1980-81, the growth of sugar production in the co-operative sector was 11.0 per cent and 8.7 per cent per annum respectively; whereas in the private sector the production recorded an absolute decline of 0.4 per cent and 0.98 per cent per annum in the same period. Even during the latest period 1980-81 to 1985-86, when sugar production in the private sector achieved a positive increase of 2.6 per cent, the rate of growth was, however, still higher at 7.2 per cent in the co-operative sector.

The co-operative sugar units produced 4.5 lakh tonnes of sugar in 1960-61 accounting for about 15 per cent of total output. In 1985-86, their share was 59 per cent. In the co-operative sector, the average size of a unit in terms of sugar production ranged between 22,200 tonnes in 1980-81 and 23,000 tonnes in 1985-86 whereas for the private sector unit it was a shade lower and ranged between 18,000 tonnes and 21,000 tonnes during the same period.

3. *Higher Capacity Utilization in the Co-operative Sector in the 1980s*

The capacity utilisation in sugar co-operatives improved from 75.8 per cent in 1960-61 to 136.5 per cent in 1980-81 and thereafter it declined to 130.2 per cent in 1982-83. During 1983-84 to 1985-86 capacity utilisation ratio in the co-operative sector fluctuated between 86.4 per cent and 96.1 per cent. In the private sector, capacity utilisation ratio during 1960-61 and 1970-71 at more than 155 per cent and 105 per cent respectively, was much higher than that in the co-operative sector. In the years 1980-81 to 1985-86, capacity utilisation ratio in the private sector units showed a declining trend and it was much lower than that in co-operative sector (Table 9). Thus, during the eightees, sugar units in the private sector faced underutilisation of capacity to a large extent than the units in the co-operative sector.

4. *State-wise Performance of Sugar Units in Co-operative and Private Sectors.*

As regards State-wise comparison between sugar units in co-operative and private sectors, a comparative analysis has been attempted in respect of units in Maharashtra with the largest number of units in the co-operative sector (80 units), followed by Uttat Pradesh (28 units), Andhra Pradesh (18 units), Karnataka (13 units), and Tamil Nadu (11 units). These five States account for 85 per cent of installed capacity in the co-operative sector and more than 50 per cent of total installed capacity of sugar industry in the country. The growth of output was much higher in the co-operative sector than in the private sector during 1971-72 to 1975-76. However, Tamil Nadu was the exception where growth was just less than 1 per cent in the co-operative sector compared to 6.8 per cent in the private sector. During the periods 1976-77 to 1980-81 and 1981-82 to 1985-86, the trend did not show any change and was similar to that observed in 1970-71 to 1975-76. The sugar units in the co-operative sector in all the five States recorded substantially higher growth rate than the units working in the private sector. An important observation which can be made on the basis of data is that co-operative units in Tamil Nadu and

Table 10: State-wise Average Growth Rate of Sugar Production

(*In Per cent per annum*)

States	1971-72-1975-76	1976-77-1980-81	1981-82-1985-86
1. **Andhra pradesh**			
Co-operative Sector	8.6	1.6	35.0
Private Sector	5.7	−0.7	16.9
2. **Karnataka**			
Co-operative Sector	16.1	7.8	12.9
Private Sector	10.4	4.7	12.7
3. **Maharashtra**			
Co-operative Sector	13.8	10.6	6.4
Private Sector	1.8	5.7	1.6
4. **Tamil Nadu**			
Co-operative Sector	0.5	25.3	27.3
Private Sector	6.8	23.6	16.9
5. **Uttar Pradesh**			
Co-operative Sector	10.1	17.0	20.7
Private Sector	2.3	3.1	8.0

Source: Various issues of *Co-operative Sugar*, National Federation of Co-operative Sugar Factories.

Uttar Pradesh achieved higher growth than the co-operative units in Karnataka and Maharashtra during 1976-77 to 1980-81 and 1981-82 to 1985-86. Even Andhra Pradesh achieved substantially higher growth (35 per cent) than the growth recorded in Maharashtra (6.4 per cent) during 1981-82 to 1985-86. As regards private sector units, Maharashtra (1.6 per cent) and Uttar Pradesh (8.0 per cent) had lower growth than Andhra Pradesh, (16.9 per cent), Karnataka (12.7 per cent) and Tamil Nadu (16.9 per cent).

In the case of Andhra Pradesh, Tamil Nadu and Uttar Pradesh, the sugar units in the private sector utilised capacity at a higher rate than the units in the co-operative sector. The analysis of capacity utilisation in the co-operative and private sectors shows wide variations in their performance. In Andhra Pradesh, sugar units in the private sector recorded higher capacity utilisation ratio between 85 per cent and 103 per cent than the units in the co-operative sector (70.7 per cent and 93.1 per cent). In Tamil Nadu sugar units in the private sector had better performance. The capacity utilisation ratio ranged between 72.1 per cent and 118.4 per cent in the private units

Table 11: Average Capacity Utilisation in Co-operative and Private Sector Units (In percent)

States	Period		
	1971-72 to 1975-76	1976-77 to 1980-81	1981-82 to 1985-86
1. **Andhra pradesh**			
Co-operative Sector	93.1	71.7	70.7
Private Sector	102.9	85.0	89.2
2. **Karnataka**			
Co-operative Sector	91.2	96.8	94.2
Private Sector	91.0	79.4	83.3
3. **Maharashtra**			
Co-operative Sector	103.1	105.6	123.4
Private Sector	93.5	98.2	108.2
4. **Tamil Nadu**			
Co-operative Sector	84.5	71.1	101.2
Private Sector	118.4	72.1	103.2
5. **Uttar Pradesh**			
Co-operative Sector	104.9	81.8	103.4
Private Sector	98.8	99.4	112.4

Source: *Co-operative Sugar*, National Federation of Co-operative Sugar Factories Ltd, New Delhi.

and between 71:1 per cent and 101.2 per cent in the co-operative sector. A similar trend was observed in Uttar Pradesh also. It can be seen from Table 11 that in Andhra Pradesh, Tamil Nadu and Uttar Pradesh, private sector units utilised their capacity better than the co-operative units. In Karnataka and Maharashtra co-operative sector units recorded higher capacity utilisation than the private sector units. It can also be seen that the co-operative sector in Maharashtra reported the highest capacity utilisation than the co-operative sugar units in other States.

IV

Conclusions

The sugar industry has shown a remarkable record of output growth rising from 15 lakh tonnes in 1951-52 to 84 lakhs tonnes in 1981-82 and to 85 lakhs tonnes in 1986-87. A conspicuous feature of the sugar industry, however, has been instability in its output. No doubt, the decrease in the value of coefficient of variation in sugar production from 36.9 per cent for the period 1950-51 to 1970-71 to 29.4 per cent for 1971-72 to 1985-86 does suggest that instability in sugar production has tended to decline over the years, which supports the claim made in the *Mid-Term Appraisal of the Seventh Five-Year Plan* to the effect that "probably more important is the fact that the range of fluctuation in production over the 'sugar cycle' has been reduced" (p 115). However, the degree of instability is still high. Besdies, instability in sugar production is much higher than that in area under sugarcane as well as in sugarcane production. The coefficient of variation in area under sugarcane was 17 4 per cent during 1950-51 to 1970-71 which declined to 9.3 per cent during 1971-72 to 1985-86. The reasons for the instability in sugar production are generally rooted in the fluctuations in cane supplies which in turn arise from variations in area under cane crop as farmers' response to incentives in terms of upward revisions in statutory sugarcane prices and stiff competition from *gur* and *khandsari* units for sugarcane supplies in the season of scarcity of sugarcane as well as the absence of a statutory minimum price of cane for the unorganised sector.

The study also shows that the industry faces regional imbalances in capacity requirements and capacity expansion. In some of the States (Punjab, Haryana, Maharashtra and Uttar Pradesh), sugar units generally utilised their capacity to the extent of 100 per cent

or above and faced capacity constraints, whereas in other States and regions like Assam, Bihar, West Bengal, Gujarat, Nagaland and Orissa, with the exceptions of a few years, capacity has been underutilised to the extent of 20 to 25 per cent.

As the capacity expansion in existing units is found to be more economic than in setting up of new units, the Government of India has permitted the existing units to expand their capacities up to 5,000 tonnes in the case of units which would meet the additional sugarcane requirements by way of enlarged productivity and not by expanding the area under sugarcane and up to 3,500 tonnes in other cases. This will require much more concerted efforts in the area of sugarcane development. The average size of a large number of sugar units in many States was uneconomic according to the norm recommended by the High Level Committee (1,500 TCD). These units are found in large number in U.P., Bihar and Maharashtra. The study shows that the quality of sugar has recorded an improvement over the years. The sugar units now produce more of large grain size sugar.

The growth in installed capacity as well as in number of units in recent period has been higher in the co-operative sector than in the private sector due to a conscious policy adopted by the Government to promote co-operative units in this field. The performance of sugar units in the private and co-operative sectors in major States show that while in the States of Andhra Pradesh, Tamil Nadu and Uttar Pradesh, private sector units utilised production capacity at higher rates than the co-operative units, in Karnataka and Maharashtra, co-operative sector units recorded higher capacity utilisation ratios than the private sector units. The better performance of co-operative sector in Maharashtra is mainly due to their modernised plants and machinery and contiguity of sugarcane farms to sugar factories.

Notes

1. Important *Ones* are:
   a) Joshi, P. C., "The Sugar Cycle: A Diagnosis" *Sankhya (The Indian Journal of Statistics), December 1973*; and
   b) Baru, Sanjay, "Scale, Location and Diversification—Sugar Mill Industry in India" *Economic and Political Weekly,* May 28, 1988 pp. M-38—M-46.
   Besides, *State Bank of India Monthly Review* (April and May 1986) carried a fairly comprehensive review of the industry.

2. Joshi, P.C. op. cit, p. 442.
3. Baru, Sanjay, op. cit.
4. Ministry of Agriculture (Government of India), *Report of the Sugar Industry Enquiry Commission (1974)*, p. 19.
5. See *Report of the Committee on 'Take-over of Sugar Mills'*, Government of UP (1970) p 27. AT least 16 firms were found not to have in fact ploughed back the depreciation allowances into the upkeep and modernisation of plant and machinery. These funds were known to have been siphoned off by the directors of the concerned companies—the amounts running into several lakh rupees.
6. Khan, M.Y. "Sugar: Rising Costs, Squeezing Profits" *Commerce Weekly*, Bombay May 26-4 June 1988, p 20.
7. Planning Commission, Government of India, *Seventh Five Year Plan*, p. 189.
8. Sandesara, J.C., "Industrial Growth in India—Problems and Prospects" Lala Lajpat Rai Memorial Lecture (1982).
9. Working Group on Sugar Industry 'Planning Commission' estimated for the Seventh Five Year Plan, the project cost of 81 such units with capacity of 1,500 tonnes at Rs. 810 crores, of this per tonne cost works out to Rs. 6,700—Planning Commission, Government of India, *Seventh Five Year Plan, Ibid.*
10. *The Mid-term Appraisal of the Seventh Plan* provides a valid justification for this optimism. See Planning Commission (Government of India), *Seventh Five Year Plan 1985-90; Mid-Term Appraisal* (New Delhi, 1987).
11. This phenomenon was well documented by P.C. Joshi, op. cit. Joshi estimated an equation of the type $Q_t = a_{40} K_t + a_{42} p_{st} + a_{43D} + a_{44} T + u_4$, regressing sugar production (Q_t) as dependent variable on deflated value of fiscal incentives given to sugar industry (K_t), deflated producer price p_{st} (ex-factory price net of excise duty) of sugar (Rs per quintal), a dummy variable (D) taking the value 1 in trough years of the sugarcane cycle and zero in the remaining years and time in years (T). His results revealed that, on an average, every rupee one lakh worth of incentives had the effect of pushing up sugar production by about 3,000 tonnes, while during the period of shortage of sugarcane, competition for cane from gur producers brought down sugar production by 3.5 lakh tonnes. His OLS results were (t value in paranthesis);

$$* Q_t = 0.850 + 0.031K_t + 0.366 p_{st} + 3.426D + 0.637T$$
$$R^2 = 0.851; \quad (3.373) \quad (1.665) \quad (2.679) \quad (8.088).$$

12. *Report of Sugar Enquiry Commission* (1965) Ministry of Food & Agriculture, Government of India, pp. 161 to 162.
13. *Business India* (Bombay) 16-29 May 1988, p. 31.
14. *Report of Sugar Enquiry Commission* (1965), Government of India p. 151.
15. Sugar Enquiry Commission, Government of India—Ministry of Agriculture (1974) pp. 137-149.

Statement I: Basic Data on Sugarcane & Sugar Output

Year	Area under Sugarcane (000 hectares)		Production of Sugarcane (000' tonnes)		Production of Sugar (000' tonnes)	
1951-52	1,941	(+13.7)	74,760	(+8.0)	1,483	(+37.4)
1952-53	1,728	(−11.0)	61,860	(−17.3)	1,314	(−11.4)
1953-54	1,410	(−18.4)	53,848	(−12.9)	1,001	(−23.8)
1954-55	1,620	(+14.9)	70,549	(+31.1)	1,690	(+68.8)
1955-56	1,846	(+14.0)	72,692	(+3.0)	1,862	(+10.2)
1956-57	2,051	(+11.1)	82,908	(+14.1)	2,059	(+10.5)
1957-58	2,072	(+1.0)	83,651	(+0.9)	1,978	(−3.9)
1958-59	1,948	(−6.0)	86,149	(+3.0)	1,918	(−3.0)
1959-60	2,137	(+9.7)	91,394	(+6.1)	2,421	(+26.2)
1960-61	2,456	(+14.9)	110,544	(+21.0)	3,028	(+25.0)
1961-62	2,413	(−1.8)	103,967	(+5.9)	2,730	(−9.8)
1962-63	2,242	(+7.6)	91,913	(−11.6)	2,135	(−21.8)
1963-64	2,249	(+0.9)	104,225	(+13.4)	2,562	(+20.0)
1964-65	2,603	(+15.7)	122,077	(+17.1)	3,232	(+26.2)
1965-66	2,836	(+9.0)	123,990	(+1.6)	3,532	(+9.3)
1966-67	2,301	(−18.9)	92,827	(−25.1)	2,158	(−38.9)
1967-68	2,047	(−11.0)	95,500	(+2.9)	2,247	(+4.1)
1968-69*	2,532	(+23.7)	124,676	(+30.6)	3,557	(+58.3)
1969-70	2,748	(+8.5)	135,024	(+8.3)	4,261	(+19.8)
1970-71	2,615	(−4.8)	126,368	(−6.4)	3,740	(−12.2)
1971-72	2,390	(−8.6)	113,569	(−10.1)	3,108	(−16.9)
1972-73	2,452	(+2.6)	124,867	(+9.9)	3,873	(+24.6)
1973-74	2,752	(+12.2)	140,805	(+12.8)	3,949	(+2.0)
1974-75	2,894	(+5.2)	144,289	(+2.5)	4,795	(+21.4)
1975-76	2,762	(−4.6)	140,604	(−2.6)	4,261	(−11.1)
1976-77	2,866	(+3.8)	153,007	(+8.8)	4,840	(+13.6)
1977-78	3,151	(+9.9)	176,965	(+15.7)	6,457	(+33.4)
1978-79	3,088	(−2.0)	151,655	(−4.3)	5,841	(−9.5)
1979-80	2,610	(−4.5)	128,933	(−4.0)	3,858	(−33.9)
1980-81	2,667	(+2.2)	154,248	(+19.7)	5,147	(+33.4)
1981-82	3,193	(+19.7)	186,358	(+20.8)	8,436	(+63.9)
1982-83	3,358	(+5.2)	189,506	(+1.7)	8,230	(−2.4)
1983-84	3,110	(−7.10)	174,076	(−6.6)	5,917	(−28.4)
1984-85	2,953	(−5.0)	170,319	(−2.2)	6,144	(+3.8)
1985-86	2,862	(−3.1)	170,648	(+1.9)	7,016	(+14.2)
1986-87	3,055	(+6.7)	182,480	(+6.9)	8,501	(+21.2)

Note: Figures in brackets are percentage variations over the previous year.
Source: *Indian Sugar*, December 1987, Indian Sugar Mills Association, New Delhi.

Statement II: State-wise Percentage Increase in Installed Capacity of Sugar Industry

State	1961-62	1962-63	1963-64	1964-65	1965-66	1966-67	1967-68	1968-69	1970-71	1971-72	1972-73	1973-74
1. Andhra Pradesh	21.5	35.43	3.38	6.53	2.30	6.74	0.35	—	—	—	4.59	2.36
2. Assam	—	—	—	—	—	—	—	—	—	—	—	—
3. Bihar	51.0	—	2.23	4.65	0.26	2.08	—	2.80	—	—	—	—
4. Gujarat	60.7	—	—	—	—	20.00	46.30	31.65	42.71	12.92	22.28	—
5. Haryana/Punjab	—	14.42	9.24	—	—	1.54	—	11.36	—	—	5.17	—
6. Kerala	20.0	—	200.00	72.22	—	—	—	—	—	—	—	—
7. Madhya Pradesh	13.9	—	—	12.19	—	—	4.34	—	—	30.00	—	10.25
8. Maharashtra	—	10.81	11.79	3.09	3.70	8.33	5.97	8.89	7.39	7.20	14.54	3.76
9. Karnataka	—	—	—	0.84	14.72	8.78	—	22.98	8.25	22.45	—	14.18
10. Orissa	—	—	83.33	—	—	—	11.11	—	—	—	—	83.33
11. Pondicherry	—	—	—	—	—	—	—	—	—	—	—	—
12. Rajasthan	—	—	—	46.15	—	13.63	—	—	—	—	—	—
13. Tamil Nadu	—	15.20	11.11	25.62	16.91	11.06	2.68	—	6.61	14.48	—	6.02
14. Uttar Pradesh	1.4	1.92	5.77	4.91	7.67	2.05	1.16	—	—	2.43	0.47	1.81
15. West Bengal	—	—	—	—	—	—	—	—	—	—	—	—
16. Nagaland	—	—	—	—	—	—	—	—	3.00	—	—	—
17. Goa	—	—	—	—	—	—	—	—	—	—	—	—
All India	2.8	6.71	7.03	6.28	5.59	4.74	2.69	4.12	4.07	5.89	5.99	3.65

Statement II: State-wise Percentage Increase in Installed Capacity of Sugar Industry

State	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
1. Andhra Pradesh	8.58	2.43	8.60	6.55	7.94	—	11.6	—	2.6	7.66	1.45	1.12	1.48
2. Assam	—	—	360.00	—	—	—	—	—	—	—	—	—	60.00
3. Bihar	—	—	—	—	—	—	—	1.4	1.2	—	—	0.86	0.86
4. Gujarat	9.35	—	26.57	11.03	18.91	—	5.4	7.7	9.8	5.22	6.90	4.03	—
5. Haryana/Punjab	—	—	21.31	12.16	—	1.2	12.7	14.2	—	—	19.12	9.05	4.15
6. Kerala	—	—	—	—	—	—	—	—	—	—	—	—	—
7. Madhya Pradesh	—	—	—	—	—	—	20.9	—	—	23.08	—	—	—
8. Maharashtra	7.25	6.29	16.58	7.52	9.33	1.8	9.2	2.0	—	1.93	8.51	6.67	4.57
9. Karnataka	10.60	14.52	3.34	19.44	—	6.7	—	—	5.8	14.41	6.70	2.24	8.64
10. Orissa	—	—	—	—	—	—	—	—	—	—	—	—	—
11. Pondicherry	—	—	—	—	—	—	—	—	—	78.95	—	—	—
12. Rajasthan	—	—	—	—	—	—	—	—	—	22.73	—	—	—
13. Tamil Nadu	7.95	—	22.10	10.77	10.11	—	3.2	—	—	6.13	1.14	7.59	2.25
14. Uttar Pradesh	—	3.25	2.32	6.15	—	1.2	3.1	1.8	2.5	3.75	4.80	3.05	2.41
15. West Bengal	—	—	—	—	—	—	—	—	—	—	—	—	—
16. Nagaland	—	—	—	—	—	—	—	—	—	—	—	—	—
17. Goa	—	—	—	—	—	—	—	—	—	—	—	—	—
All India	4.50	4.06	10.29	7.89	6.02	1.10	5.7	2.3	1.7	4.81	5.71	4.41	3.44

Note —: Shows no increase.

Sources: 1. *Indian Sugar Year Book*, 1981-82 and 1983-84, Indian Sugar Mills Association (New Delhi).

2. *Co-operative Sugar*, April 1988, National Federation of Co-operative Sugar Factories.

Statement III: Ratios of Capacity Utilisation in Sugar Industry

(In percent)

State	1960-61	1961-62	1962-63	1963-64	1964-65	1965-66	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73
Assam	70.0	40.0	40.0	40.0	60.0	90.0	60.0	40.0	50.0	200.0	160.0	120.0	80.0
Andhra Pradesh	127.1	107.4	72.6	96.7	117.2	111.6	50.9	66.1	118.5	118.7	94.3	106.7	86.1
Bihar	107.8	47.4	47.4	64.9	102.1	96.4	53.7	37.4	64.4	98.2	86.1	44.2	63.7
Goa	—	—	—	—	—	—	—	—	—	—	—	—	—
Gujarat	100.0	75.6	82.2	93.3	95.6	122.2	77.8	59.5	74.0	96.1	57.1	59.0	70.0
Haryana/Punjab	117.3	50.7	51.3	53.1	75.4	120.8	62.9	61.4	66.7	143.1	112.9	90.5	109.0
Kerala	200.0	183.3	200.0	50.0	87.1	67.7	29.0	22.6	51.6	95.5	68.2	72.7	95.5
Madhya Pradesh	97.2	75.6	82.98	51.2	80.4	76.1	17.4	8.3	39.6	126.7	127.6	53.8	71.8
Maharashtra	117.8	114.2	107.7	99.5	112.2	132.7	100.3	91.9	129.0	120.4	113.4	100.5	94.1
Karnataka	100.8	116.0	106.7	96.6	139.5	104.1	54.7	75.8	104.0	109.2	86.9	83.7	99.0
Nagáland	—	—	—	—	—	—	—	—	—	—	—	—	0.0
Orissa	100.0	133.3	135.3	33.3	44.4	61.1	50.0	25.0	75.0	141.7	66.7	58.3	41.7
Pondicherry	111.1	55.6	55.6	83.3	88.9	66.7	55.6	50.0	116.7	73.7	42.1	121.1	100.0
Rajasthan	138.5	123.1	107.7	53.9	42.1	94.7	36.4	27.3	59.1	90.9	59.1	22.7	72.7
Tamil Nadu	104.8	92.8	68.8	86.3	104.5	95.3	66.3	67.9	123.1	105.9	79.0	90.1	99.7
Uttar Pradesh	139.5	82.0	80.4	98.8	106.7	108.8	55.9	67.5	90.1	131.7	105.4	65.8	105.5
West Bengal	94.1	64.7	50.0	45.5	54.6	59.1	36.4	31.8	77.3	93.3	53.3	6.7	26.7
All India	123.7	108.5	79.5	89.1	105.8	109.5	63.9	64.7	153.9	119.8	101.1	79.3	93.2

(Contd.)

Statement III: Ratios of Capacity Utilisation in Sugar Industry *(Concluded)*

(*In percent*)

State	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
Assam	120.0	140.0	160.0	40.0	35.0	55.0	35.0	20.0	60.0	40.0	25.0	15.0	10.7	15.6
Andhra Pradesh	93 4	120.7	96.7	77.3	103.8	73.7	47.3	55.5	110.1	100.0	53.8	63.8	72.1	92.7
Bihar	65.8	62.5	52.2	58.7	84.4	76.1	48.7	57.2	100.0	106.3	64.8	41.4	71.2	86.0
Goa	5.0	20.0	35.0	30.0	45.0	40.0	30.0	20.0	60.0	50.0	35.0	35.0	29.9	40.0
Gujarat	86.7	72.5	51.8	81.5	99.0	80.0	59.8	84.9	126.1	107.3	84.5	81.3	108.1	111.7
Haryana/Punjab	132.0	156.6	154.9	133.8	148.6	136.8	83.6	79.3	157.4	156.9	148.3	—	—	—
Kerala	118.2	86.4	31.8	63.6	104.5	104.6	72.7	77.3	77.3	86.4	45.5	36.4	33.5	45.5
Madhya Pradesh	67.4	132.6	111.6	100.0	160.5	144.2	55.8	32.7	111.5	144.4	115.6	79.7	66.2	110.9
Maharashtra	80.8	123.9	118.8	99.0	123.9	115.0	74.9	120.5	145.8	145.7	94.2	100.7	97.5	93.2
Karnataka	86.1	92.1	86.4	97.5	110.7	94.4	49.2	67.3	117.6	107.7	57.4	61.9	69.9	77.3
Nagaland	16.7	25.0	41.7	50.0	66.7	75.0	58.3	33.3	58.3	50.0	25.0	16.7	18.8	33.3
Orissa	40.9	59.1	86.4	45.5	77.3	90.9	45.5	45.5	95.5	109.1	77.3	63.6	61.4	95.5
Pondicherry	136.8	126.3	84.2	136.8	121.1	136.8	84.2	110.5	131.6	136.8	152.9	82.4	150.9	173.5
Rajasthan	95.5	136.4	150.0	145.5	204.5	154.6	50.0	54.6	104.6	118.2	85.2	70.4	49.9	81.5
Tamil Nadu	125.9	101.1	47.9	69.4	90.7	88.3	66.0	74.9	131.5	113.4	69.3	97.0	121.7	119.6
Uttar Pradesh	100.3	110.8	87.3	107.8	128.5	98.1	66.1	78.7	131.2	125.2	102.4	83.6	90.5	137.1
West Bengal	40.0	66.7	66.7	86.7	93.3	66.7	20.0	26.7	66.7	60.0	13.3	6.7	6.7	26.7
All India	91.7	106.5	91.0	93.7	115.9	98.9	64.6	81.5	130.7	125.4	86.0	84.5	92.5	108.5

Sources: *Indian Sugar Year Book*, 1981-82 and 1983-84, Indian Sugar Mill Association (New Delhi).
Co-operative Sugar, April 1988, National Federation of Co-operative Sugar Factories Ltd., (New Delhi).

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BOOK REVIEW

Individual Forecasting and Aggregate Outcomes: Rational Expectations Examined

Edited by
Roman Frydman and Edmund S. Phelps
(Cambridge University Press, 1986)

THIS book is the outcome of the proceedings of a Conference on "Expectations Formation and Economic Disequilibrium", held in New York City, December 4, 1981. Its ten chapters, contributed by well-known economists like Roman Frydman, Edmund S. Phelps and Phillip Cagan, encompass a wide spectrum of issues. The conference was essentially devoted to a critical examination of the rational expectations hypothesis and its relevance to the policy-making discussion. As a prelude to the review of the book, it may be worthwhile discussing briefly the concept of 'Rational Expectations' itself.@

In a world of risk and uncertainty, different problems arise with regard to the choice of means to achieve a particular end. As per Simon and Muth, who both worked on the subject of 'Rational Expectations' simultaneously, but independently, there are two different strategies to tackle such problems. Simon viewed the certainty equivalence results as a useful approximation for certain situations but did not elevate them to the plateau of a foundation for a general theory of economic behaviour. John Muth viewed the problem somewhat differently. The certainty equivalence results, which enabled the investigator to focus only on the expected values of variables that were uncertain, provided the key to an attack on another problem, which could loosely be termed the 'interaction between expectation and reality'. There were many examples of this problem

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@ This discussion on definition is based on Steven M. Sheffrin, *Rational Expectations* (Cambridge Surveys of Economic Literature, London, 1983).

in the literature at the time of the 1950s, perhaps the most well known being the 'Cobweb Theorem' in agriculture. The work of Nerlove (1958) and others stressed that the decisions of farmers concerning planting depended on the prices they expected to receive when the crop was marketed. Another example of this phenomenon that was prominent in the literature of the 1950s, concerned the dynamics of hyperinflation. Cagan (1958) developed a simple model in which the velocity of money depended inversely on *expected inflation*, whereas expected inflation, in turn was a function of past inflation.

Progress in economics, therefore, seemed to require a working knowledge in quantitative terms, of how expectations of key phenomena were formed. Unfortunately, such verification of the theory of expectations formation existed neither at the time nor does it exist today. If anything, the literature on expectations continues to derive its inspiration on psychology and tends to suggest that peoples' expectations are intimately connected with their particular situation, and that no general theory seems to work. Muth suggested that economists are often interested in knowing how expectations might change in certain circumstances and one should not be satisfied with fixed expectational formulae that do not allow for change, as when, for example, the structure of the system undergoes a change. If the underlying economic system changes, we would expect economic actors, at least after a certain lapse of time, to change the content of their expectations. Muth's rational expectations hypothesis essentially equates two distinct concepts; economic actors' subjective expectations (of economic variables) are postulated to be equal to the mathematical conditional expectations (of those variables). Or, in other words, people's subjective expectations of a phenomenon add up to a rationally conceivable theory and hence, on average, equal to the true value of the variable. Thus there is a connection between the perceptions of individual economic actors and the actual stochastic behaviour of the system; the individual perceptions themselves may have a predictable deviation from the average. This is the essence of the rational, expectations approach.

Expectations are rational if, given an economic model, they would produce actual values of variables that, on average, equal the expectations. Expectations will diverge from actual values only because of some unpredictable uncertainty, when expectations of

variables coincide with the actual values, it is a situation of perfect foresight. The rational expectations hypothesis (REH) differs from perfect foresight because it allows for "uncertainty" in the economic system. Nevertheless, the expectations are not "indeterminate;" economic agents do exercise their judgement and hence take "risk".

Thus, coming back to the book under review, the origins of the theory of 'Rational Expectations' lie in the ideas of 'risk' and 'uncertainty'. Speaking of uncertainty, Keynes, with his oft-quoted "beauty contest" example, sought to dramatise the role played by subjective guesses of 'average opinion' in the formation of stock market prices. As Edmund S. Phelps mentions in Chapter 1, "one of the fundamental problems in the formulation of the REH is the absence of any definition of the relevant economic theory and the objective probability distribution of outcomes". Phelps doubts the validity of the escape route adopted by REH that the relevant economic theory is represented by the specific model being analysed by rational expectations theorists since it is not easy for the agents to learn the parameters of those models and, even if some parameters were obtained (using regression technique, etc.), it would still result in a biased estimator since average opinion on the right-hand side of the equation is endogenously formed. This problem is further complicated when government's actions alter the processes governing the behaviour of exogenous variables.

In Chapter 2, entitled 'The Trouble with Rational Expectations and the Problem of Inflation Stabilization', Edmund S. Phelps expresses doubts regarding the essential assumption of the REH that each agent uses the modeller's own model to make the forecasts of the endogenous variable. The REH meets this difficulty with the implicit assumption that, in fact, each agent believes other agents too have the same expectations about the various exogenous parameters as he has. But, in the theory of macro-economics disturbances—slump, inflation and recovery—to which the REH has frequently been applied, it is difficult to justify the premise that each agent presumes his expectations to be universal. Phelps attempts the task of replacing rational expectations with a more general theory, viz. theoretic expectations, in which agents may believe that others' expectations would differ from their own.

Chapter 3 by Juan Carlos Di Tata is on "Expectation of others'

expectations and the transitional non-neutrality of fully believed systematic monetary policy". Di Tata argues that each market participant presumes that everyone else is forming expectations by the same model of the economy that he is using in his own forecasting process and that everyone else assigns to the monetary role the same degree of credibility that he is assigning to it. But once it is assumed that each rational agent follows his own model, then the implicit assumption of the REH is not fulfilled and one has to resort to the expectations of average opinion when modelling expectations formation. Thus, when forecasting the price level, each rational agent will have to form expectations of the economy—wide average opinion about the price level, as well as expectations of the economy—wide average opinion about the economy—wide average belief about price level and so forth. Each agent will have to form his own beliefs about the model of the economy being employed by the other agents. As to the impact of rational expectations of one economic agent over the rational expectations of another agent it can happen that if each agent believes that the other market participants do not believe completely in the government's announcement, then the new monetary policy will have transitional effects on the mean value of output.

"The stability of rational expectations in macro economic model" by George Evans is the focus of the Chapter 4. An important problem in rational expectations is that agents may not know the true values of key parameters, or more fundamentally, they may not know the true structure, so that they cannot form (strong-form) rational expectations. Again, there is a fundamental problem of stability even if the true structure of the economy is completely known. In this paper Evans has proved that conventional rational expectations equilibrium can be thought of as an expectations equilibrium.

Chapter 5, by Roman Frydman, relates to the "Individual rationality, decentralisation and the rational expectations hypothesis". He casts doubt on the most important presumption that individuals behave optimally and thus they seem to be consistent with the rest of traditional economic theory. Thus, Frydman re-examines the connection between the rational expectations hypothesis, the postulate of optimality of individual behaviour and decentralization of competitive markets. The forecasting behaviour of individual agents, assumed in the rational expectations models, cannot be justified by

an appeal to the assumption that individual agents process "optimally" information available to them; consequently, there is an important distinction between the basic optimality postulate in economics and the REH. Further, the notion of decentralization, as formalised in the rational expectations models, appears incompatible with the REH. The central point is that REH appears to be incompatible with the fundamental characteristics of a decentralised market economy, suggesting that the question of modelling individual forecasts has not been satisfactorily solved by the REH.

In Chapter 6, on "Convergence to rational expectations equilibrium", Margaret Bray examines the issue that in a completely non-stationary world, it is impossible to identify probabilities with observed frequencies, as per the REH. The intuition that although people may not initially hold rational expectations, they must eventually come arbitrarily close to doing so, is perhaps misleading since it is merely based on textbook theorems on the asymptotic properties of estimators, not always compatible with the reality. Hence, the theory of stability of equilibrium is in a somewhat unsatisfactory state. It is eminently plausible that people will not persist indefinitely in using stationary forecasting rule that generates non-rational expectations that are systematically confounded by events; rational expectations seem to be the only type of expectations formation in a long-run stationary equilibrium that is compatible with the general assumption of optimizing behaviour. However, this assertion does not rule out the possibility that people try to learn and understand what is going on, and continually change the way in which they form expectations, never reaching a stationary equilibrium. Making the assumption that agents follow a correct Bayesian learning process does generate convergence to a stationary equilibrium, but in Bray's opinion, applying this assumption to the very complicated situations that can be generated even by rather simple model with the learning is pushing the general presumption of optimising behaviour to the point where it loses many of its attractions.

Chapter 7, by Roman Frydman, is devoted to the discussion on "A distinction between the unconditional expectational equilibrium and the rational expectations equilibrium". Frydman stresses that the simple forecast rule proposed by Bray does not lead to a convergence to the rational expectations equilibrium in a more general

model. He takes up the task of defining an alternative type of equilibrium, viz., "aggregate" equilibrium, also called as unconditional expectational equilibrium; it is defined under the condition that forecasts of the endogenous variable be equal to the expected value of the probability distribution of the variable. The unconditional expectational equilibrium coincides with the rational expectations equilibrium in models containing exogenous variables that are independently and identically distributed.

In Chapter 8, Alan Kirman focuses the discussion on "Mistaken beliefs and resultant equilibria". If agents in an economic model start out with personal, possibly mistaken, belief and then learn, to what extent will their learning lead them to a knowledge of true situation in which they have complete information? As per Kirman, this question is not as trivial as it might appear precisely because of the nature of economic situations. Kirman raises a question that in the rational expectations literature, equilibrium is one in which what people believe is coherent with what they observe, but the question is still largely open as to how one might arrive at such a situation. Alan Kirman concludes that even in the most simplified model, misspecification of functions will not necessarily be corrected as learning takes place. Worse can happen that a perfectly reasonable learning process may lead to a result that bears no relation to any standard non-cooperative or cooperative equilibrium.

Chapter 9, by Robert M. Townsend, is devoted to the discussion on "Equilibrium theory with learning and disparate expectations". This Chapter begins with the premise that equilibrium models with learning and with disparate but rational expectations will prove to be useful in describing aspects of reality. Thus, rather than being deterred by assumptions that can cause analytical difficulties, the emphasis here has been on specification strategies and solution techniques that make those models tractable. It turns out that the time series of these models do display interesting oscillations and can in principle be fitted to the data. So, consistent with basic premise, an empirical application may soon be warranted.

Further, one caveat is in order: economic policy issues have not been considered. When considering the effect of "new" policy, one must confront the "change-of-regime" issue and ask what determines decision makers' expectations. To the extent that decision makers'

expectations are arbitrary, one is led to an infinite regress problem. On the other hand, it may well be that statistical decision theory will prove to be useful construct here, as well, with priors of decisions makers linked to government policy announcements, general political sentiments and past experience:

The last chapter of the book by Axel Leijonhufvud is related to the discussion on "Keynesianism, monetarism, and rational expectations: some reflections and conjectures". At the outset, Leijonhufvud distinguishes between "well-behaved" expectations linked in a stable manner to observable variables and "ill-behaved" expectations, which are not only incorrect but also inconsistent across agents. As such, measures of expectations do not inspire trust. Their unreliability (or unavailability) makes direct tests of all the novel propositions about the influence of expectations difficult. The behaviour of expectations should not be analysed within the context of the particular economist's model; rather it should be based on examination of existing monetary institutions. In fact, a useful and workable model linking expectations of the price level to the observable variables can be formulated only if monetary policy and institutions are sufficiently stable. Since the agents face insurmountable difficulties in forming price level expectations, constitutional constraints should be put on the monetary policy. At the end of the Chapter, the author discusses about the equilibrium or disequilibrium theory from the point of view of information available to agents and their expectations formation.

The book is well documented and is written mainly in a mathematical style. For an understanding of the book, some idea of the advance probability and measure theory is essential as it makes extensive use of the various theorems relating to the convergence in terms of probability. The book is useful for the people devoted to the area of econometrics as it cautions them not to stress too much on the role of "Rational Expectations Hypothesis", while formulating econometric models, as many assumptions of the "Rational Expectations Hypothesis" are not still fully proved. A lot more empirical work on the assumptions of this hypothesis is necessary before it can be of use for policy purposes. As conceded by the authors, REH is closer in spirit to a planned economy than to a decentralised market economy. Even so, it appears that the verification process relating to REH has been kept restricted to a free market economy. Perhaps,

the REH will have different applicability, in degree if not in kind, under different social framework. Yet, another important question relates to extreme constraints faced by those who have a very limited range of choices, e.g, the people below an accepted minimum standard of living. Aggregation of the individual forecasting under the REH will differ not only within the context of variations in the nature of economic systems, but also will vary differently for different segments of a society. In such an aggregative exercise, the parameters of the probability distributions of the upper income groups will be significantly different from the parameters of lower income groups. In this case, the parameter space of the probability distribution of one income group will differ widely from the parameter space of the probability distribution of the overall population; consequently, convergence of the two distinct distributions may or may not take place. Perhaps, REH is applicable to the economies having some degree of homogeneity amongst social classes, or perhaps to the planned economies where expectations are formed under certain constraints, having limited choices.

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