CHAPTER IV

DATA BASE AND METHODOLOGY

Industrial organization has got a strong empirical focus since it is linked to the matters of economic policy. It is especially true for one of its component namely industrial concentration as it is a significant dimension of market structure and hence market power, conduct and performance. It can serve as an important device for antitrust policies. Measurement of concentration also helps to empirically test the behavioural hypotheses about the market or industry. The present study attempts to measure the industrial concentration and its changes in pre and post-liberalization period by using most of the popular measures of concentration and also study the structure-performance relationship which seeks to explain variations in performance in terms of differences in concentration. However, the selection of the industries, performance variables and the type of measures of concentration to be used is very important to achieve the objective of the study. The aim of this chapter is methodological and therefore this chapter attempts to discuss the scope of the study and sources of data in section-I, variables used in the study in Section- II and methodology in Section- III.

Section-I

The study is aimed at measurement of industrial concentration in eleven major industrial groups comprising of 3769 firms in total. Initially, the concentration in the respective industrial groups was measured on the basis of these 3769 firms but later on due to some limitations like non-presence of the firm throughout the period, merger or acquisition of the firm, non-availability of the data etc., while analyzing the relationship of the industrial concentration with the performance of the firms, the study was confined to 678 firms. The firms have been selected on the basis of following criteria:

- Those firms have been selected for the study which were mainly engaged in the one of the selected 11 industry groups.
- Those firms have been selected for the study which were registered with the Bombay Stock Exchange.
Those firms have been selected for which the data was available throughout i.e. the firm was operational throughout the period of the study.

Samples of at least 10% of the firms relating to each industry group with a minimum number of 30 firms were selected for the study.

The data for the study has been taken from 1988-89 to 2004-05 i.e. period of 17 years. It is quite a long period to study and find a trend or a tendency. For more reliable results a longer period could have been taken but because of certain constraints, firstly, the constraints of the data sources itself and secondly, selecting only those firms for which the data was available throughout were the major constraints in the selection of still a longer period.

The present study is based on secondary data provided by Prowess Database, Centre for Monitoring Indian Economy (CMIE), Economic Intelligent Services. However this data base has certain limitations like missed or no data entries, time durations for which the data is available, number of firms covered by the data base etc. No other data base has been accessed for cross-comparison and the present study derived its conclusions assuming that the data provided by CMIE is reliable.

The available data from 1988-89 to 2004-05 has been divided into two periods. First period from 1988-89 to 1994-95 to study the industrial concentration in the pre liberalization period and second period from 1995-96 to 2004-05 for the study of effect of liberalization on industrial concentration in the post liberalization period. The liberalization process started in India in 1991 with India gradually abolishing most of the internal controls by the time the WTO came into force in 1995. Since 1995, WTO induced policy measures to liberalize the external relationships of the country in terms of both trade and investment. Therefore, the pre and post-liberalization period has been taken with respect to pre and post-WTO era. Thus the changes in the industrial concentration in the selected industries, if any after 1995, were with respect to the post liberalization policies.

The selection of the industries for the study is also a very important and crucial matter. There are so many internal as well as external factors which affect the structure of an industry and make them distinctive. On the basis of those factors the industries could be growing, stagnant or contracting. In other words, on the basis of those factors a particular industry may
be moving towards more concentration or diversification. Keeping this in light, a mix of both fast growing modern industries and also some agro-based conventional industries have been selected for the study. The selected industries are:

- Capital goods industries namely Automobiles, Electronics and Electricals.
- Agro-based consumer goods industries viz. Textiles, Sugar and Food & Beverages.

The above mentioned eleven industries are the broad industries which can be further classified. In other words, the each set of industry includes some sub industries which are classified as follows:

1. Automobile industry includes:
   i. Commercial vehicles.
   ii. Passenger cars and multi-utility vehicles.
   iii. Two and three wheelers.
   iv. Other transports:
       a) Other vehicles.
       b) Bicycles.

2. Cement industry including cement & asbestos products.

3. Chemicals & allied industry comprising of :
   i. Inorganic chemicals.
   ii. Alkalies i.e. caustic soda and soda ash.
   iii. Fertilizers which includes nitrogenous, phosphatic and other fertilizers.
   iv. Pesticides.
   v. Paints & varnishes.
   vi. Dyes & Pigments.
   viii. Organic Chemicals consisting of acetic acid, acetic anhydride and other organic chemicals.
ix. Polymers which include thermoplastic, plastic resins and other forms of primary plastic.

x. Plastic products including plastic tubes, plastic sheets, plastic films, plastic packing goods and other plastic products.

xi. Petroleum products including refineries and lubricants.

xii. Tyres and tubes.

xiii. Rubber and rubber products including contraceptives and other rubber products.

xiv. Other chemicals which includes industrial gases, carbon black, explosives, photographic films and miscellaneous chemicals.

4. Drugs & pharmaceuticals industry.

5. Electrical industry which includes:

   i. Wires & cables
   ii. Welding machinery.
   iii. Domestic electrical appliances.
   iv. Generators, transformers and switch gears.
   v. A.C. and refrigerators.
   vi. Dry cells and storage batteries.
   vii. Industrial furnaces.
   viii. Miscellaneous electrical machinery.

6. Electronics industry comprising of:

   i. Consumer electronics.
   ii. Computer hardware.
   iii. Communication equipment.
   iv. Other electronics consisting of electronic tubes, equipments and components.

7. Food & beverages industry which can be classified as:

   i. Food products:
      a) Dairy products.
      b) Tea.
      c) Coffee.
      d) Vegetable oils & products consisting of vegetable oil, soya products, oil cakes and animal feed.
e) Other food products which includes cocoa products & confectionery, bakery and milling products, food processing, starches, marine foods, poultry and meat products, floriculture, packed food and other agriculture products.

ii. Beverages and Tobacco:
   a) Tobacco products.
   b) Beer & alcohol.

8. Paper industry including paper and paper products.

9. Steel industry consisting of:
   i. Finished steel.
   ii. Stainless steel.
   iii. Ferro alloys.

10. Sugar industry.

11. Textiles industry which is classified as:
   i. Cotton textiles consisting of cotton and blended yarn and cloth.
   ii. Synthetic textiles which include synthetic yarn and synthetic fabric.
   iii. Other textiles comprising of textile processing, readymade garments, silk textiles, woolen textiles, jute products and miscellaneous textiles.

Section-II

Different economic and financial variables have been included in the study for the measurement of industrial concentration and to analyze the impact of industrial concentration on the performance of the firms. The variables calculated / used for all the firms are as follows:-

1. Size of the firm: a) Total sales b) Total assets.
2. Closing size.
4. Profitability.
5. Liquidity ratios: a) Quick assets ratio b) Current ratio.
Size of the firm:

The profit & loss account values of total sales and balance sheet values of total assets of all the firms have been used as the two different measures of size in the study. They are defined as follows:

a) **Total Sales:** Total sales are the net revenue generated by sales of goods and services. It is arrived at by adding the invoices raised to the customers as reduced by goods returned, allowances and usual trade discounts given.

b) **Total Assets:** Following items are added to compute the total assets:

i. Liquid assets which include cash in hand and cash at bank;

ii. Current assets comprises of marketable securities i.e. short term investments of the firm such as bonds, debentures, govt. securities etc; inventories of raw materials, finished goods, semi-finished goods, stores and spares; loans and advances which includes sundry debtors, bills receivables, prepaid expenses like advance tax payments and outstanding incomes;

iii. Net fixed assets which included land & buildings, plant & machinery, furniture & fixtures and other tangible assets that are capitalized on account of relatively long life and substantial value;

iv. Investment in subsidiaries;

v. Intangible assets like trademarks, patents, copyrights, licenses, goodwill etc.

vi. Fictitious assets like advertisement, profit & loss account, preliminary expanses etc;

vii. Miscellaneous assets including all tangible and intangible assets not included above.
Liquidity Ratios: -

Liquidity Ratios study the firm’s short term solvency and its ability to pay its current liabilities. The liquidity refers to the maintenance of those assets which are easily convertible into cash in order to meet the current liabilities of the firm. The liquidity Ratios provide a quick measure of liquidity of the firm by establishing a relationship between its current assets and current liabilities. Two types of liquidity ratios have been used for the study of relationship between short term solvency of the firms and industrial concentration.

a) **Current ratio**: - It is the ratio of current assets to current liabilities. Inventories, marketable securities, account receivable, cash in hand and cash in bank are included in current assets. These are the assets which are either in cash or are convertible into cash or equivalent in the short period of time to meet the current liabilities i.e. liabilities which are payable in the short period of time. Higher the current ratio the better from the creditor’s point of view though it may not be wise from management’s view point as firm would be losing profit on account of idle cash. Therefore a higher current ratio is not itself a guarantee of the strong short term financial position of the firm. A proper balance is required to be maintained between liquidity and profitability but a current ratio of 2:1 is taken as a standard. The current ratio is calculated as:

\[
\text{Current ratio} = \frac{\text{Current Assets}}{\text{Current Liabilities}}
\]

b) **Quick Assets Ratio**: - The quick assets or ‘acid test’ ratio is a much stronger test for liquidity of a firm. It eliminates some of the disadvantages of the current ratio by concentrating strictly on liquid assets whose value is certain. The inventories are deducted from the current assets to compute the quick assets as it takes time to dispose-off the inventories and then the ratio of the quick assets to the current liabilities is computed to find the quick assets ratio. The objective of this ratio is to assess the short term solvency of the firm. As a part of current assets are not readily convertible into cash, therefore the current ratio does not adequately indicate the ability of the firm to discharge the current liabilities whereas, while computing the quick assets, a part of the current assets that are not liquid are eliminated. A comparison of current ratio and quick assets ratio would indicate the inventory held up. A high quick assets ratio compared to current ratio may
indicate under-stocking and a low quick assets ratio indicated over-stocking. The magnitude for the ratio is difficult to specify but a value of unity is a norm for this and any value less than unity is a warning for the firm. Thus,

\[
\text{Quick assets ratio} = \frac{\text{Quick Assets (Current Assets–Inventories)}}{\text{Current Liabilities}}
\]

**Capital Structure Ratios:**

Capital structure ratios indicate the long term solvency position of the company. There are basically two broad sources of funds—long term creditors and shareholders’ funds. Long term creditors consist of debentures, mortgage loans, public deposits or any other long term loan from financial institutions. Shareholders’ funds can be raised with the issue of shares or ploughing back of profits. The long term creditors would judge the soundness of the firm on the basis of long term financial strength measures in terms of firm’s ability to pay the interest regularly as well as to repay the principal amount in installments or lump sum on the due dates. In the study two capital structure ratios has been used.

**a) The Debt-Equity Ratio:** The debt-equity ratio or leverage ratio is taken as a proportion of debt to the net worth (i.e. paid up capital plus reserves) of the firm. In other words, it shows the relationship between the owned funds and the borrowed funds. So, the debt-equity ratio will reflect the extent of owner’s own money in the total capital of the firm. It is also a proportion of the external funds minus paid-up capital to the internal funds including paid-up capital of the firm. Debt-equity ratio will be an important index for evaluation of the credit-worthiness of a firm. A higher ratio shows more financing by the creditors of the firm and the lower ratio implies a smaller claim of creditors. The debt-equity ratio is also important from operational side of the firm. If the earnings of a firm are high and stable, it may go for higher debt-equity ratio, otherwise not as it may lead to insolvency due to poor earnings and high interest charges. The acceptable value of the ratio may vary from firm to firm depending upon type and size of the business, nature of industry, degree of risk involved etc. But still as a rule of thumb, debt-equity ratio of less than one is taken as acceptable standard however in some concerns higher debt-equity ratio can also be acceptable if it promotes profitability. The ratio is computed as:
Debt-equity ratio = \frac{\text{Total Debt}}{\text{Total Owner's Equity}}

b) Solvency ratio: - This ratio explains due relationship of total liabilities to total assets. This ratio shows the financial strength of the firm as it indicates whether the firm is capable of meeting its total outside liabilities out of its total assets or not. The outside liabilities include long term loans and current liabilities and total assets included current as well as fixed assets. This ratio is calculated on the basis of following formula:

Solvency ratio = \frac{\text{Total Liabilities to Outsiders}}{\text{Total Assets}}

Difference in Closing size:-

It is the difference between the firm’s value of the particular variable at the end of post-liberalization period under study i.e. in 2004-05 and the corresponding value of the variable at the end of pre-liberalization period i.e. in 1994-95.

Growth:-

All firms aim at maximization of the rate of growth of certain aspects of its activities such as sales, assets, profit, and value of the equity shares etc. In the given study, growth of the firms has been measured in terms of total sales and total assets of the firms during the pre and post-liberalization period. To measure the growth of the firms, average compound growth rates of total sales and total assets have been computed.

Profitability:-

Profit is the difference between the total expenses in making or buying of a commodity and the total revenue received from its sale. This difference, when expressed as a proportion of total sales or total assets or capital invested, shows the profitability of a firm. In the present study, profit has been taken as PAT (NNRT) as percentage of sales which means Profit After Tax (Net of Non-Recurring Transactions) as percentage of sales. NNRT is the income from non-recurring transactions net of non-recurring expenses. Non-Recurring Transactions include profit/loss of sales of fixed assets/sale of investments, provisions written book, prior period income/expenses, insurance claim etc.

Section-III

Various quantitative indexes are used for the measurement of industrial concentration. Every index has its own merits and limitations. Therefore in this study, an attempt has been made to measure concentration in selected industries by applying most of the indexes. This section deals with various measures of industrial concentration used in the study as explained below:

Concentration Ratios: -

Concentration ratios are calculated based on the market shares of the largest firms in the industry or market. The market share of such firms may be in sales, output, assets, employment etc. In this study the concentration has been measured on the basis of share in sales and total assets. Concentration ratio is measured as: -

\[ c = \sum_{i=1}^{k} P_i \]

Where \( n \) = Number of largest firms taken.

\( P_i \) = market share of \( i^{th} \) firm in descending order.

The two most common concentration ratios used are the four largest firms and the eight largest firms’ concentration ratio.

- **Four-Firm Concentration Ratio:** This concentration ratio measures the total market share held by the four largest firms in the industry.

- **Eight-Firm Concentration Ratio:** This concentration ratio measures the total market share held by the eight largest firms in the industry.
Generally the four firm concentration ratio is used for finding the concentration but if the data for the industry or the market is large the eight firms or even more firms’ concentration ratio can be used depending on the sample size of the firms. But still four & eight firms concentration ratios are the most widely used measures. As such, they have become something of analytical standards in the study of market structures and therefore are also readily comparable from industry to industry. Keeping this in view, in the present study also the concentration ratios has been measured for the largest four and eight firms.

As far as interpretation of the results based on these measures are concerned higher the concentration ratio greater is the concentration and vice-versa. The concentration ratios vary from 0 percent to 100 percent. If the concentration ratio is near to 0 that means the concentration level is very low in the market or in other words the market is an extremely competitive market. If the concentration ratio is near to 100 that means the concentration level is very high in the market and there is a high degree of oligopoly in the market. The nature of level of concentration based on concentration ratios can be summed up as under:-

<table>
<thead>
<tr>
<th>Value of Concentration Ratio</th>
<th>Four Firm concentration ratio</th>
<th>Eight Firm concentration ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Concentration</td>
<td>0 percent</td>
<td>0 percent</td>
</tr>
<tr>
<td>Low Concentration</td>
<td>0 to 40 percent</td>
<td>0 to 50 percent</td>
</tr>
<tr>
<td>Medium Concentration</td>
<td>40 to 60 percent</td>
<td>50 to 75 percent</td>
</tr>
<tr>
<td>High Concentration</td>
<td>60 to 100 percent</td>
<td>75 to 100 percent</td>
</tr>
<tr>
<td>Total Concentration</td>
<td>100 percent</td>
<td>100 percent</td>
</tr>
</tbody>
</table>

The concentration ratios do not provide much details about the competitiveness of the market rather only suggests about the nature of competition in the market. It only provides an indication about the oligopolistic or non-oligopolistic nature of the market. More over in case of the ‘k’ firm concentration ratio the ratio remains the same whether the firms ‘k’ firms have the same market share or one or more firms have the more market share. But the industry though oligopolistic in nature is likely to be more competitive if all larger firms have
almost equal share in the market than if one or two firms have more share in the market than the others.

**Coefficient of Variation:**

Coefficient of Variation (C.V.) is a simple measure of concentration which takes into account the dispersion of the market share / total assets across the firms in the industry. It is calculated as

\[
\text{C. V.} = \frac{\sigma}{p}
\]

Where

\[\sigma = \text{standard deviation of the market share / total assets of the firms.}\]

\[p = \frac{\sum P_i}{n}\]

\[P_i = \text{share of } i^{th} \text{ firm in proportion.}\]

\[N = \text{number of firms.}\]

The coefficient of variation varies between 0 and \(\sqrt{n - 1}\). Larger the value of coefficient of variation more will be the inequality in the distribution of the assets or the market share and hence more the concentration and vice versa. On the basis of the value of coefficient of variation in different industries a common range to determine the nature of level of concentration in this study has been used as under:

<table>
<thead>
<tr>
<th>Concentration Level</th>
<th>Value of Coefficient of Variation × 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Concentration</td>
<td>Below 150 percent</td>
</tr>
<tr>
<td>Medium Concentration</td>
<td>150-250 percent</td>
</tr>
<tr>
<td>High Concentration</td>
<td>Above 250 percent</td>
</tr>
</tbody>
</table>
Normalized Entropy Index: -

Entropy index is used to measure the degree of market concentration and is measured as follows:

\[ E = \sum_{i=1}^{n} P_i \ln \left( \frac{1}{P_i} \right) ; 0 \leq E \leq 1n \ n \]

Where, \( E \) = Entropy Index, \( n \) = number of firms and \( 1n \) = \( \log_e \)

\( P_i \) = market share of the \( i^{th} \) firm or share of it firm in total assets, in symbols: -

\[ P_i = \frac{x_i}{X} ; \]

\[ X = \sum_{i=1}^{n} x_i \]

Where

\( x_i \) = share of the \( ith \) firm and \( X \) = Total sales or total assets of the industry (Hart, 1971).

There is an inverse relationship between the entropy coefficient and the degree of concentration i.e. for a monopoly firm where \( n = 1 \), the value of entropy coefficient will be 0 which means maximum concentration. But increase in equality of the market shares of the firms and also an increase in number of firms increase the value of entropy coefficient. But increased number of firms affects the entropy coefficient at diminishing rate because of the use of logarithms as when the number is already large enough it becomes less significant from the point of view of concentration. If all the firms are equal in size then the entropy coefficient will be maximum. That is called maximum entropy or no concentration. It is calculated as: -

\[ E_{max} = \sum_{i=1}^{n} \frac{1}{n} \times 1n \ n = 1n \ n \]
Normalized Entropy Index is the relative measure of entropy which shows the actual degree of dispersion of the market share to the maximum dispersion for a given number of firms. It is found as:

\[ E_{\text{Normalized}} = \frac{E}{E_{\text{Max}}} = \frac{E}{\ln n}; \quad 0 \leq E_{\text{Normalized}} \leq 1 \]

The nature level of concentration in the study is summed up as:

<table>
<thead>
<tr>
<th>Concentration Level</th>
<th>Value of Normalized Entropy Index × 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Concentration</td>
<td>100 percent</td>
</tr>
<tr>
<td>Low Concentration</td>
<td>100-80 percent</td>
</tr>
<tr>
<td>Medium Concentration</td>
<td>80-70 percent</td>
</tr>
<tr>
<td>High Concentration</td>
<td>70-0 percent</td>
</tr>
<tr>
<td>Total Concentration</td>
<td>0 percent</td>
</tr>
</tbody>
</table>

**Hirschman Herfindahl Index:**

The Herfindahl Index of concentration is a summary statistics denoting the level of concentration of the market share / assets in the hands of few firms. The index takes the value between 0 and 1, where 0 indicates no concentration at all and 1 indicate maximum concentration. Thus, a Herfindahl Index close to 1 indicates a situation where the industry is close to a monopoly. Conversely, the smaller the index the more dispersed is the concentration. Suppose there are \( N \) companies in an industry and \( s_i \) is the market share of the \( i^{th} \) firm then the Herfindahl Index is the sum of the squares of the market shares or shares in the total assets of all the firms in the industry. Thus,

\[ H = s_1^2 + s_2^2 + s_3^2 + \ldots \ldots + s_n^2. \quad 1/N \leq H \leq 1 \]

The Herfindahl Index uses information on all the companies and is not limited to just a few companies as is the case with some alternative measures of concentration like \( k \)-firm concentration ratios (EIS, 2009).
The nature of level of concentration in the study has been taken as under:

<table>
<thead>
<tr>
<th>Concentration Level</th>
<th>Value of Hirschman Herfindahl Index × 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Concentration</td>
<td>Below 6 percent</td>
</tr>
<tr>
<td>Medium Concentration</td>
<td>6-12 percent</td>
</tr>
<tr>
<td>High Concentration</td>
<td>Above 12 percent</td>
</tr>
</tbody>
</table>

The major benefit of the Herfindahl index in relationship to measures such as the Concentration ratios is that it gives more weight to larger firms as the market shares are squared prior to being summed up.

**Gini Coefficient: -**

Gini coefficient is a measure of inequality, defined as the mean of absolute differences between all pairs of individuals for some measure. Gini coefficient is calculated as half of the Relative mean difference. The mean difference is the average absolute difference between two items selected randomly from a population, and the relative mean difference is the mean difference divided by the average, to normalize for scale. It is calculated as:

\[
G = \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} |x_i - x_j|}{2n^2 \bar{x}}
\]

Where \(x\) is an observed value, \(n\) is the number of values observed and \(\bar{x}\) is the mean value.

The minimum value is 0 when all measurements are equal and the theoretical maximum is 1 for an infinitely large set of observations where all measurements but one has a value of 0, which is the ultimate inequality (Stuart and Ord, 1994). The value of Gini Coefficient varies from 0 to 100 when it is expressed in percentage.
Coefficient of Concentration:

Coefficient of Concentration is another measure of concentration which is derived from the gini coefficient. In order for $G$ to be an unbiased estimate of the true population value, it should be multiplied by $n / (n-1)$ (Dixon, 1987; Mills and Zandvakili, 1997). This corrected form of Gini coefficient does not appear in most of the literature, but there are few situations when it is not the most appropriate form to use and the modified form of it i.e. Coefficient of Concentration is more appropriate. The formula for calculating Coefficient of Concentration is as follows:

$$C = \frac{n}{n-1} G$$

Where ‘$G$’ is Gini Coefficient.

The value of Coefficient of Concentration also varies from 0 to 1 or 0 to 100 when it is expressed in percentage.
Growth Rate:

To estimate the compound growth rate of total assets and total sales following model was used:

\[ Y = A B^t e^u \]

or

\[ \log Y = \log A + t \log B + u \]

Where \( Y \) is the value of dependent variable.

\( t \) is the time variable.

\( A \) & \( B \) are constant and \( u \) is the error term.

\[ r = (B - 1) \times 100 \]

\( r \) is the compound growth rate of \( Y \).

Chi-Square Test:

In order to find out whether there is any association between industrial concentration and the performance variables of the firms in respective industries or not, Chi-Square test was applied, after preparing two-way tables. The two-way tables were prepared on the basis of frequency distribution of difference in closing size of various performance variables with respect to levels of concentration. The distribution tables were prepared on the basis of Hirschman’s Herfindahl Index and Normalized Entropy Index. These two indexes were selected for further analysis because, firstly, these are the most widely accepted & used indexes for measuring concentration and secondly, when a consolidated statement of industries falling in the various categories of concentration on the basis of various measures of concentration used in the study was prepared, the results of these two indexes were more closer to the results of the consolidated statement.
Chi-Square is defined as:

\[ \chi^2 = \sum_{i=1}^{r} \sum_{j=1}^{c} \frac{(O_{ij} - E_{ij})^2}{E_{ij}} \]

Where \( O \) = Observed frequency

\( E \) = Expected frequency

The chi-square values were calculated for 3×3 two way classification tables of degree-wise concentration (row-wise) and difference in size of the performance variables of firms (column-wise). The calculated value of chi-square was compared to the tabulated value of the Chi-Square at \((r-1) (c-1)\) degrees of freedom where ‘r’ is number of rows and ‘c’ is number of columns in the table and results were interpreted accordingly.