Chapter-III

DATA BASE AND METHODOLOGY

The present study is an attempt to study cost of capital of selected companies in India. This chapter explains the research methodology of the thesis. It explains in detail the objectives of the study, universe and sample of the study, period of the study and measures to compute cost of each specific long-term source of finance and overall cost of capital. It explains in detail variables selected for the purpose of study, sources of data collection, techniques of data analysis and presentation of collected data. This chapter ends with limitations of the study.

3.1 Objectives of the Study

Every research is conducted to achieve certain objectives. Objectives represent the basic intent or purpose of the research. The main objective of this research study is to have insight into the cost of capital of selected companies in India. A comparative study of pre-liberalization and post-liberalization periods has been made. The specific objectives of the study are as follows:

1. To study the trends in the historical cost of capital of selected Indian companies in selected industries (1979-80 to 2005-06);
2. To analyze the effect of liberalization on cost of capital;
3. To test the effect of capital structure upon cost of capital and
4. To determine the effect of size, age and return on Government securities upon cost of capital.

3.2 Universe and Sample of the Study

The present research is concerned with the study of cost of capital of selected Indian companies. The various issues of the Bombay Stock Exchange Official Directory from 1979 to December 1999 have been referred to select the companies covered in the study. Initially, a list of 347 companies representing selected eight industries had been take for the purpose of checking the availability of data and final selection thereof.
Table 3.1

Industry-Wise Distribution of Sample

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Industry Group</th>
<th>No. of Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Electricity (Power)</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Metals, Alloys, Metal Products &amp; Structuralal (Metal)</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>Cement (Cement)</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>Cotton Spinning, Weaving, Synthetic Fibers, Silk and Woolen Textiles (Textiles)</td>
<td>29</td>
</tr>
<tr>
<td>5</td>
<td>Paper, Pulp &amp; Hardboard (Paper)</td>
<td>13</td>
</tr>
<tr>
<td>6</td>
<td>General Engineering (General Engineering)</td>
<td>21</td>
</tr>
<tr>
<td>7</td>
<td>Sugar, Brewery (Sugar)</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>Tea Plantations (Tea)</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

**Source:** Various issues of the Bombay Stock Exchange Official Directory (Mumbai).

Companies, though listed but whose accounting data for period of twenty seven years were not published in the said directory had to be dropped. Further, companies with negative values of earnings per share, accumulated losses and non availability of data on the market value of shares had also been excluded from the scope of the present study. The final sample of the study consists of 100 companies representing these 8 industries over the study period of 27 years (1979-80 to 2005-06). The industry classification on the basis of the Bombay Stock Exchange Official Directory as given in Volume 2, dated Jan. 4, 1980 is used to divide the sampled companies into various groups. The Table 3.1 shows that number of companies in the sample have been 5, 8, 7, 29, 13, 21, 7 and 10 respectively for power, metal, cement, textiles, paper, general engineering, sugar and tea industries.
3.3 Measures for Cost of Each Specific Source of Long-Term Finance and Overall Cost of Capital ($K_{o1}$ and $K_{o2}$)

The measures used to compute cost of each specific source of long-term finance i.e. cost of debt ($K_{dat}$), cost of preference share capital ($K_p$), cost of equity capital ($K_{e1}$ and $K_{e2}$) and overall cost of capital ($K_{o1}$ and $K_{o2}$) are as follows:

**Cost of Debt ($K_{dat}$):** The cost of debt ($K_{dat}$) for a company is the rate of discount that equates the present value of outflows on account of use of debt with the present value of net proceeds received from the issue of debt. Since the data regarding floatation cost, discount or premium concerning issue and redemption are not available, the cost of debt ($K_{dat}$) has been computed by following formula:

$$K_{dat} = K_{dbt} (1-t)$$

Where,

$$K_{dbt} = \frac{\text{Annual Interest Payable}}{\text{Average Debt}} \quad \text{i.e. Cost of debt before tax}$$

$$\text{Avg. Debt} = \frac{\text{Intt. Bearing Debt at the end of curr. year} + \text{Intt. Bearing Debt at the end of prev. year}}{2}$$

$$\text{Intt. Bearing Debt} = \text{Long Term Intt. Bearing Debt} + \text{Short Term Intt. Bearing Debt}$$

$$t = \text{Effective Tax Rate} = \frac{\text{Tax Provision}}{\text{Pre-Tax Profit}}$$

**Cost of Preference Capital ($K_p$):** The cost of preference share capital ($K_p$) is function of preference dividend payable to preference shareholders. As a general rule, the company has no legal obligation to pay preference dividend but the investors when they invest in preference share capital have an expectation of getting return from the company. Since the data regarding floatation cost, discount or premium concerning issue and redemption are not available, the cost of preference share capital ($K_p$) has been worked out by using the following formula:

$$K_p = \frac{PD}{PC}$$
Where,

\( K_p \) = Cost of preference share capital.

\( PD \) = Preference dividend.

\( PC \) = Paid up preference share capital.

**Cost of Equity Capital** (**\( K_{e1} \) and \( K_{e2} \)\): The cost of equity capital (**\( K_e \)\) is the minimum rate of return that a company must earn on its equity-financed portion of investment to leave the market price of stock unchanged. A number of approaches are available for computation of cost of equity capital (**\( K_e \)\) such as dividend approach, earnings per share approach, dividend per share and earnings per share growing at a constant rate and variable rate, realized yield approach and bond yield plus risk premium approach. Although the dividend model is more logical, yet it is the earnings model which is widely used in practice (**Ezra, 1967**). It is preferred over the dividend model because the cost of capital is used primarily as an investment criterion and since earnings is the goal, the problem should be approached directly by using the earnings model. Earnings model taking into account annual anticipated growth in earnings per share and compound growth in earnings per share on five-year basis has been used as base for computation of cost of equity capital (**\( K_{e1} \) and \( K_{e2} \)\) respectively. The following formulas have been used to compute cost of equity capital (**\( K_{e1} \) and \( K_{e2} \)\):

\[
K_{e1} = \frac{EPS_1}{P_o} + g
\]

\[
EPS_1 = EPS_0 (1+g).
\]

\[
EPS_1 = \text{Expected earnings per share at the end of year.}
\]

\[
EPS_0 = \text{Earnings per share for the previous year.}
\]

\[
P_o = \text{Average market price of share at the end of previous year.}
\]

\[
g = \text{Growth rate in earnings per share computed on annual basis.}
\]

\[
K_{e2} = \frac{EPS_1}{P_o} + g
\]
\[ \text{EPS}_1 = \text{EPS}_0 (1+g). \]

\[ \text{EPS}_1 = \text{Expected earnings per share at the end of year.} \]

\[ \text{EPS}_0 = \text{Earnings per share for the previous year.} \]

\[ P_0 = \text{Average market price of share at the end of previous year.} \]

\[ g = \text{Compound growth rate in earnings per share computed on five year basis.} \]

Annual growth rates in earnings per share are computed by taking into account earnings per share for current year and earnings per share for previous year. It represents the difference between the two, divided by earnings per share for previous year multiplied by 100. In order to compute compound growth rates in earnings per share, regression technique has been used. The logarithm of both sides of equation set for EPS is taken in order to estimate growth rates statistically. This equation is linear in logarithms and has a slope equal to \( \log (1+g) \). Using the least squares regression technique, we can estimate \( \log (1+g) \).

\[
\log (1+g) = \frac{\sum_{i=1}^{n} y_i \log \text{EPS}_i}{\sum_{i=1}^{n} y_i^2}
\]

By using this equation compound growth rates in earnings per share are estimated. On the basis of earnings per share of first five years i.e. 1979-80 to 1983-84, ‘g’ is calculated and its value is used for measurement of cost of equity capital (\( K_{e2} \)) for the immediate next year i.e. 1985. In the same way ‘g’ is calculated and used for measuring cost of equity capital (\( K_{e2} \)) for next 22 years. In case the value of ‘g’ is negative, it is ignored for measuring cost of equity (\( K_{e2} \)) capital.

**Overall Cost of Capital (\( K_{o1} \) and \( K_{o2} \)):** The overall cost of capital (\( K_{o1} \) and \( K_{o2} \)) of selected companies in selected industries is computed by taking into account respective cost of debt (\( K_{\text{d1}} \)), cost of preference share capital (\( K_{p} \)) and cost of equity capital (\( K_{e1} \) and \( K_{e2} \)) (including cost of common stock plus cost of retained earnings) multiplied by their respective proportions in the total financing mix of company. The following
formulas have been used to compute overall cost of capital (K_{o1} and K_{o2}): 

\[ K_{o1} = K_{dat} W_d + K_p W_p + K_{e1} W_e \]

\[ K_{o2} = K_{dat} W_d + K_p W_p + K_{e2} W_e \]

Where, \( K_{o1} \) and \( K_{o2} \) represent overall cost of capital, whereas \( K_{dat} \), \( K_p \), \( K_{e1} \) and \( K_{e2} \) represent respective cost of debt after tax, cost of preference share capital and two expressions of cost of equity capital (\( K_{e1} \) and \( K_{e2} \)) computed by taking growth rate as annual percentage change in earnings per share and compound growth rate in earnings per share computed on five-year basis. \( W_d \), \( W_p \) and \( W_e \) represent respective weights of each source in total financing mix of company.

### 3.4 Period of the Study

The period selected for the study is from 1979-80 to 2005-06. During the 1980s there was a worldwide trend towards financial liberalization and globalization of the stock markets. Due to domestic and international compulsions, most of the developing countries liberalized their financial markets during this period. Increased emphasis was put on the development of equity markets. India has also followed this path. Stock markets grew rapidly in India during the late 1980s and early 1990s. Since 1991, India has embarked on a large-scale economic liberalization and structural adjustment programme which includes modernization and internationalization of the financial sector. Thus, the decade of 1990s, which forms the part of our period of study has witnessed radical changes in public policy in India. As a result of liberalization, there has been reduction in the involvement of State in economic activities—both as direct participant in the production process and through its indirect control over the process of production and resource allocation in the economy. These changes were manifested in dismantling of the industrial licensing system, a dilution of the anti-monopoly laws, withdrawal of directed credit programs and opening of several economic activities for private sector participation. The financial sector also experienced deregulatory initiatives to encourage the growth of financial markets—both equity and debt instruments. All these changes have effect on the operating environment, financing patterns and cost of capital of Indian companies.
3.5 Description of Variables

Different researchers have used different methods for measuring explanatory and dependent variables. The interpretation of the results largely depends upon the definitions of selected variables. On the basis of review of empirical research and theoretical literature available on this concept the following variables have been identified:

- **Size**: Large firms are able to take advantage of economies of scale in issuing long-term debt and have bargaining power over creditors. Size is also an indicator of borrowing capacity of firms. Large firms have higher borrowing capacity and lower cost of borrowing with better access to capital markets. **Gordon (1962) and Kang and Stulz (1996)** found out that market systematically capitalize earnings of large firms differently from those of small firms in the same industry. **Ferri and Jones (1979) and Kim and Sorensen (1986)** stated that large companies are less risky. Large firms have more stable or less volatile cash flows and may be able to exploit economies of scale in issuing securities (**Graham, 1999** and **Gaud et al., 2005**). They may have an advantage over smaller firms in accessing capital markets and can borrow under better conditions (**Ferri and Jones, 1979** and **Wiwattanakantang, 1999**). **Smith (1979)** argued that the cost of issuing debt and equity is also related to firm’s size. In particular, small firms pay much more than large firms while raising funds through debt or equity. Furthermore, large firms can diversify their investment projects on a broader basis and limit their risks. Large firms are often diversified and have more stable cash flows and the probability of bankruptcy for large firms is smaller than small firms. Larger firms have lower cost of equity capital (Ke) consistent with **Fama and French (1998)**. Large firms enjoy easy access to capital markets, receive higher credit ratings for their debt issues and pay lower interest rates on their borrowed funds. These firms have lower cost of debt capital (Kd), low cost of equity capital (Ke) and have lower overall cost of capital (Ko). Accordingly, size is negatively related with overall cost of capital (Ko) (**Boetang, 2004**). The natural logarithms of net sales and total assets have been taken as two indicators of size for present study.
1. Size \((S_1)\) = Natural logarithm of net sales  
2. Size \((S_2)\) = Natural logarithm of total assets  

**Leverage:** Leverage may be defined as employing that source of fund which has fixed cost. Different researchers have defined leverage in different ways depending upon their objective of analysis. Kakani (1999) measured leverage by using total debt, long-term debt and short-term debt. Booth et al. (2001) measured leverage by using total debt, long-term book debt and long term market debt. The ratios of funded debt to equity (including preference capital) \((L_1)\), funded debt to equity (excluding preference capital) \((L_2)\), interest-bearing debt (short term interest bearing debt plus long term interest bearing debt) to equity \((L_3)\) and total debt (long term loans plus short-term loans including current liabilities) to equity \((L_4)\) respectively have been taken as four measures of leverage for the present study.

1. Leverage \((L_1)\) = \(\frac{\text{Funded Debt}}{\text{Equity (Including Pref. Capital)}}\)  
2. Leverage \((L_2)\) = \(\frac{\text{Funded Debt a+ Pref. Capital}}{\text{Equity (Excluding Pref. Capital)}}\)  
3. Leverage \((L_3)\) = \(\frac{\text{Interest Bearing Debt}}{\text{Equity}}\)  
4. Leverage \((L_4)\) = \(\frac{\text{Total Debt}}{\text{Equity}}\)  

**Non-debt tax shields:** The tax-based model suggests that the major benefit of using debt financing is corporate tax deduction. DeAngelo and Masulis (1980), Bowen et al. (1982), Mackie-Mason (1990), Dhaliwal et al. (1992), Givoly et al. (1997), Ayers et al. (2001) and Schulman et al. (1996) argued that existence of other non-interest items such as depreciation, tax credit and pension funds as non-debt tax shields substitute for the tax advantage of debt and reduce the demand for debt. Accordingly, firms with higher non-debt tax shields are likely to use less debt. The preference of NDTS is due to high cost to the firm
associated with debt covenants. Debt covenants are likely to cause high transaction costs for some firms. The use of non-debt tax shields helps companies to reduce their overall cost of capital ($K_o$). Among non-debt tax shields, depreciation is the most important item used by Indian companies to shield income against tax. Following Titman and Wessels (1988), Ozkan (2001) and Chen (2003) the ratio of annual depreciation expense to total assets is used as proxy to measure non-debt tax shields in the present study.

\[
\text{Non-debt Tax Shields} = \frac{\text{Depreciation}}{\text{Total Assets}}
\]

- **Reserves and retained earnings/total assets:** The internal funds i.e. reserves and retained earnings available with companies do not carry issue costs and reduce the cost of equity capital ($K_e$) as consistent with the pecking order hypothesis (Krishnan and Moyer, 1996 and Myers, 1984). Following this viewpoint the ratio of reserves and retained earnings to total assets (RTA) has been used in the present study.

\[
\text{RTA} = \frac{\text{Reserves and retained earnings}}{\text{Total Assets}}
\]

- **Liquidity:** To measure the short-term risk of companies liquidity ratio has been included in the model designed for present study. Firms with sufficient liquid assets have lower leverage as compared to companies not having sufficient liquid assets at their disposal. Kaur (2000) stated that more liquid the firm, the less will be the overall cost of capital ($K_o$) which implies that it has negative impact on the dependent variable. The ratio of current assets to current liabilities is used as a proxy to measure liquidity in the present study.

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

- **Growth:** Gupta (1969) suggests that a company with rapid growth will tend to finance its expansion with debt. Gupta (1969), Toy and others (1974), Marsh
(1982) and Sinha (1992) argued that companies that experience high growth would relatively have higher debt ratios. Weston (1963) showed in his empirical work that growth being correlated to leverage variable would tend to influence the relationship between overall cost of capital (K_o) and leverage. Carleton and others (1977) and Barton and others (1989) made use of percentage change in net sales to measure growth. Titman and Wessels (1988), Ooi (1999) and Chen (2003) used firm’s annual growth in total assets as measure of growth. Annual percentage change in net sales, total assets and earnings before interest and taxes (EBIT) have been taken as three indicators of growth in the present study.

1. Growth (G_1) = Annual percentage change in net sales
2. Growth (G_2) = Annual percentage change in total assets
3. Growth (G_3) = Annual percentage change in earnings before interest and taxes (EBIT)

**Profitability:** Even after decades of empirical research since Modigliani and Miller (1958), no consistent predictions have been reached of the relationship between profitability and overall cost of capital (K_o). Tax-based models suggest that profitable firms should borrow more, ceteris paribus, as they have greater need to shield income from corporate tax. However, pecking order theory suggests that firms should use retained earnings first as investment funds and then move to bonds and new equity only if necessary. In this case profitable firms tend to have less debt. The most common expectation in financial literature is that there exists negative relationship between profitability and overall cost of capital (K_o). Toy and others (1974), Marsh (1982), Friend and Lang (1988), Titman and Wessels (1988), Allen (1991), Rajan and Zingales (1995), Wiwattanakantang (1999) and Chen (2003) stated that firms with high profits will maintain a relatively lower debt ratio because of their ability to finance themselves from internally generated funds. As highly profitable firms are able to raise funds by way of debt or equity on easy terms, profitability is
said to be negatively related to overall cost of capital ($K_o$). The ratios of earnings before interest and taxes (EBIT) to net sales and earnings before interest and taxes (EBIT) to total assets (ROA) respectively are taken as two proxies to measure profitability in the present study.

1. Profitability ($P_1$) = \[
\frac{\text{Earnings before interest and taxes (EBIT)}}{\text{Net Sales}}
\]

2. Profitability ($P_2$) = \[
\frac{\text{Earnings before interest and taxes (EBIT)}}{\text{Total Assets}}
\]

- **Collaterals:** The fixed assets of firms are considered as real representatives of the real guarantees to its creditors and are sound collateral for loans. Lenders are more willing to supply loans to companies having greater proportion of tangible assets in the balance sheet. The greater the collaterals, the more value the debt holders can receive in case of default (Jensen and Meckling, 1976). Collaterals mitigate information asymmetry and agency problems as it secures the interest of lenders in the event of problems arising because of lack of information or conflict of interest with the owners-managers of firm. Collaterals are expected to have negative relationship with overall cost of capital ($K_o$) as assets backing make the business more secure and hence overall cost of capital ($K_o$) is reduced. The ratio of net fixed assets to total assets is used as proxy to measure collaterals in the present study.

\[
\text{Collaterals} = \frac{\text{Net Fixed Assets}}{\text{Total Assets}}
\]

- **Age:** There is very little literature available on this factor. Archer and Faerber (1966), Leeth and Scott (1989) and Johnson (1997) included age in their leverage related studies on the basis that it could be considered as measure of risk and reputation. Barton and others (1989) stated that it is expected that mature firms will experience lower earnings volatility and these enterprises will have higher debt ratios and lower overall cost of capital ($K_o$).
years since incorporation have been taken as proxy to measure age in the present study.

\[ \text{Age} = \text{Number of years since incorporation} \]

- **Return on Government securities (ROGS):** Return on Government securities (ROGS) has direct impact upon cost of capital. The return expected by an investor from a particular security depends upon risk associated with particular security. The return expected by an investor is composition of risk free rate of return plus risk premium. The risk free rate of return is based upon the rate fixed by Government on its securities. The rate of interest on time deposits of post-office is taken as proxy to represent return on Government securities (ROGS) for the present study.

\[ \text{ROGS} = \text{Rate of interest on time deposits of post-office} \]

### 3.6 Sources of Data Collection

The choice of source of data has been made keeping in view the objectives of the study, consistency and uniformity of information published about the companies. The scope of present study has been confined to listed 100 Indian companies only. Secondary data have been collected for present study. The financial data for the purpose of study have been collected from The Bombay Stock Exchange Official Directory, Prowess database maintained by Centre for Monitoring Indian Economy (CMIE) and annual reports of selected companies. In addition, websites of sampled companies, published financial statements of sampled companies, articles in various journals and other published literature on the subject have been screened to gather the required information for the purpose of study. The collected information have been suitably classified and tabulated in the form of tables with the help of statistical techniques like trend analysis, compound growth rates, t-values, averages, standard deviation and backward step-wise panel data regression analysis. The data have been objectively analyzed and conclusions are drawn on the basis of parametric tests at 1 percent, 5 percent and 10 percent levels of significance respectively. The entire period of study has been segregated into two parts i.e. pre-liberalization period (1979-80 to 1989-90)
and post-liberalization period (1990-91 to 2005-06). The sample selection criteria is described below:

1. The company must be listed on the Bombay Stock Exchange (BSE).
2. The data must be available for a period of 27 years i.e. 1979-80 to 2005-06.

The selection criteria indicate that sample size for the present study has been restricted to relatively old companies for the sake of comparability and consistency between pre-liberalization and post-liberalization periods selected for the purpose of study.

3.7 Techniques of Data Analysis and Presentation

The data have been analyzed by using following statistical techniques:

3.7.1 Annual Growth Rate

To estimate the simple growth rate of various variables a simple yearly increase has been considered.

3.7.2 Compound growth rate

It represents the average growth rate over a period of time. It is geometric average of annual growth rates. In the present research work compound growth rate has been used for computing cost of equity capital ($K_{c2}$) and for analyzing of behavior of different costs over a period of time.

$$\log (1 + g) = \frac{\sum_{i=1}^{n} y_i \log EPS_i}{\sum_{i=1}^{n} y_i^2}$$

3.7.3 Arithmetic Average

An average of dataset refers to a measure of the “middle” or “expected” value of the data set. Average of a list of numbers is the sum of all the members of the list divided by the number of items in the list. If the list is a statistical population then the average of that population is called a population average. If the list is a statistical sample then the resulting statistic is average of a sample.
\[
\bar{X} = \frac{\sum X}{N}
\]

Where,
\[
\bar{X} = \text{Average}
\]
\[
\sum X = \text{Sum of all the items in the series}
\]
\[
N = \text{Total number of items in the series}
\]

### 3.7.4 Standard Deviation

The standard deviation measures the spread of the data about the mean value. The standard deviation is usually denoted with the letter \( \sigma \) (lower case sigma). It is defined as the square root of the variance. The standard deviation is the most common measure of statistical dispersion, measuring how widely spread the values in a data series from mean. It is measured by multiplying the probability with the squared difference of outcome and expected value and finally getting root of this summation of all possible outcomes. Square of the standard deviation is called variance. If many data points are close to the mean, then the standard deviation is small. If many data points are far from the mean then the standard deviation is large. If all the data values are equal then the standard deviation is zero. Higher the standard deviation greater will be risk relative to return.

\[
\sigma = \frac{\sum X^2}{N}
\]

Where,
\[
\sigma = \text{Standard deviation}
\]
\[
\sum X^2 = \text{Sum total of the squares of deviations from their mean value}
\]
\[
N = \text{Total number of items in the series}
\]

### 3.7.5 Coefficient of Variation

The coefficient of variation is statistical measure of the dispersion of data points in a data series around the mean. It describes the magnitude of sample values and
variations within them. As a relative measure of risk, it is computed by dividing standard deviation of data set by mean of same sample set. It is a useful statistic for comparing the degree of variation from one data series to another even if the means are drastically different from each other. Coefficient of variation suggests relative variability, homogeneity or stability of data series. Higher value of coefficient of variation suggests greater degree of variability and lesser degree of stability and homogeneity. A lower value of coefficient of variation on the other hand suggests lower degree of variability, high degree of homogeneity and stability of data series.

\[ CV = \frac{\sigma}{X} \times 100 \]

Where,

- \( CV \) = Coefficient of Variation
- \( \sigma \) = Standard deviation of the Series
- \( \bar{X} \) = Average of the Series

3.7.6 Trend Analysis

Trend analysis is a tool which provides a dynamic study of the behavior of items over a passage of time. This analysis shows one of the direction-upward or downward. In the words of Myer, “The ratios of the magnitude of financial statement in a series of statement to its magnitude in one of the statements selected as base may be called trend ratios as they reveal the trend of item with the passage of time”. These ratios are also known as index numbers showing relative changes in the financial data with the passage of time. In other words trend means general direction or shape of time series.

Computation of Trend Percentage

1. A statement is to be selected as base for the study of all other statements.
2. Every item of the base years is to be stated as 100.
3. On the basis of the base year, trend ratios or index is computed for corresponding items in all other years.
Thus trend analysis shows whether an item has increased or decreased as well as rate of change over a period of time.

3.7.7 Panel Data Regression Analysis

Panel data follow a given sample of individuals over time, and thus provides multiple observations on each individual in the sample. Panel data combine the features of time series and cross-section. It provides information on a number of statistical units for a number of years. Panel data for economic research has several advantages over cross-sectional or time-series sets. Panel data usually provides the researcher a large number of data points, increasing the degrees of freedom and reducing the collinearity among explanatory variables hence improving the efficiency of econometric estimates.

Since panel data relate to a sample of firms over time, there is bound to be heterogeneity in these units. The techniques of panel data estimation can take such heterogeneity explicitly into account by allowing for individual-specific variables. Panel data can better detect and measure effects that simply cannot be observed in pure cross-section or pure time-series data.

Model Specification

- Constant Coefficient Model

This is also known as pooled regression. This is the simplest of all the panel data models. The model disregards the time, space or individual effects. All the observations are stacked on one another of each company. The assumption of the model is that all firms are similar with regard to capital structure and cost of capital and there is no significant industry or time effect on overall cost of capital (K_{o1} and K_{o2}). The estimated model assumes that the intercept values of all the companies are the same. It also assumes that the slope coefficients of the independent variables are identical for all the companies in the sample. Therefore, the pooled regression may distort the true picture of the relationships among overall cost of capital (K_{o1} and K_{o2}) and the independent variables across firms if the assumptions of the models are not met. Therefore, to capture the firm or industry or random effects, we need to apply some other models of panel data.
• **Fixed and Random Effects Model**

To capture the individual company effect on overall cost of capital ($K_{o1}$ and $K_{o2}$) or control for omitted variables that differ among companies but are constant over time, we use fixed effects model. The individuality of each cross section unit is taken into account by letting the intercept vary for each unit but still assume that the slope coefficient are constant across firms. The subscript $i$ on the intercept term suggests that the intercepts for each cross section unit will be different. Suppose we, create dummies for each company/industry, then the difference may be due to special features of each company/industry, such as assets intensity, research expenditures, subsidies or tax favors by government for a specific industry. To apply the model while using panel data analysis, we use dummies for all except one company/industry to which a specific firm belongs for controlling the company/industry effect.

Panel data involve the pooling of observations on a cross-section of units over several time periods and facilitates identification of effects that are simply not detectable in pure cross-sections or pure time-series studies. The panel regression equation differs from a regular time-series or cross section regression by the double subscript attached to each variable.

We compute the conventional random and fixed effects models from the specification below:

$$y_{it} = \alpha + \beta' x_{it} + u_{it}$$

the subscript $i$ represents the cross-sectional dimension and $t$ denotes the time-series dimension. The left-hand variable $y_{it}$, represents the dependent variables in the model, i.e. overall cost of capital ($K_{o1}$ and $K_{o2}$). $x_{it}$ contains the set of independent variables in the estimation model, is taken to be constant over time $t$ and specific to the individual cross-sectional unit $i$. Independent variables here refer to size ($S_1$ and $S_2$), leverage ($L_1$, $L_2$, $L_3$ and $L_4$), non-debt tax shields (NDTS), reserves and retained earnings to total assets (RTA), liquidity (Liq.), growth ($G_1$, $G_2$ and $G_3$), profitability ($P_1$ and $P_2$), collaterals (Coll.), age and return on Government securities (ROGS) respectively. The coefficient of determination ($R^2$) has been computed to determine the percentage
variation in the dependent variable explained by independent variables. The value of $R^2$ lies between 0 and 1. The greater the $R^2$, the greater the percentage of variation of Y explained by the regression model. Restricted F-test has been used to make a choice between the fixed effects and random effects models to find out whether or not the regressors have been correlated with individual effects that have been investigated.

The panel data analysis is employed for each sector separately as well as taking all the sectors together. The dummies for N-1 companies within regression equation for each industrial sector or N-1 industries in the overall regression equation have been introduced. Thus, in each of above equations, numbers of company/industry dummies are included in the following order:

<table>
<thead>
<tr>
<th>Industry</th>
<th>Total No. of Companies</th>
<th>No. of Dummies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Metal</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Cement</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Textile</td>
<td>29</td>
<td>28</td>
</tr>
<tr>
<td>Paper</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>General Engineering</td>
<td>21</td>
<td>20</td>
</tr>
<tr>
<td>Sugar</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Tea</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Total Industries</td>
<td>8</td>
<td>7</td>
</tr>
</tbody>
</table>

In the fixed effects model, it is assumed although the intercept may differ across individuals, each individual’s intercept does not vary over time; that is, it is time-invariant. The coefficient (slope) of the regressors does not vary across
individuals or over time. Intercept vary between companies/industries by dummy variable technique. In the equations above the term $\alpha$ is the slope coefficient of all the companies/industries. By subtracting $\alpha$ from regression coefficient of a company/industry, we get the intercept for the said company/industry.

In Fixed Effect Model (FEM), each cross-sectional unit has its own (fixed) intercept value, in all $N$ such values for $N$ cross sectional units. In Random Effect Model (REM), on the other hand, the intercept $\beta_1$ represents the mean value of all the (cross-sectional) intercepts and the error component $u_i$ represents the (random) deviation of individual intercept from this mean value.

If you sum the random effect values given for all the companies, it will be zero and the mean value of the random error component, $u_i$, is the common intercept value. The selection between FEM and REM has been done by applying Restricted F-test as under:

$$F = \frac{(R^2_{FE} - R^2_{RE})/v_1}{(1 - R^2_{FE})/v_2}$$

Where $R^2_{FE}$ represent $R^2$ computed by using Fixed Effects Model (FEM), $R^2_{RE}$ represent $R^2$ computed by using Random Effects Model (REM) and $v_1$ and $v_2$ represent degree of freedom. If the restricted F-ratio is significant, then the REM will be invalid. If the restricted F-ratio is non-significant, then both the FEM and REM are equally important.

### 3.8 Structure of the Study

The thesis is organized into eight chapters presenting the issue of cost of capital of selected companies in logical sequence. The study is organized as follows:

**Chapter 1** deals with the introduction. It acquaints the reader about the concept of cost of capital, the major factors affecting cost of capital of a firm and computation of cost of each specific source of long-term finance and overall cost of capital.
Chapter 2 presents the review of existing literature. The studies conducted in India as well as abroad on various issues of cost of capital are discussed in this chapter. This chapter ends up with major gaps in earlier studies and justification of present research plan.

Chapter 3 discusses the methodology of the study. It deals with objectives of the study, universe and sample of the study, period of the study, measures of cost of each specific source of finance, a brief description of selected variables and sources of data collection. The selected methods or techniques of data analysis have been explained. It also details the limitations of the study.

Chapter 4 presents trends of historical cost of capital of Indian companies in selected industries over the entire period of study covering 27 years. The trend analysis and other statistical techniques have been used in this chapter in order to derive meaningful results.

Chapter 5 analyzes the impact of liberalization upon overall cost of capital (K_{o1} and K_{o2}) of Indian companies in selected industries. A classification into pre-liberalization and post-liberalization period has been made and data have been analyzed using trend analysis and other statistical techniques.

Chapter 6 deals with effect of capital structure upon cost of capital. The effect has been studied by applying technique of panel data regression analysis.

Chapter 7 outlines the effect of size, age and return on Government securities upon cost of capital. The effect has been studied by applying technique of panel data regression analysis.

Chapter 8 summarizes the findings of the study. In addition, scope for future research is discussed. The thesis carries an exhaustive and updated bibliography. The appendices contain a list of selected companies and a list of rate of interest on time deposit of post office for the study period.
3.9 Limitations of the Study

The present study is based on secondary data collected from various sources mentioned earlier. Thus, the conclusions drawn are subject to the correctness of data. Some other limitations of the study are as follows:

1. Due to non-availability of data sample size has been restricted to 100 companies. Further classification of companies into different industries leads to reduced sample size for each industry and conclusions drawn from there are subject to limitation of small sample size.

2. Prior to 1988, the companies in India were allowed to follow different accounting years for closing their books of accounts. For the sample of 100 companies belonging to eight industries, their accounting period was different. Some companies closed their accounts on 31\textsuperscript{st} March, some on 30\textsuperscript{th} June, some on 30\textsuperscript{th} September and some on 31\textsuperscript{st} December. For calculating the dependent and independent variables for the selected sample of companies, we have considered all firms irrespective of year ending as belonging to same category.

3. The computation of dependent and independent variables are based upon accounting data. Accounting data as pointed out have following limitations:

   i. The accounting practices used for determining profits and valuing assets may differ among companies and may not conform to accounting principles.

   ii. The accounting year of different companies is not uniform, so also the practices adopted by different companies.

   iii. The statements are not final because ultimate profit or loss is ascertained only on the liquidation of the company. These statements are not complete and accurate because they are essentially interim reports and the flow of income and cost transactions is cut off artificially at each balance sheet date. The apportionment of cost and income to an accounting period involves personal judgment and numerous difficulties and differences of opinion arise in such allocation.
iv. Financial statements are expressed in terms of rupees, which gives an impression of accuracy. Transactions involving rupee values of different dates, such as fixed assets acquired at different price levels are added together. As the rupee value of assets acquired is different on different dates, we cannot add them together directly as we do.

v. Financial data taken for the purpose of study have been taken from balance sheet of each selected company as reported in the Bombay Stock Exchange Official Directory. The reported data is based upon historical costs which may not be appropriate. Since the rupee has been steadily depreciating in the recent years, assets acquired in the past cannot be replaced accordingly (at historical cost). Since the price level changes are not taken into account while preparing final accounts these considerations make financial statements unrealistic and imprecise.

4. In addition to explanatory variables selected for the present study, other important variables like management style, industry class and ownership pattern, etc. also influence the cost of capital. These variables have been kept out of the preview of present research work because it is difficult to quantify these variables.

5. The companies in India consider book values while preparing their final accounts. Most of the companies have been using the figures as given in the balance sheet. All the companies have been considering paid up capital as equity capital. In the Indian context, we do not find the market values being quoted for preference shares, loans and retained earnings. Only equity and debentures to some extent are quoted. This leads to preparation of final accounts on the basis of book values and not market values.

6. Although the researcher has tried her best to review available articles, papers, thesis, research studies and books, etc. on cost of capital but something might have been escaped. This may be due to the limited resources, time and other facilities.