CHAPTER IV
RESEARCH METHODOLOGY

The relevance and reliability of a research work heavily rests upon the nature of the database. There are important implications of the quality of data and research methodology on the validity of results obtained. The present chapter describes process and sources of data selection and collection, specification of model and analytical tools used to meet the objective of this research work.

This chapter has been divided into five sections. The first Section 4.1 revisits objectives of the study while section 4.2 elaborates the major and sub-hypotheses. Section 4.3 contains the scope of the study in terms of sources of data, sample companies’ selection, period of study, and the accounting data used. The next section, 4.4 deals with research methodology and the last section, 4.5 summarises the chapter.

4.1 OBJECTIVES OF THE STUDY

The objectives laid down in the introductory chapter have been revisited and they are as follows:

e) To identify the trends about the frequency and size of capital expenditures.

f) To study the significance of various sources of funds for financing long-term investment decisions.

g) To analyze the importance of cashflows in firm’s investment decisions and the nature of its relationship with corporate investment.

h) To examine the relationship between financing and capital expenditure decisions.

4.2 HYPOTHESES OF THE STUDY

The hypotheses for the study have been framed with respect to above mentioned specific objectives.
i. As regards the first objective, the hypothesis is that routine investments are more frequent than growth related investments. The sub-hypotheses are as follows:
   a) Change in net fixed assets (capital expenditure) has taken place in every year of the study period.
   b) Rate of increase in capital expenditures incurred by sample companies has increased over the study period.

ii. As regards the second objective of the study, it is hypothesised that borrowed funds are most frequently used for financing capital expenditures. Further, the following sub-hypothesis have been developed:
   a) Flow of new equity has a significant relationship with change in net fixed assets.
   b) Flow of borrowings has a significant relationship with change in net fixed assets.
   c) The coefficient for flow of borrowings is larger than coefficient of flow of new equity in investment equation.
   d) The coefficient for flow of borrowings is larger than coefficient of operating cashflows (proxy used for internal funds) in investment equation.
   e) Change in inventory has a negative and significant relationship with change in net fixed assets.
   f) Trade credit has a positive and significant relationship with change in net fixed assets.

iii. As regards the third objective of the study, the hypothesis states that investment decisions of firms are sensitive to cash-flows and there is a U-shaped relationship between investment and cashflows. In this regard, the following sub-hypotheses have been tested.
   a) Accelerator-cashflow theory of investment is applicable in Indian corporate sector.
   b) Internal funds (operating cashflows) have a significant relationship with change in net fixed assets.
c) There is a U-shaped relationship between change in net fixed assets (investment) and operating cashflows.

iv. Sources of finance have a positive relationship with change in net fixed assets. Within this major hypothesis, the following sub-hypotheses have been tested:
   a. Flow of new equity has a positive relationship with change in net fixed assets.
   b. Flow of borrowings has a positive relationship with change in net fixed assets.
   c. Operating cashflows have a positive relationship with change in net fixed assets.

4.3 SCOPE OF STUDY

The objectives to be served largely govern the choice of data and its sources. The present study aims at analysing the financing of capital expenditures (corporate investment). Accordingly, data on capital expenditures and its various possible determinants have been sourced from the secondary data, as detailed below.

4.3.1 Sample of Companies and Data Collection

This study is based on the analysis of firm level data. The objective of the study as stated earlier requires the sample to have companies actively involved in capital expenditures. The initial sample includes top 500 companies of India (turnover basis) as per the ET500 list published by Economic Times Group in 2008. The aforesaid list is publicly available at The Economic Times’ website (www.etintelligence.com) and final sample list has been attached in Appendix I.

The study is based on the 500 largest companies of India on the premise that large companies are actively involved in capital (investment) expenditures. Inclusion of the largest Indian companies makes the sample more representative of Indian corporate sector rendering authenticity to the results thereby. The scope of investigation has been confined to listed companies because the financial and
accounting information related to unlisted companies is not available in detail. The parameters developed for the purpose of analysis required specific details of the sample companies. The inclusion of unlisted companies would have led to gaps in the dataset thereby rendering the results handicapped. Moreover, such companies are, usually of small size and are generally funded through own savings, or the funds of friends and relatives. Borrowings primarily comprise of short-term loans from banks.

An attempt has been made to include government companies which are run as commercial enterprises. In the initial heydays of socialism, the public sector enterprises were not envisaged as purely commercial entity. Rather these were entrusted with a large number of non commercial objectives, such as, equitable growth, generating employment, balanced regional development and also as a stimulating agent for other private sector initiatives intended to benefit from backward and forward linkage. As a result, a large number of public sector enterprises’ turned in to loss making units and budgetary support used to be provided to such public sector enterprises’ to keep them in operation. With the onset of the New Economic Policy, 1991 and economic liberalisation, an increasing number of public sector firms/government owned companies have started operating on commercial lines. This is also reflected in corporatisation of many departmental undertakings. The economic reforms have changed the ideology ruling the management of these government companies. Divestment of shareholding and autonomy in management has brought these companies at a common platform in terms of their investment policies and expansion plans.

Only the government owned commercial enterprises featuring in ET500 list have been incorporated in the final sample. Statutory corporations have not been included in the present study due to the different set of objectives governing their decision making process. Further, the companies from banking and finance industries have been excluded at the outset due to the different nature of services offered by them. The capital expenditure decisions of these companies are governed by factors different from those affecting other industries. Their primary dealings involve financial products and services which are different from general definition of capital expenditure as is largely referred to, in finance literature. Trading companies also
were excluded as by their very definition they are involved in trading activities for revenue generation where capital expenditures are not a primary requisite. Inclusion of these companies would have increased the degree of heterogeneity in the sample thereby raising doubts about the reliability of results and there applicability in common parlance. Also, there was a problem of using appropriate deflator for these companies. This issue has been addressed in a later section in the chapter.

The following criterion has been applied to select companies in the study:

(i) **Continuity of Operations**

The companies with uninterrupted operating activity have been considered. A company to be covered in the study should be functional for the whole sample period of 1994-95 to 2008-09. 76 companies that have been unable to meet this criterion have been rejected.

(ii) **Consistent Data Availability**

As the study is based on balanced panel, it requires the requisite data to be available for the total sample period. Therefore, companies which have necessary financial data for the whole period have been included in the study. The data requires observation on multiple financial variables of sample companies over the sample period. The data relating to 80 companies was not available on consistent basis for the total sample period.

(iii) **Common and Consistent Accounting Year**

The companies having a common accounting year starting from 1st April to 31st March have been incorporated in the study to maintain a consistent basis of comparison. 18 companies were rejected due to a different accounting period followed by them as the data alignment of these companies with the rest of the sample was not possible. Even the companies that have changed the accounting year during the study period have been kept outside the scope of analysis. The financial data pertaining to these companies was imbalanced for two accounting years, with one year having less than twelve months data and succeeding year having more than
twelve months data. 67 companies have been rejected due to different or change of accounting year during the study period.

Hence, a sample of 210 companies was left. While furthering the analysis of this sample, the companies beyond manufacturing sector had to be dropped due to unavailability of a suitable deflator, Wholesale Price Index (WPI). As this study is covering a period of fourteen financial years, it is necessary to conduct the analysis on constant prices so as to avoid the influence of price level changes. This led to exclusion of 34 companies, finally leaving a sample of 176 companies. Sample companies are displayed in Table 4.1.

<table>
<thead>
<tr>
<th>Total Number of Companies</th>
<th>500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less:</td>
<td></td>
</tr>
<tr>
<td>Central/State government's Non-commercial Enterprises and Statutory Corporations</td>
<td>2</td>
</tr>
<tr>
<td>Banking Companies</td>
<td>36</td>
</tr>
<tr>
<td>Finance Companies</td>
<td>20</td>
</tr>
<tr>
<td>Trading Companies</td>
<td>9</td>
</tr>
<tr>
<td>Rejected due to discontinuous data</td>
<td>76</td>
</tr>
<tr>
<td>Rejected due to inconsistent data</td>
<td>80</td>
</tr>
<tr>
<td>Rejected due to change in/different accounting year</td>
<td>67</td>
</tr>
<tr>
<td>Dropped due to unavailability of suitable WPI</td>
<td>34</td>
</tr>
<tr>
<td><strong>Total Companies in the Final Sample</strong></td>
<td><strong>176</strong></td>
</tr>
</tbody>
</table>

### 4.3.2 Study Period

The study period was planned to be 1990-91 to 2008-09, to virtually cover the growth of Indian corporate sector after the structural adjustments, industrial policy and opening up of Indian economy since 1991. However, the source of data collection (i.e. PROWESS) had some limitations on this count. PROWESS database provides company specific information on numerous variables from 1989-90. The coverage of the companies and the relevant information about the sample companies was
insufficient for the initial years. Specifically, the details of depreciation component (which is an integral part of the study) were however consistently available only from 1994-95. As disaggregation of net fixed assets from gross fixed assets was more desirable for analytical purposes, the study period was finalised as 1994-95 to 2008-09. Thus, a large panel of 176 firms over a period of fourteen years (1994-95 to 2008-09) has been studied as the final sample.

The data pertaining to sample companies for the sample period of 1994-95 to 2008-09 has been sourced primarily from a firm-level micro database; PROWESS administered by the Centre for Monitoring Indian Economy (CMIE). Prowess is a database of large and medium Indian firms. It contains detailed information on over 23,000 firms comprising all companies traded on India's major stock exchanges and several others including the central public sector enterprises. The database covers most of the organised industrial activities, banking and organised financial and other services sectors in India. Prowess provides detailed information on each company. This study includes a normalised database of the financials covering more than 18,000 data points.

4.3.3 Limitations of the Accounting Data

The objective of the study necessitates the use of secondary data; precisely, the published accounting information of listed companies. The CMIE database is perhaps the most suited available database for a study based on firms’ financing and investment decisions. Though the data is maintained in standard format on daily/weekly/monthly and yearly basis, the limitations of accounting data are bound to creep in.

The accounting practices employed by various companies in calculation of profit may differ, leading to difference in valuation of assets within same industry. The difference may come due to different policies followed for valuation of inventory, depreciation, goodwill, valuation of assets and so on. Though these
constraints are important, they do not minimise the importance of this data for analytical purposes. The study considers only listed companies in Indian corporate sector. Also, foreign multinationals are not covered in the study.

It is widely accepted that published annual accounts of listed companies are purely transparent and also subject to independent audit mechanism. All the stockholders of various companies use this data for their respective decisions. They are therefore considered as the most useful source of economic and business information. Accounting data found in company annual reports have been used to calculate and measure the financial variables employed in this analysis.

4.4 STATISTICAL TOOLS USED

The research methodology has been aptly designed to meet the study objectives. Frequency and trends of capital expenditure decisions has been analysed with the help of tabulation of data, use of frequency distribution, simple percentages, correlation, and cross tabulation. The trends have been captured by tabulating the major variables used in the study for aggregate as well as industry-wise samples. The same have been graphically depicted by using line charts.

Since this is a study of investment behaviour of Indian corporate sector requiring a cross-section comprising of companies over fourteen years (1994-95 to 2008-09), panel data models are used for regression and estimation. Balanced panel has been chosen for two reasons:

a) In case of unbalanced panel, the results have to be interpreted with caution and there will be necessity of dropping the groups (firms) with many missing points; and

b) If firms with incomplete data for the entire period under study are included, it will lead to an extremely large number of groups (firms) for analysis.

In this study, panel data model with balanced dataset has been used. The classical regression (Ordinary Least Squares) results have been estimated using LIMDEP
Software, Version 7.0. Further, fixed effects model has been examined wherever, LM test statistic favours fixed effects/ random effects model over classical regression. A choice between fixed and random effects model has been made as suggested by Hausman Test statistic. Additionally, fixed effects results have been presented for both ‘group dummy’ and ‘group dummy and period effects’.

A brief literature pertaining to the above mentioned tools and techniques has been provided in the following paragraphs.

4.4.1 Panel Data Model

Panel data models are used to examine group (individual-specific) effects, time effects, or both. It combines the estimation techniques of both cross-sections (individual-specific effects are examined) and time series, thereby providing greater flexibility in modelling differences in behaviour across individuals and over time. The reliability of results also tends to improve due to better coverage.

The basic equation of a panel data model is as follows.

\[ Y_{it} = Z'_i\alpha + X'_{it}\beta + \nu_{it} ; \quad \nu_{it} \sim IID(0, \sigma^2_{\nu}) \]  \hspace{1cm} 4.1

Where \( I = 1, \ldots, n; \ t = 1, \ldots, T \)

The heterogeneity or individual effect is \( Z'_i\alpha \), where \( z_i \) contains a constant term and a set of individual or group specific variables, which are assumed to be constant over time \( t \). If \( z_i \) contains only a constant term, then Ordinary Least Squares (OLS) provides consistent and efficient estimates of the common \( \alpha \) and the slope vector \( \beta \). This is also called Pooled Regression and the regression equation is

\[ Y_{it} = \alpha + X'_{it}\beta + \nu_{it} ; \quad \nu_{it} \sim IID(0, \sigma^2_{\nu}) \]  \hspace{1cm} 4.2
4.4.1.1  **Fixed Effects Model**

If \( z_i \) in equation 1 is unobserved but correlated with \( X_{it} \), then the panel OLS estimates of \( \beta \) is biased and inconsistent because of some omitted variable. In such cases fixed effect model is used, which is defined as

\[
Y_{it} = (\alpha + u_i) + X'_{it}\beta + \nu_{it} ; \quad \nu_{it} \sim \text{iid}(0, \sigma^2)
\]  

Thus, the parametric estimate of a dummy variable is a part of the intercept here. By including a group (firm)–specific term in the intercept, i.e. \( \alpha + u_i \) it captures all the observable effects and specifies an estimable conditional mean.

There are three methods of estimating fixed effect model, namely, least squares dummy variable (LSDV), within effect model and between effect models. The LSDV uses dummy variables, whereas the within effect model does not. Both these models, however, produce the identical parameter estimates of non-dummy independent variables. The between effects models fits the sample using the group and/or time means of dependent and independent variables without dummies.

Among the three methods, the LSDV is relatively easy to estimate and interpret substantively. However, it has its own limitations, especially if there are many groups in Panel data. The reason is that if \( nT \to \infty \), only coefficients of regressors are consistent. The coefficients of dummy variables, \( \alpha + u_i \), are not consistent since the number of these parameters increases as \( nT \) increases. This is known as ‘incidental parameter problem’. So, if \( nT \) is very large, ‘within effect model’ may be favoured over LSDV.

A “within group effect model” uses deviations from group means instead of dummy variables. Thus this model is essentially an OLS without intercept and the OLS equation may be written as
\[(Y_{it} - \bar{Y}_i) = (X_{it} - \bar{X}_i)\beta + (v_{it} - \bar{v}_i)\]  

The ‘between group effect model’, also called the ‘group mean regression’, uses group means of the dependent and independent variables. This reduces the number of observations down to n. The equation is essentially of Ordinary Least Squares which is as follows

\[\bar{Y}_i = \alpha + \bar{X}_i\beta + \bar{v}_i\]

### 4.4.1.2 Random Effect Model

Random Effect Model (REM) has two methods of estimation – Generalized Least Squares (GLS) and Feasible Generalized Least Squares (FGLS). GLS is used when the variance structure \(\Omega\) is known; and FGLS is used when \(\Omega\) matrix is not known.

A fixed effects model examines if intercepts vary across groups or time periods, while a random effect model explores differences in error variances affected by group and/or time. Usually fixed effect estimates are considered as the robust estimates and random effect estimates are considered as the efficient estimates.

### 4.4.2 Lagrange Multiplier Test

This test was developed by Breusch and Pagan. The null hypothesis is that cross-sectional variance components are zero:

\[H_0: \sigma^2 = 0\]

\[H_1: \sigma^2 \neq 0\]

Large value of LM statistic suggests in favour of one of the one factor models (FEM/REM) against the classical regression with no group effects.

### 4.4.3 Hausman Test

The Hausman specification test compares the fixed effects versus random effects under the null hypothesis that the individual effects are uncorrelated with the other regressors in the model. If correlated, i.e. \(H_0\) is rejected; a REM produces biased
estimators; so that the fixed effect model is preferred. Hausman’s essential result is that the covariance of an efficient estimator with its difference from an inefficient estimator is zero.

It is notable that an intercept and dummy variables should be excluded in computation. Large volume of the Hausman statistic argues in favour of the fixed effects model over the random effects model. A large volume of the LM statistic in the presence of a small Hausman statistic argues in favour of the random effects model.

4.4.4 Problems in Estimation

The following section throws some light on the problems related to estimation of panel data models. Heteroskedasticity, auto-correlation and multicollinearity are the three major problems encountered during estimation and the same has been discussed below:

4.4.4.1 Heteroskedasticity

The error terms in Ordinary Least Squares (OLS) is assumed to have constant variance. When the error terms, or the regression disturbances violate this assumption, such regression disturbances, whose variances are not constant across observations are said to be heteroskedastic.

That is, in a heteroskedastic regression model,

\[ \text{Var} \{ v_i | X_i \} = \sigma_i^2 \quad ; \quad i = 1, \ldots, n \quad 4.6 \]

Heteroskedasticity usually arises in volatile high frequency time-series data such as daily observations in financial markets and in cross-section data where the scale of the dependent variables and the explanatory power of the model tend to vary across observations.

In the presence of heteroskedasticity, the OLS estimator continues to be best linear unbiased (BLU), consistent and asymptotically normally distributed. However, it is no longer efficient and the usual inference procedures are no longer appropriate.
Because the estimates are not efficient when the disturbance terms are heteroskedastic, it is advisable to test for heteroskedasticity.

The issue of heteroskedasticity has been addressed by scaling down the dependent and independent variables by beginning of the year value of net fixed assets. Hence, no specific tests had to be carried out.

**4.4.4.2 Autocorrelation**

When the disturbances across period are correlated, there is autocorrelation. This is usually observed in time series data. The least squares estimates are inefficient when there is autocorrelation. The phenomenon of autocorrelation usually arises due to misspecification of the model.

The simplest indicator is the slope in the regression. The Durbin–Watson Test statistic is the most widely used test where the test statistic is

\[
d = \frac{\sum_{t=2}^{T} (e_t - e_{t-1})^2}{\sum_{t=1}^{T} e_t^2} = 2 (1-r) - \frac{\sum_{t=1}^{T} e_t^2}{\sum_{t=1}^{T} e_t^2}
\]

Where \( r \) is first order autocorrelation. If the sample is relatively large, \( d \approx 2 (1-r) \)

In the present study, Durbin–Watson statistic has been used to check the existence of auto-correlation for the aggregate sample as well as industry wise sub-groups.

**4.4.4.3 Multicollinearity**

It refers to the case in which two or more independent variables are highly correlated. This may lead to following problems:

1. Small changes in the data produce wide swings in the parameter estimates.
2. Coefficients may have very high standard errors and low significance levels even though they are jointly significant and the \( R^2 \) for the regression is very high.
3. Coefficients may have the “wrong” sign or implausible magnitude.
One argument is that since multicollinearity problem arises because of a shortage of information, an attempt should be made to obtain more data. Another solution suggested is to drop the variables suspected to cause the problem from the regression, i.e., eliminating “problem variable” from the model altogether. However, this may cause problem of erroneous specification. If the variable that is dropped has a non-zero coefficient, then estimates of the remaining coefficients will be biased. At the same time, over-fitting, i.e., too many determining variables in the model may not be correct and in such cases dropping variables from an excessively specified model may improve some results.

In the present study, correlation matrix for various independent variables has been estimated for aggregate as well as industry group-wise sample. The analysis of these matrices will suggest the existence and extent of multicollinearity.

4.5 MODEL SPECIFICATION

This section presents a formal statement of the model estimated in the study. The relationship between corporate financing patterns and investment has been assessed through correlation analysis between various independent variables and investment. However, this methodology does not consider other factors affecting investment. A multivariate analysis is therefore found to be appropriate in this context.

The review of literature on theories of investment suggest that various investment models have been used including accelerator, accelerator cum cashflow, neo-classical, modified neo-classical and Q theory to analyse the investment financing relationship at firm level. The major explanatory variables used in these studies are output, Tobin’s Q and internal liquidity.

The accelerator theory posits that firms adjust their capital stock in response to demand so that investment has a direct relationship with output. Various researchers have used sales or profit as a proxy for output. Kuh (1971)\(^1\) argued that due to certain structural relationship between output and profit, accelerator theory indirectly considers the impact of profits. On the other hand, Tobin’s Q refers to the ratio

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between market and book valuations of the same physical asset (Tobin and Brainard, 1977). Thus, Q reflects the market valuation of firms’ future investment opportunities under the assumption of perfect capital market. The liquidity theories, however, improve upon Q theory by accepting capital market imperfections. In practice, various aspects of imperfect capital markets create a wedge between the cost of external and internal financing. Asymmetric information, agency costs and such other factors make the external funds costlier and the firms then take recourse to internal liquidity i.e. cashflows.

An attempt has been made to study a standard accelerator cum cashflow investment model across Indian corporate sector collectively and across various industry groups separately. The following general model is estimated for the sample,

\[
\Delta F'_{it} = \alpha + \beta_1 \Delta Y'_{it} + \beta_2 \Delta I'_{it} + \beta_3 \text{CFO}'_{it} + \beta_4 \text{FEQ}'_{it} + \beta_5 \text{FB}'_{it} + \beta_6 \text{TC}'_{it} + \beta_7 \text{LAG} \Delta F'_{it} + \\
\beta_8 \text{LAG} \Delta Y'_{it} + v_{it}; \quad v_{it}\sim\text{IID} (0, \sigma_v^2)
\]

Where

- \(\Delta F'_{it}\) = Change in net fixed assets of firm I in period t
- \(\Delta Y'\) = Change in output
- \(\Delta I'\) = Change in inventory
- \(\text{CFO}'\) = Cashflow from operating activities
- \(\text{FEQ}'\) = Flow of equity
- \(\text{FB}'\) = Flow of borrowings
- \(\text{TC}'\) = Trade credit and acceptances
- \(\text{LAG} \Delta F'\) = Change in net fixed assets in the period t-1
- \(\text{LAG} \Delta Y'\) = Change in output in the period t-1
- \(v\) = Error term

Investment is defined as change in net fixed assets of firm i in period t (\(\Delta F'_{it}\)). The explanatory variables entering this equation are change in output (\(\Delta Y'\)), change in inventory (\(\Delta I'\)), cashflow from operating activities (\(\text{CFO}'\)), flow of equity (\(\text{FEQ}'\)),
flow of borrowings (FB'), trade credit and acceptances (TC'), change in net fixed assets in the period t-1 (LAG ∆F') and change in output in the period t-1 (LAG ∆Y') for the period under consideration. All the variables were deflated using the relevant WPI (1993-94=100) of manufacturing industries pertaining to specific industry groups with 1994-95 as the base year. The variables including change in net fixed assets, change in output, cashflows and change in inventory have been divided by capital stock at the beginning of the year to tackle heteroskedasticity. This has been done to counter the scale problems and to make the data comparable over time and among firms. Hence the dependent variable is the ratio of change in net fixed assets to capital stock at the beginning of the year.

According to the accelerator theory, the desired level of capital stock is directly proportional to the change in output. Hence the change in output or the expected increase in demand explains a firm's investment behaviour. As the sample covers various industry groups, the output has been measured in rupee value terms instead of units. Various studies also use change in sales as a proxy for change in output due to lack of data. In the present study, output has been used as an indicator of accelerator as it has been seen that firms undertake capital expenditures even during periods of downward trend in profits. Change in output has been defined as sales during the year plus change in finished goods stock. To lend literature support, various studies including, Chenery (1952)\(^3\), Eisner and Nadiri (1968)\(^4\), Krishnamurty and Sastry (1975)\(^5\), Athey and Laumas (1994)\(^6\), Gangopadhyay et al (2001)\(^7\), Bhattacharya (2007)\(^8\) conclude that flexible accelerator model along with some financial variables satisfactorily explain the investment behaviour of firms.


\(^{8}\) Bhattacharyya, Surajit, "Determinants of Private Corporate Investment: Evidence from Indian Manufacturing Firms,” Economic Society of South Africa, Conference, 2007
Profits are integral sources of internal finance and an incentive for investment. As per profits theory, an increase in profits leads to a rightward shift in the marginal efficiency of capital (MEC) schedule which in turn raises the desired level of capital stock. Further, the firms may invest even more with an expectation of higher profits. However, cashflows capture the internal financing capability of the firms in a better manner. Companies need cash to finance investments. Studies such as Bagchi (1962)\textsuperscript{9}, Sarkar (1970)\textsuperscript{10}, and Eisner (1978)\textsuperscript{11} have argued in favour of profit as a determining variable. On the contrary, several studies like Krishnamurty and Sastry (1975)\textsuperscript{12}, Fazzari, Hubbard and Peterson (1988)\textsuperscript{13}, Athey and Laumas (1994)\textsuperscript{14}, Goergen and Renneboog (2000)\textsuperscript{15}, Gangopadhyay et al (2003)\textsuperscript{16}, Nair (2004)\textsuperscript{17} have accepted cashflows as a significant variable. Cashflows have been defined as cashflows from operating activities. These measure the liquidity position of the firm and its ability to bank upon internal sources to finance its capital expenditure decisions. Further, they have been added to the model to capture the sensitivity of investment to internal funds. In case a firm is financially constrained, the investment will tend to be sensitive to internal funds (Fazzari, Hubbard and Peterson, 1988)\textsuperscript{18}. As explained earlier, the cashflow variable just like other variables has been scaled down and is represented in the equation by the ratio of cashflows to capital stock at the beginning of the year.

Capital expenditures are a part of total investment of the firm apart from inventory investment. The retained profits and externally raised funds of the company

\begin{thebibliography}{9}
\bibitem{11} Eisner, R., Factors in Business Investment, Ballinger Publishing Company, Cambridge, Massachusetts, 1978
\bibitem{12} Krishnamurty and Sastry, 1975, op. cit.
\bibitem{14} Athey and Laumas, 1994, op. cit.
\bibitem{15} Goergen M. and Renneboog, L., "Investment Policy, Internal Financing and Ownership Concentration in the UK", Centre for Economic Research, November 2000
\bibitem{16} Gangopadhyay, Lensink and Molen, 2001, op. cit.
\bibitem{17} Nair, V.R. Prabhakaran, "Financial Liberalization and Determinants of Investment: An Enquiry into Indian Private Corporate Manufacturing Sector", 8th Capital Markets Conference, Indian Institute of Capital Markets Paper, December 20, 2004
\bibitem{18} Fazzari, Hubbard and Petersen, 1988, op. cit.
\end{thebibliography}
may not be solely invested in capital expenditures but may also be used in accumulation of inventories. For a manufacturing firm, capital assets alone are not sufficient and it is important to have stock in the form of raw material, work in progress and finished stock. However, the expansion plans of the company may even push both capital and inventory investment simultaneously if the funds allow. Both the types of investment are therefore expected to be complementary in nature. In this study, a negative sign for change in inventory has been postulated for the reasons stated above. This variable has been explicitly included in various studies conducted in India such as Krishnamurty and Sastry (1975)\textsuperscript{19} and Rao and Mishra (1976).\textsuperscript{20}

Since the retained earnings are not purely invested in fixed assets, they are not sufficient to fund a firm’s financing requirements. The demand is therefore to be met through external funds. The finances may be arranged through fresh equity issues, long-term debt or short-term funds. The effect of equity has been captured in the model through the flow of equity and that of borrowed funds through flow of borrowings. The data for both the variables has been gathered through PROWESS. A positive sign has been hypothesised for both these variables as most of the studies till date have found debt to be a significant variable (Fazzari, Hubbard and Peterson, 1988\textsuperscript{21}; Krishnamurty and Sastry, 1975\textsuperscript{22}; Nair, 2004\textsuperscript{23}; Bhaduri, 2005\textsuperscript{24}) in defining the investment behaviour of a firm. Though equity has not played a significant role in determining investment in various previous studies, this study hypothesizes a positive sign for the same on the premise that the data pertains to a robust and positive phase of Indian economy.

Also a part of firm’s internal funds is held back due to goods and services taken on credit in the form of trade credits. The next explanatory variable is therefore trade credit. Keeping other things constant, an increase in trade credits will signal a

\textsuperscript{19} Krishnamurty and Sastry, 1975, op. cit.
\textsuperscript{21} Fazzari, Hubbard and Petersen, 1988, op. cit.
\textsuperscript{22} Krishnamurty and Sastry, 1975, op. cit.
\textsuperscript{23} Nair, 2004, op. cit.
holding of short-term funds for an extended short term thereby leaving more funds for total investments. It is therefore postulated that change in net fixed assets has a positive relationship with trade credit.

Lagged investment in fixed assets is likely to stimulate current investment because the capacity creation process of the firm is an extended process with substantial lags. Accordingly a positive relationship is expected between the two.

A single equation balanced panel model has therefore been specified and estimated for the cumulative sample and industry-wise sub-samples. Further, the movements and trends of major variables have been captured through cross tabulation and line charts. The relationship between change in net fixed assets (capital expenditures) and independent variables has been estimated with coefficient of correlation. The regressions have been run using LIMDEP Version 7.0. Initially, Classical Regression or Ordinary Least Squares has been estimated. However, Lagrange Multiplier Statistic has been calculated to examine if fixed/random effects model is favoured over ordinary least squares or classical regression. In order to make a choice between fixed and random effects model, Hausman test statistic has been calculated. Auto correlation has been captured using Durbin-Watson statistic and multicollinearity has been analysed with correlation matrix. Moreover, all the variables have been divided by capital stock at the beginning of the year (K) to remove the scale effects from the data and address heteroskedasticity. This summarizes the techniques that have been used to draw conclusions on the objectives of the study.