Chapter 3
Objectives, Methodology and Limitations
CHAPTER III
OBJECTIVES, METHODOLOGY AND LIMITATIONS

Introduction

This chapter aims at defining the objectives of the study, the methodology that is adopted, the models that are built, the variables that are used, and the limitations of the study.

Objectives

Being exploratory in character, the present study aims at understanding the fixed investment behaviour of some sample companies in selected Indian industries. This study is undertaken:

a) To analyse the investment pattern in Gross Fixed Assets of some selected companies in the corporate sector in India.

b) To analyse the investment pattern in Plant & Machinery separately in the above companies of Indian corporate sector.

c) To analyse the determinants of investment in Gross Fixed assets i.e., Gross Block and Plant & Machinery in some Indian industries.

d) To analyse the best models which determine the investment behaviour in fixed assets through Stepwise Multiple Regression Analysis and

e) To find out the extent of the presence of the econometric problems in the study.
of 10 years; the number of regression equations to be estimated and more particularly, the time and resource constraint of the individual researcher.

As such, only industries which were considered to be modern, highly relevant to the present day society, growth-oriented and profit yielding such as (i) Chemicals, (ii) General Engineering, (iii) Electrical Equipment & Cables, (iv) Metals, Alloys, Cable Products and Structuralts, (v) Sugar & Breweries, (vi) Aluminium, (vii) Coal Mining, (viii) Electric Power were chosen purposively to restrict the size of the sample to a more manageable limit eliminating the traditional industries like Cotton Textiles, Jute textiles et cetera.

The selection criteria of the companies for inclusion in the sample of the study have been that

a) Companies must have been incorporated on or before 1975, i.e., 15 years before the period for which analysis has been started here so that a minimum period of at least 15 years must have been elapsed for them to establish themselves and invest in fixed assets;

b) Companies must have had a paid-up capital of more than Rs 10 lakhs in 1975 so that only medium and large companies as per the classification of the Reserve Bank of India are included in the sample; and

c) Companies must be continuously profit-making companies in all 10 years (which is the study period here) so as to ensure that only which made profits on consistent basis are included.

Based upon the above selection criteria a total of 74 firms mentioned hereunder against the industrial groups to which they belong, constitute the size of the sample for the purpose of this research investigation.
Source of data

The data relating to the different economic variables of companies has been collected from various issues of the Bombay Stock Exchange Official Directory. Since the data relating to different companies for all the years of this study is not available at a single place, it is collected from number of institutions like, The Indian Institute of Sciences, Bangalore; Institute for Social and Economic Change, Bangalore; Indian Institute of Technology, Madras; the Stock Exchange, Hyderabad and the Nagarjuna University Library.

The source of data for the fixed investment policy of industries is the data relating to the individual sample companies in those industries. The industry, for the purpose of the study, means the aggregate of sample units in the industry. Thus the cross section data of micro level economic variables is added to make up the industry data.

Period of study

The present study covers a period of 10 years from 1990 to 1999. Since the fixed investment policy is a long-term policy, a period of 10 years is considered to be long enough to study the Fixed Investment policy of companies/Industries.

The sample selection

The selection of the sample industries for the purpose of this study has been done on a more purposive basis. All the firms that belong to different industries as per the Official Directory of Bombay Stock Exchange, which appeared to have been making profits, have been listed out initially. Firms which satisfied the criteria specified (here under) for inclusion in the sample of the study exceeded 150 in number, a large number infact, taking into consideration the magnitude of the required data to be collected over as many as 8 selected variables for a period
Variables explained

A brief explanation of the variables - both dependent and independent - that are used in this study is presented here. The dependent variables are Gross Block/Plant & Machinery and there are 8 independent variables specified here which influence the investment in Fixed Assets of the companies and Industries included in the study.

Dependent Variables

1. $GB_{t-(t-1)} = \text{Change in Gross Block}$

The Growth in the value of Assets is one of the dependent variables in this study. The growth in 'gross fixed assets' represents the expansion in the installed production capacity in the corporate sector. Gross Block includes Plant & Machinery, Land & Buildings, Furniture & Fixtures, Electrical installation etc.

Fixed assets are those, which are not convertible into cash in the ordinary course of business. The company retains them for comparatively longer periods
with a view to carrying out the objectives of the undertaking. These items are not bought or sold periodically, nor are they liquidated in the normal operations of the business except as depreciation charged to the cost of goods sold. The proportion of fixed assets to total assets fluctuates according to the nature of the business. In capital intensive industries and public utilities like shipping and electricity the proportion is very high, whereas for concerns like banks and insurance companies the proportion is relatively low. Since investment in new fixed assets requires new financing, management instead of diluting their control by expanding the ownership, plan in advance and plough back the necessary finance through retained earnings.

To measure the impact of these determinants of investment of fixed assets, the growth in the value of Gross Fixed Assets is taken as a dependent factor in the present study.

2. \( \text{Pm}_{t} - \text{(t-1)} = \text{Change in Plant & Machinery} \)

The growth in the value of Plant & Machinery is another dependent variable. It is one of the fixed assets of the companies. Plant & Machinery plays an important role in the manufacturing process as well as the growth of the company.

**Independent variables**

1. \( \text{S}_{t} - \text{(t-1)} = \text{Change in sales} \)

Net sales constitute the effective volume (or total revenue) of business on which the profit accrues. Net sales are derived by deducting goods returned, allowances and discounts from the gross amount received from sales. It is a figure of central importance in the growth analysis of the firms, i.e., investment in fixed assets over a period of time, the net sales indicates the future trend and stability of the business of the company.
2. GIFₜ = Gross Internal Funds

Gross Internal Funds includes retained earnings and depreciation. Depreciation charge—the amount set apart as a source to replace the fixed assets after a certain period—is a key factor which influences the investment in fixed assets. Because depreciation is a non-cash expense among other items, that is charged against the revenues to arrive at the net profit after tax.

The management of a company has to consider different factors while appropriating the net profit of the organisation among different heads. The various reserves that are maintained, the requirement of working capital, the requirements of investment in fixed assets in future periods, the situation of the capital and money markets, the aspirations of the shareholders about the returns on their investment etc., will influence the management's decision making process regarding how much of the earnings must be distributed to the shareholders in the form of dividends and how much to be ploughed back or retained in the organisation.

Since the size of the retained earnings and depreciation influence the size of the investment in fixed assets, this amount of gross internal funds is taken as an important variable which influences the investment in fixed assets of the company.

3. NLₜ = Stock of Net Liquidity

Liquidity is considered as a measure of current finance. This variable is introduced in order to study the effect of liquidity on the growth of total Fixed Assets and Plant & Machinery. It is defined as the net working capital i.e., Current Assets – Current Liabilities.
Working capital is necessary to enable the company to carry on its activities on the most economical lines, comfortably and without any financial stringency; to expand its operations without any need for new financing and to take care of emergencies and losses and withstand periods of depressions without being involved in disaster. Shortage of working capital slows up payment of bills which affects the company's credit standing; makes it difficult for the company to take and extend cash and credit discounts; and curtails its business operations by making it difficult to maintain the inventories at a level where they can satisfactorily serve the demand of the customers. The company can work efficiently only if it has enough working capital to secure materials, services and supplies without facing constant credit difficulties. To obviate these difficulties, the management retains a large portion of their net profits.

Positive net working capital indicates that the company has good short-term financial strength, and that it can pay off its current liabilities at short notice. To measure the influence of working capital on the investment in fixed assets, size of stock of net liquidity is taken as an independent explanatory variable.

4. $D_1 = \text{Dividends}$

Another variable of considerable importance to the firms standing or growth of fixed assets is the dividend paid out to the shareholders who get the fruits of the business operations last.

This item is shown as 'Equity Dividend' in the profit and loss appropriation statement of the companies. Equity dividend for the purpose of this study includes the equity dividend that is recommended for the year plus the differed dividend, if any that is paid to equity shareholders during the current period.
5. \( EC_{t-[i]} \) = Growth of equity capital

Equity capital represents the capital contributed by equity shareholders. The growth in equity capital is a good indicator of the overall efficiency with which the funds available with the company are put to use. Due to this, this variable has been introduced in this analysis.

6. \( DETOUT_{t} \) = Debt outstanding

There is an intimate relationship between the growth of the fixed assets of the firm and Differed liabilities. The principle items of differed liabilities are long term loans from financial institutions and debentures issued by the company. The degree of reliance on debt outstanding may vary from firm to firm. Thus external finance is as important in the growth process of firms as is the internal finance.

7. \( T_{t} \) = Provision for taxes

The tax provision directly affects the distributable profits and hence this item is taken as a separate variable, which affects the investment in fixed assets. At times, some companies make an excess provision, which do not desire to disclose to their shareholders the larger profits they may have earned. Since corporate taxation claims more than 50% of the corporate earnings, the companies tend to be uneconomical or extravagant in their overhead expenditure. Similarly, companies may tend to make more use of borrowed funds (for example, for acquiring fixed assets) and instead of raising capital from their shareholders they may issue debentures for financing their requirements because debenture interest is an allowable expense for income-tax purpose. Thus taxation has a powerful influence on investment in fixed assets.
8.1\text{t} = \text{Interest on borrowed funds}

Interest paid is very important and a direct factor affecting the net profits and indirect factor affecting the investment in fixed assets. It includes interest paid on debentures and on all other borrowed funds. If the debt is heavy, which is true in many of the cases, a large proportion of earnings is absorbed by interest payments and only smaller proportion remains for the shareholders. In this case no one can purchase the fixed assets at high interest rates. The company treats interest payments as chargeable expenses for the purpose of determining the income-tax payable and therefore if the borrowed money can be so utilised to earn more than what has to be paid on them by way of interest the shareholders stand to gain.

\textit{Methodology}

\textbf{Step wise Regression}

The present study is mainly based on stepwise multiple regression analysis. This technique begins with the simple correlation matrix and enters into regression of the independent variables most highly correlated with the dependent variable. Using the partial coefficients generated with respect to the other variables, the computer programme then selects the next variable to enter the model.

Stepwise regression permits the analyst to start with a large number of variables that might have predictive values and then use the model to select the particular variables that appear to provide the prediction.
Statistical analysis

The multiple linear stepwise regression was run in order to determine the order of importance in terms of explanatory powers of different variables influencing the dependent variable in the study; in other words, which independent variable has the greatest effect in determination of the dependent variable; how sensitive is dependent variable to fluctuations in independent variables. This technique is adopted in order to obtain a realistic picture of the importance of the various independent variables, which influence financing investment in the corporate industries in India.

Models built

This study is conducted on the basis of 3 models. These three models have been tested in the case of each company. They are


The above 3 models have been tested in each case with the intercept term. Thus altogether 15+ equations are estimated in each case.

1. Adding Model

It may be noted that in this model, an independent variable has been entered into the model at an earlier step, then another independent variable is added to the first one and then another variable etc. So ultimately all the independent variables are added and tested under this model.

The following are the equations, which are estimated under this model.

1. \[ GB_{t-(t-1)} \text{or PM}_{t-(t-1)} = b_0 + b_1 S_{t-(t-1)} \]
2. \[ GB_{t-(t-1)} \text{or PM}_{t-(t-1)} = b_0 + b_1 S_{t-(t-1)} + b_2 GIF_t \]
3. \[ GB_{t-(t-1)} \text{or PM}_{t-(t-1)} = b_0 + b_1 S_{t-(t-1)} + b_2 GIF_t + b_3 NL_t \]
4. GB_t- (t-i) or PM_t- (t-i) = b_0 + b_1 S_{t-1} + b_2 GIF_t + b_3 NL_t + b_4 D_t \\
5. GB_t- (t-i) or PM_t- (t-i) = b_0 + b_1 S_{t-1} + b_2 GIF_t + b_3 NL_t + b_4 D_t + b_5 EC_{t-1} \\
6. GB_t- (t-i) or PM_t- (t-i) = b_0 + b_1 S_{t-1} + b_2 GIF_t + b_3 NL_t + b_4 D_t + b_5 DBTOUT_t \\
7. GB_t- (t-i) or PM_t- (t-i) = b_0 + b_1 S_{t-1} + b_2 GIF_t + b_3 NL_t + b_4 D_t + b_5 EC_{t-1} + b_6 DBTOUT_{t-1} + b_7 T_t \\
8. GB_t- (t-i) or PM_t- (t-i) = b_0 + b_1 S_{t-1} + b_2 GIF_t + b_3 NL_t + b_4 D_t + b_5 EC_{t-1} + b_6 DBTOUT_{t-1} + b_7 T_t + b_8 I_t \\

2. Constant Model

In this model the first two independent variables (change in sales and gross internal funds) are kept as constant variables because these two are very closely related to the dependent variables, and the third variable is changed in each model.

The following are the equations, which are estimated under this model.

1. GB_t- (t-i) or PM_t- (t-i) = b_0 + b_1 S_{t-1} + b_2 GIF_t + b_3 NL_t \\
2. GB_t- (t-i) or PM_t- (t-i) = b_0 + b_1 S_{t-1} + b_2 GIF_t + b_3 D_t \\
3. GB_t- (t-i) or PM_t- (t-i) = b_0 + b_1 S_{t-1} + b_2 GIF_t + b_3 EC_{t-1} \\
4. GB_t- (t-i) or PM_t- (t-i) = b_0 + b_1 S_{t-1} + b_2 GIF_t + b_3 DBTOUT_t \\
5. GB_t- (t-i) or PM_t- (t-i) = b_0 + b_1 S_{t-1} + b_2 GIF_t + b_3 T_t \\
6. GB_t- (t-i) or PM_t- (t-i) = b_0 + b_1 S_{t-1} + b_2 GIF_t + b_3 I_t \\

3. Elimination Model

In elimination model, the estimated equations are not constant but the number of equations depend on the significance of the variables which proved to be significant.

The following procedure is adopted while estimating the equations. Initially, all the independent variables are included in the model. Based upon the significance of ‘t’ values, the variable with the least ‘t’ value is dropped and then again the equation is estimated with the remaining independent variables. Again the variable with the least ‘t’ value is dropped and the equation is again estimated. This process is continued till all the independent variables in the equation have proved to be significant either at 5% or at 10% level.
So the number of equations vary depending upon the significance of variables in each case of companies/Industries.

Variables Studied:

Dependent Variables:
GB \(_{\cdot(t-1)}\) = Change in Gross Block (gross fixed assets);
PM \(_{\cdot(t-1)}\) = Change in Plant & Machinery;

Independent Variables:
b_0 = The constant or intercept term;
S_{\cdot(t-1)} = Change in Sales in time period 't';
GIF_{\cdot t} = Gross Internal Funds in time period 't';
NL_{\cdot t} = Stock of Net Liquidity in time period 't';
D_{\cdot t} = Dividends in time period 't';
EC_{\cdot(t-1)} = Growth of Equity Capital in time period 't';
DBTOUt = Debt Outstanding in time period 't';
T_{\cdot t} = Provision for Taxes in time period 't';
I_{\cdot t} = Interest Charges in time period 't'.

The above 15+ equations are estimated for all the 74 companies and 8 industry aggregates. The total number of estimated equations are as follows:

For 74 companies & eight industry aggregates in two cases (both gross block and plant & machinery):

In Adding Model ...... \(82 \times 8 \times 2 = 1312\)
In Constant Model ...... \(82 \times 6 \times 2 = 772\)
In Elimination Model ............... = 984

Total 3068
Thus altogether 3068 equations have been estimated with all the necessary tests, using the data for 10 years in each case.

To find out the effect of different independent economic variables on the fixed investment of the companies during the period of this study, the Multiple Linear Regression Analysis is used with all its limitations. The econometric problems, which arise when some of the important assumptions of the Multiple Linear Regression are violated, are separately dealt with in Chapter VI.

Selection of the best model:

Since it is intended in this study to pick up the best model out of the 20 models that are estimated in each case, the goodness of fit, of the model can be measured through the Coefficient of Determination $R^2$, adjusted for degrees of freedom that is $\bar{R}^2$.

The following procedure is adopted to select the best model in each case from out of the 15+ estimated equations.

Step - I

Out of the 15+ estimated equations in each case, all those equations, whose Multiple Correlation Coefficients are found to be significant at 5% level based on their calculated ‘F’ values are picked up for further analysis.

Step - II

The equations thus picked up according to step-I above are further screened in the following way:
a) The values of intercept term \((b_0)\) and other regression coefficients \((b_1, b_2, b_3)\) are tested at 5% level of significance based on their calculated ‘\(t\)’ values. If only one equation is found in which all the explanatory variables are significant at 5% level, then that equation is taken as the best model to explain the fixed investment behaviour of the company. If, on the other hand, there are two or more equations in which all the explanatory variables are found significant at 5% level, the procedure explained in step III is followed.

b) But if, in a company, there is not even a single equation in which all the independent variables show significant effect at 5% level, the significance level is relaxed and the impact of the variable is tested at 10% level wherever necessary. That is, the variables, which are not significant at 5% level, are tested at 10% level of significance. However, this has happened in a very few cases in this study. If only one equation is found in which the explanatory variables are significant at 5% level or 10% level, then that model is selected as the best model to describe the fixed investment behaviour of the company. On the other hand, if there are two or more than two equations in which the independent variables are significant at 5% or 10% level, the procedure explained that in step III is followed to decide the best model.

Step - III

As stated in step II, if there are two or more equations in which all the explanatory variables are significant that particular equation whose \(R^2\) is the highest is chosen as the best equation to explain the fixed investment behaviour of the company.
Limitations of the study

This study has the following limitations.

1) The accounting years of the sample companies are not common and the closing of the accounting years is spread over all the 12 months of the year. So for the industry aggregate data the accounting year is not uniform.

2) The Industry data, for the purpose of the study, comprise the aggregate of the data of the micro level sample units that are selected for this study. As there is difference in the classification of industries between Reserve Bank of India and the Bombay Stock Exchange, the RBI data could not be relied upon for the industry aggregate data and the Bombay Stock Exchange Directory does not provide the Industry aggregate data. Since it is highly difficult to collect the data of all the firms, which appear on the Bombay Stock Exchange Directory the aggregate data of the sample micro level units is taken to represent the industry data for this study.

3) The data for the study are taken in absolute values as given in the Bombay Stock Exchange Directory and no price deflator is used to adjust for the inflationary trends.

4) This study is only exploratory in its objectives and does not aim at recommending any policy measures either for the companies or for the government.

This list is not an exhaustive one, and other limitations of the techniques etc., are explained at the appropriate places.