Chapter 4

Cluster Analysis of Private Sector Companies
4.1 INTRODUCTION

The economy of a country mostly depends on the performance of its industries. Thousands of private and public sector companies, which contribute to the growth of a nation, have financial profile ranging from low to high, in terms of the known financial parameters such as gross sales, gross profit and networth. The quantum of these parameters clearly indicate the size of the company from giant to small industries. Many of the parameters are made available in the Annual reports of the companies. The financial parameters are compiled by various journals and magazines every year. In addition, it is mandatory for the listed companies to report the annual performance to the stock exchange, where the company's stocks are traded.

4.2 RATIOS

A financial tool is a logical method employed to measure the effectiveness of operations/performance of a company. A dynamic analysis involves study of financial statements over different periods of time. Different tools of financial analysis make use of a set of financial variables to study the profitability and financial position. There are many financial variables reported by any company. As such these variables will show the actual cash involved in managing a company. Balance sheet will include most of the financial variables. Giant companies will have values of these variables very high, whereas a small private sector may have them at a very negligible size. In terms of financial variables, it may not be possible to compare the performance of any company and hence there is a need for defining ratios
involving financial variables. Financial variables are those such as gross sales, operating profit, gross profit, net profit, networth, tax, net cash flow and total capital employed. Srivatsava (1984) gives a detailed definition of financial variables and ratios. A number of ratios such as liquidity ratios, activity ratios, investibility ratios, and profitability ratios have been defined with the intention of explaining the performance of an enterprise. High values of some of these ratios may indicate that an enterprise has performed well.

During the last three decades, financial data have been subjected to many analyses including statistical methods. Financial ratios of the fundamental parameters have been considered to standardise the actual money values to quantities that are independent of magnitude and also to give suitable interpretation to such ratios. These ratios are the barometer of the performance of companies. Each ratio can be explained in its own way.

Indices are defined in terms of ratios as indicators of financial stability. The objective of the present study is to give a new method of rating to the companies on the basis of certain profitability ratios. It is not always feasible to include all information of companies in any analysis. So only selected number of companies and a selected number of financial variables are used.

Financial ratios can be used to compare the present performance of a company with that of the past and expected future. Alternatively, financial ratios of one firm can be compared with those of similar or with industry averages at the same time. This kind of analysis help analysts in predicting industrial financial failures. Financial ratios have been used extensively as
predictors of business financial difficulty [Altman, 1968,1984; Beaver, 1966,1968; Chen and Shimerada, 1981]. Cluster analysis has been successfully applied to the study of financial performance of industries [Jensen, 1971; Gupta and Huefner, 1972]. Multivariate techniques such as principal component analysis and discriminant analysis have been extensively used in the study and analysis of financial failures of companies [Edmister, 1972; Altman and Eisenbeis, 1978; Taffler, 1982; Pandey and Ramesh, 1990; Joshi and Ramani, 1991].

4.3 DATA BASE

In order to grade the private sector companies that are rated as the top most companies (in terms of gross sales), in this chapter an attempt is made to analyse the financial data published in The Economic Times (Special Edition) in the years 1992, 1993 and 1994. We are interested only in profitability ratios. The period of our study is 1991-92, 1992-93 and 1993-94.

From among the listed companies, the top 250 companies in terms of gross sales, are chosen for the analysis from each of the periods 1991-92, 1992-93 and 1993-94, eliminating those companies having very high/very low ratios.

We define below some of the financial variables and ratios that are used in this chapter.

Operating Profit is Profit before providing for Interest, Depreciation and Tax.

Gross profit is Operating Profit less Interest.
Net profit is **Operating Profit** less **Tax** less **Interest** less **Depreciation**. Gross Sales is **Total Revenue** less **Other Income**.

**Total Capital Employed** is the sum of **Reserves**, **Equity** and **Total Borrowings**.

Net Cash Flow is **Net Profit** plus **Depreciation** provided for the year, less **Dividend paid**.

Net Worth is the sum of **Equity**, **Reserves** and **Net Profit**, less **Dividend**.

The **profitability ratios** considered in the present study are as follows:

1. **Operating Profit/Gross Sales** - **OP/GS**
2. **Operating Profit/Total Capital Employed** - **OP/TCE**
3. **Gross Profit/Gross Sales** - **GP/GS**
4. **Gross Profit/ Total Capital Employed** - **GP/TCE**
5. **Net Profit/Net Worth** - **NP/NW**
6. **Cash Flow/Net Worth** - **CF/NW**

Our preliminary analysis indicated that the other ratios were not contributing **any useful information** in the formation of clusters or groups of companies and hence they have been leftover.

### 4.4 RESULTS AND DISCUSSION

Each of the data sets were subjected to cluster analysis followed by the iterated discriminant function analysis as explained in Chapter 3. Formation of clusters are explored by considering 2 - cluster, 3 - cluster, 4 - cluster and so on. Out of all trials, 3 - cluster analysis presented better picture than 2 - cluster, 4 - cluster and higher clusters, as there were only one or two
companies in many of the groups formed. Having decided to consider only 3-cluster, it was possible to rate a company as Grade A, Grade B or Grade C, depending on whether the company belonged to cluster 1, cluster 2 or cluster 3.

4.4.1 ANALYSIS OF FINANCIAL DATA - 1992

Table 4.1 summarizes the number of companies in each of the cluster group as obtained by the analysis. The initial column provides the grouping done in the initial level, the second column indicates the clusters obtained by the clustering method and the third column gives the grouping after the application of discriminant analysis in 7 cycles. About one fifth of the companies are graded as C. Only nine companies are found to have the Grade A. Maximum number of firms (191) are graded as B. This indicates that majority of the companies are in the medium profile. The cluster centres for the three clusters at various levels, relating to the year 1992, are shown in Table 4.2. Figure 4.1 shows the grouping into 3 clusters. Table 4.3 provides the Fisher's linear discriminant functions (LDF) for the three groups. It is interesting to note that the mean vectors of these clusters can be arranged in the increasing order of magnitude (Table 4.2). We rate the members in the first cluster as Grade A, the second as Grade B and the third as Grade C. Companies belonging to Grade C category are the ones that perform better than those of Grades B and A. Similarly the companies belonging to Grade B category are superior to those of Grade A, indicating the members in the category Grade A are at a low-profile in terms of the ratios considered in the present analysis. Linear discriminant functions can be used to classify a given company into one of the categories, A, B or C. This rating should not be used
Figure 4.1 Clustered Groups of Financial Data

- Year - 1992 - 3 Clusters

4.4.2 ANALYSIS OF FINANCIAL DATA - 1993

Analysis of the 1993 financial data indicates that there are 3 - clusters as discussed in the previous section. Table 4.4 gives a summary of the number of cases at various levels of grouping. As in the year 1992, a majority of companies (209) are graded as B, whereas 27 companies have Grade C. About eight percent increase is noted in the number of medium profile companies compared to previous year. The final clusters are obtained after 9 cycles using discriminant analysis. Figure 4.2 shows the clustering of financial data 1993. The centroids of the clusters can be arranged in the ascending order of magnitude as in the previous period. This clearly indicates that there is a precise grouping of companies. When compared to 1992 grouping, a higher number of companies are found in Grades A and B, rather than in Grade C category. The cluster centres of the three groups are found to be on the lower side compared to those of 1992 results (Tables 4.2 and 4.5). This clearly indicates that there is a drift in the performances of the companies. The profitability ratios have declined sharply in 1993. This could be attributed to the slow down of the expansion of the industries. Also the sales, assets and profit are found to be on the decline. The net worth has expanded appreciably thereby bringing down the associated ratios. This situation had been clearly discussed in detail in the special edition of The Economic Times in the year 1993. The LDF given in Table 4.6 are the Fisher's linear discriminant
Figure 4.2 Clustered Groups of Financial Data
- Year 1993 - 3 Clusters
functions constructed for the 1993 financial data. The findings of the analysis of the 1994 data is summarised in the following section.

4.4.3 ANALYSIS OF FINANCIAL DATA - 1994

The converged clusters are shown in Table 4.7. It is interesting to note that out of 250 companies, 150 companies are found to be in Grade A category. There are 92 companies having Grade B and 8 having Grade C. Figure 4.3 depicts the grouping of the members of the three clusters. Tables 4.5 and 4.8 show that the companies with low profile of the ratios in 1993, have improved their performances in 1994 as indicated by the positive ratios in Cluster 1 having Grade A. The mean ratios of the cluster 3 having Grade C, have come down compared to those of 1993 and 1992, except NP/NW and CF/NW. This indicates that the cash flow and net profit has gone up significantly in the year 1994. Since there is an upward shift in the Grade A companies of 1993 and downward shift to Grade A of 1994, more companies tend to group in the first cluster in 1994, resulting in the reduction of Grades A and B members in 1994. Table 4.9 gives the list of Fisher’s linear discriminant functions that can be used for classification and assignment purposes for companies belonging to the period 1993-1994.

The centroids of the 3 clusters in 1994 indicate that there is a significant jump from the ratios of 1993 to 1994. This shows that the economy is up and accelerated.
Figure 4.3 Clustered Groups of Financial Data

- Year 1994 - 3 Clusters

Cluster Centers
Cluster 1
Cluster 3
Cluster 2
The summary of the financial performance for the year 1993-94 had mentioned that the government policy was good and so were the successive agricultural performances (The Economic Times, 1994). There was high growth in the export. The accelerated industrial growth had helped private sector companies perform well. This report clearly justifies the increase of the ratios in the year 1994, which agrees with our findings.

4.5 SUMMARY

An attempt is made to analyse the financial data relating to private sector companies that are rated as topmost companies in terms of gross sales. We have chosen 250 private sector companies from among the topmost 300 companies from each of the period 1991-1992, 1992-1993 and 1993-1994. These data are subjected to cluster analysis followed by iterative discriminant analysis until 100 percent classification is achieved. Cluster analysis yielded three group clusters for each of the periods. It was not possible to get higher number of clusters which could be interpreted meaningfully. The clusters were arranged in the order of their centroids and these members were graded as A, B, or C depending on whether they belong to cluster 1, 2 or 3. Members having Grade A have low-profile in terms of the ratios, members with Grade B are classified as having medium-profile and members with Grade C are of high-profile ratios. The performance of the companies were observed to be low for the period 1992-1993 compared to that of 1991-1992. However there was an upward trend in the year 1993 and hence the private sector companies performed well in the period 1993-1994. This finding supported the discussion of the financial position of the companies in the year 1993 and 1994 in the
special editions of The Economic Times published in 1993 and 1994. The present study clearly indicates that topmost ranking companies (in terms of the gross sales), can be grouped into three clusters and a classification scheme can be used for assignment. It is to noted that this type of analysis should be done for every financial year and the results derived for one period cannot be generalised and used for others.