CHAPTER 4

METHODOLOGY

4.1 INTRODUCTION

This chapter discusses in detail about the methodology adopted in the study of Mergers and Acquisitions in Indian Pharmaceutical Industry. The chapter introduces the research design used in the study, issues related to sampling framework, introduction of variables used in the study and proposed model and theoretical foundation of the model and hypotheses related to ANOVA models.

4.2 RESEARCH DESIGN

Research design is the blue print of the entire research process. This section briefly introduces the research design adopted in the present study. Since the research problem is well defined and all the variables related to the study and their behaviours are well established by the earlier researches, the research design suitable to study very well fits into a descriptive research design. The study attempts to confine its framework to Indian Pharmaceutical companies alone and analyze the factors influencing the takeover targets and proposes to fit a model.
(description of the data) for predicting the takeover target companies. The study covers the period between 1991 and 2006.

4.3 DATA AND SAMPLING

The study primarily depends upon the secondary data sources. The data were obtained from sources like Registration and Liquidation of Joint Stock Companies in India (annual publication of Department of Company Affairs, Government of India), Company News and Notes (Monthly publication of Department of Company Affairs, Government of India), Monthly Review of Indian Economy (a publication of CMIE), Website of SEBI and List of Companies that have Undergone Mergers and Name Changes—a publication of Bombay Stock Exchange.

Judgment sampling procedure was used to select the companies. The list of companies that have become acquisition targets was prepared using the data sources mentioned above. The companies that were not listed in the stock exchange and companies for which the required data were not available were eliminated from the list. Thus, finally a list of 23 companies was arrived at. This was the sample for companies that became acquisition targets. A list of pharmaceutical companies was obtained from the PROWESS database. From this list, all companies that have become acquisition targets were eliminated first and
those companies in respect of which full data was not available on March 31, 2006 were also eliminated. Finally, we were left with 58 companies. This was used as the sample for companies that were not the targets of acquisition.

4.4 AN INTRODUCTION TO THE VARIABLES

A review of literature on mergers and acquisitions shows that several firm characteristics (variables) are likely to influence the odds of the takeover. This section gives a brief description about the variables used in the study and their theoretical expectations in the proposed Logistic Regression Model.

(i) **Size:**

The SIZE variable is measured as the prior years’ net book value of assets. The Size of a firm is highly correlated with the cost of acquisitions. The cost involved in absorbing a large firm into the acquirer’s business and also the cost of hostile takeover of a large firm is prohibitive. Palepu (1986), Mikkelson and Partch (1989) and Song and Walking (1993) have described in detail the correlation between the size of the firm and its likelihood of being taken over. Since the price paid for the acquisition is directly proportional to the size of the firm, companies would think twice before
making a huge capital investment such as a takeover or an acquisition. So size is expected to be negatively correlated with the likelihood of takeover.

(ii) R & D

The Research Development (R&D) is measured as firm’s R&D expense over prior years’ firm value. Increase in R&D means that the Research and Development Expenditure is growing faster than the growth in the market value and/or growth in assets. This means that the firm is not in a position to capitalise on the expenditure made on research since it has not built the required complementary assets and/or the market opportunity is not so big as to have warranted the Research and Developmental expenditure. Hence we expect the R&D variable to be positively correlated with the odds of takeover. This is in line with the explanation given in the study of Dhayanithy and Vasudevan (2004).

(iii) BV

The variable BV is defined as the Book Value of assets over prior year’s total firm value. Higher value of BV comes across as a definite sign to potential acquirer that the firm is undervalued and the time is ideal for a takeover attempt. Thus the value of BV is expected to be positively correlated with the odds of takeover (Espahbodi and Espahbodi 2003).
(iv) **MBCE**

MBCE is computed as the ratio of market to book value of common stock averaged over the previous year. Theoretically, the market to book ratio (also known as Tobin’s Q) should be computed as the market value of a firm over the replacement cost of its assets. However, given the assumptions required to estimate the replacement cost and the resulting measurement errors, this study following others approximates Tobin’s Q by the market value of common equity over its book value. Firms with low MBCE may represent bargains to acquirer because it is a sign that either the market undervalues the firm or that the market feels that the firm has low growth potential. If the value of the individual parts of a firm is larger than its current market value, the firm could be acquired at or even above its market value and sold in pieces, resulting in a substantial profits for the acquirer. Alternatively an acquirer planning to use the target firm’s assets in an attempt to expand business would prefer to buy such a firm rather than its individual assets. So, overall a lower value of MBCE would result in an increased probability of takeover (Hasbrouck 1985).

(v) **P/E**

This variable reflects not only the investment and growth opportunities, but also reflects measures of a firm’s intangible assets including the quality of
management, monopoly power, goodwill and so on (Morck, Schleifer and Vishny 1988). Hence a lower value of P/E is expected to be associated with the higher odds of takeover.

(vi) FCOTA

It is defined as free cash flow over total assets. Firms with greater levels of free cash flows over total assets have higher odds of being taken over, as they have lower investment opportunities and more agency problems. Manager’s interest in increasing the resources under their control creates a conflict of interest with shareholders over payout policies. The agency cost associated with this conflict of interest is a major cause of takeover activities (Jensen 1988). So FCOTA is expected to be positively associated with the probability of a firm being a takeover target.

(vii) MEFV

MEFV is defined as the market value of equity over firm value. This reflects the firm’s financing policies. The higher this ratio, the lower is the firm’s advantage and larger is the proportion of the firm value represented by growth options (Smith and Watts 1992). Thus, to the extent that high growth firms are less likely to be takeover, this ratio should be negatively
correlated to the odds of takeover. On the other hand, if the leverage effect prevails, the ratio should be positively related to the odds of takeover.

(viii) DIVIDEND YIELD

The DIVIDENDYIELD variable captures the dividend policy of the firm. The smaller the dividend yield ratio, the better are the growth opportunities (Smith and Watts 1992) and thus, the lower is the takeover probabilities. Low dividend payouts however may indicate not only growing firms, but also firms with higher agency cost or firms that are financially constrained. Both of these categories represent likely candidates for takeover (Espahbodi and Espahbodi 2003).

(ix) GROWTH

The Growth variable is measured as the percentage growth in sales over the last three years. Companies with negative growth or low positive growth are likely to become takeover targets because they offer a good proposition to the acquirer. Growth is expected to be negatively related with the odds of takeover (Espahbodi and Espahbodi 2003).

(x) LIQUIDITY

Liquidity variable is defined as the average quick ratio over the past three years. Firms with excess liquidity are more likely to be taken over because
there is an opportunity for the bidders to finance the acquisitions with the targets’ own resources. So liquidity should have a positive relation with the probability of takeover (Song and Walking 1993).

(xi) LEVERAGE

The Leverage variable is computed as the average leverage ratio over the past three years. Leverage should be negatively associated with the odds of takeover, as acquisition of firms with low leverage is less costly to finance (Espahbodi and Espahbodi 2003).

(xii) AGE

Mortality risk is greater for young companies due to lack of experience. So for the purpose of the study, the age of the firm is taken as a proxy for mortality risk faced by all young companies. Therefore, the later the year of incorporation, the greater is the chance of a firm being a takeover targets.

(xiii) EXRETURN

EXRETURN is computed as the average excess return over the BSE Sensex for the previous year. This variable is expected to be negatively associated with the odds of takeover as consistent excess return is associated with good performance and management Palepu (1986).
RONW is defined as the average return on net worth computed over a three year prior period. Consistently strong RONW is associated with good performance and management. Hence RONW is expected to be negatively correlated with odds of being taken over.

The variables were computed from the data compiled from the PROWESS database for sample companies. The study covers mergers and acquisitions in the pharmaceutical industry that took place between years 1991 and 2006. The following table summarizes the above description of variables and their theoretical expectations.

**Table 4.1 Description of variables and their theoretical expectations**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Variable Name</th>
<th>Description of the variable</th>
<th>Expected Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SIZE</td>
<td>Size of the firm</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>RD</td>
<td>Research and Development</td>
<td>+</td>
</tr>
<tr>
<td>3</td>
<td>BV</td>
<td>Book Value</td>
<td>+</td>
</tr>
<tr>
<td>4</td>
<td>MBCF</td>
<td>Market to Book Ratio of Common Equity</td>
<td>+</td>
</tr>
<tr>
<td>5</td>
<td>PE</td>
<td>Price Earnings Ratio</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>FCOTA</td>
<td>Free Cash flow over Total Assets</td>
<td>+</td>
</tr>
<tr>
<td>7</td>
<td>MEFV</td>
<td>Market Value of Equity by Firm Value</td>
<td>+/-</td>
</tr>
<tr>
<td>8</td>
<td>DIVIDENDYIELD</td>
<td>Dividend Yield ratio</td>
<td>+/-</td>
</tr>
<tr>
<td>9</td>
<td>GROWTH</td>
<td>Percentage growth in sales</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>LIQUIDITY</td>
<td>Average quick ratio</td>
<td>+</td>
</tr>
<tr>
<td>11</td>
<td>LEVERGAE</td>
<td>Average Leverage Ratio</td>
<td>-</td>
</tr>
<tr>
<td>12</td>
<td>AGE</td>
<td>Age of the firm</td>
<td>-</td>
</tr>
<tr>
<td>13</td>
<td>EXRETURN</td>
<td>Average Excess Returns over BSE Sensex</td>
<td>-</td>
</tr>
<tr>
<td>14</td>
<td>RONW</td>
<td>Average return on net worth</td>
<td>-</td>
</tr>
</tbody>
</table>
A positive sign for a variable indicates that higher levels of that variable are associated with greater odds of takeover and a negative sign implies the opposite. Few studies like Espahbodi and Espahbodi (2003) classified the variables as financial and non-financial in nature; however, no such classifications were adopted in the present study.

4.5 PROPOSED LOGISTIC REGRESSION MODEL WITH THEORETICAL EXPECTATIONS ON THE PREDICTOR VARIABLES

Discriminant analysis is a statistical technique which allows the researcher to study the differences between two or more groups of objects with respect to several variables simultaneously. Logistics regression analysis has been used to investigate the relationship between binary or ordinal response probability and explanatory variables. The Logistics regression model, a nonlinear model, is one of the prediction techniques with few assumptions and the dependent variable is a binary variable.

However, several authors modelled the mergers and acquisitions through models like MDA, Logit and Probit analysis. Simkowitz and Monroe (1971), Stevens (1973), Rege (1984) and Barnes (1990) used Multiple Discriminant Analysis in their studies; Probit Models were used by Harris (1982) and Pastena
and Ruland (1986). Discriminant analysis requires data to have multivariate normal distribution and the dispersion matrices of the groups to be equal. Neter and Wasserman (1974) state “both theoretical and empirical considerations suggest that when the dependent variable is binary, the underlying relationship is frequently curvilinear.” In logit analysis, no assumptions need be made about the prior probability that the firm belongs to a specific group, and the assumptions of normal distribution and the equality of variances and co-variances across groups are less critical.

Thus, many researchers at later years used Logistic Regression analysis in modelling the mergers and acquisitions scenarios. Dietrich and Sorenson (1984), Megginson (1992), Cudd and Duggal (2000), Sorenson (2000) and Panigrahi (2004) are few research works, that predominantly used logit models. Thus, in the present study, it is proposed to fit a Logistic Regression Model rather than a Discriminant Model.

The proposed model is given below;

\[
\text{Logit} \ (Y) = f \ (\text{SIZE}, \text{RD}, \text{BV}, \text{MBCE}, \text{PE}, \text{FCOTA}, \text{MEFV}, \text{DIVIDENDYIELD}, \\
\text{GROWTH}, \text{LIQUIDITY}, \text{LEVERAGE}, \text{AGE}, \text{EXRETURN}, \\
\text{ROWNW}) \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots ......
\[ P (Y = 1) = \frac{e^{(\text{Logit } Y)}}{1 + e^{(\text{Logit } Y)}} \]

Stepwise backward selection technique is employed to develop the logit models. Specifically, variables would be dropped from each model one at a time based on their contribution to the overall fit of the model (increase in the Chi-square goodness of fit value). Thus, only a subset of the original variables that best separate target and non-target firms is represented in the final model.

4.6 ASSESSING THE MAGNITUDE OF DIFFERENCES IN THE SELECTED VARIABLES BETWEEN TAKEOVER TARGETS VS. NON TAKEOVER TARGETS

To confirm the results of logistic regression and assess the magnitude of difference in each of the selected variables, it is proposed to use One-way analysis of variance with each of study variables as dependent measure and takeover / non takeover targets as independent measure.

Thus, it is proposed that

H1: The takeover firms and non takeover firms significantly differ in each of the firms’ characteristics variables.
4.7 TOOLS USED FOR ANALYSIS

The study analyses the data by using Logistic Regression models and One-way Analysis of Variance, as they found to be most suitable to summarize the data collected.