ASSESSING CREDIT WORTHINESS OF FIRMS
Chapter 3

ASSESSING CREDIT WORTHINESS OF FIRMS:
SELECT REVIEW OF METHODOLOGY AND THEORETICAL FRAMEWORK

Introduction

Analysis of the financial health of a business enterprise for the purpose of determining its chances of survival or failure has been the researcher's concern for more than three decades now. The approach to the problem has varied depending on whether it is looked upon from the insiders' viewpoint or outsiders'. Insiders typically have a personal feel of the problems faced by the enterprise under their control and have access to a variety of inside information which help them identify distress signals as part of an internal control system. But the outsider has to depend mainly on the published financial statements of the firm in order to assess its performance and make predictions. Outside parties who utilise research on financial distress prediction of individual companies are lenders, investors, regulatory authorities, government officials etc. Such research has the most direct and immediate relevance to lenders, "both in deciding whether to grant a loan (and its conditions) and in devising policies to monitor existing loans." (Foster, 1986). In this context, it is important for banks and other lending institutions to assess the credit worthiness of their borrowers to ensure the security and profitability of their loan portfolio. The present study concentrates on this problem of assessing the borrower's creditworthiness (or default risk). This chapter in particular reviews the methodological developments towards this problem and then looks into the theoretical framework of the issue.

Credit worthiness is defined as the ability of a borrower to meet his payment obligations timely. Accordingly, a firm is said to default when it misses principal or interest payments under the borrowing agreements. For the lender, the credit granting process involves a trade off between the perceived default risk of the credit applicant and the potential returns from granting the requested credit. (Srinivasan and Kim 1986). Given that there are direct as well as indirect costs to bankruptcy, banks would like to assess the default risk of their borrowers, before granting the requested credit. The default risk as perceived by the bank depends on financial and non-financial factors of the
borrowing firm as well as the amount of credit requested. More information and knowledge about the borrowing firm and its performance implies less perceived risk, as there are fewer imponderables and unknowns. Consequently, analysts and researchers have tried to assess firms' performance using different yardsticks with the aim of predicting their proneness to financial distress. The following section deals with the main strands of literature in this field.

**Univariate Models Of Distress Prediction**

Traditionally, analysts have used financial ratio analysis as an analytical technique in assessing the performance of a business enterprise. The use of ratio analysis - consisting of extensive computations of a myriad of ratios and statistics - for detecting company operating and financial difficulties was prevalent even as early as the 1930s. It was only but a natural extension then for lenders to start using ratio analysis to determine the probability of default by their borrowers. Studies following this tradition implied a definite potential for financial ratios as predictors of bankruptcy. In general, ratios measuring profitability, liquidity and solvency have prevailed as the most significant indicators in the literature.

Financial ratio analysis can focus on a single financial variable (univariate analysis) or on a combination of financial variables (multivariate analysis). There are two key assumptions in a univariate approach to predicting financial distress.

1. The distribution of the variable for the distressed firms differs significantly from the distribution of the variable for the non-distressed firms.
2. This systematic distribution difference can be exploited for prediction purposes." (Foster, 1986)

An assumption of normality for each ratio along with assumption (1) implies that either the mean or the variance of the distribution differs between the two groups of firms. Comparisons of the mean ratios of distressed and non-distressed firms have a long history in the published literature. Beaver (1966) made an important contribution by comparing the mean financial ratios of 79 failed firms and 79 non-failed firms for the period 1954-64. The equally weighted means of financial ratios were computed for each of the failed and non-failed groups in each of the five years before failure. In general there was a marked difference in the behaviour of the mean financial ratios of the two
groups. The cash flow to total assets ratio appeared to exhibit significant differences as early as five years before failure. (Foster, 1986).

One limitation of the comparison of the mean financial ratios test is that it examines only one point on the distribution. Some extreme observation in either one of the groups concerned could induce the differences between the group means. Apart from these extreme observations, there could be almost complete overlapping in the distribution of the ratio of the two groups. One way of verifying if there are distribution differences in the ratios of distressed and non distressed firms is to plot selected points of the distribution (say, the .1,--.3,--.5,--7 and .9 fractiles) of the two samples and examine the overlap. A second option is to use a formal statistical significance test for a difference in the distributions, (Foster, 1986). Yet another method is to conduct a univariate predictive test.

According to Foster, well over 100 individual financial ratios and other variables have been examined in distress prediction studies published over the last 20 years. He reports a 1983 study by Zmijewski in which 75 of these variables have been classified into ten categories. Using a sample of 72 bankrupt and 3573 non-bankrupt firms over 1972-78 period, Zmijewski concluded that the four categories of variables showing the most consistent differences between bankrupt and non-bankrupt firms were rate of return, financial leverage, fixed payment coverage and stock return volatility. His results pertained to the period one year prior to the bankruptcy filing.

However, a serious limitation of the univariate nature of traditional ratio analysis was recognised as its emphasis on individual signals of impending problems. This was criticised as potentially confusing and as susceptible to faulty interpretation. The individualistic approach meant that different variables can imply different predictions for the same firm. For instance, a firm with a poor profitability and/or solvency record may be regarded as a potential bankrupt. However, because of its above average liquidity, the situation may not be considered serious, (Altman, 1968). This brings out the potential ambiguity as to the relative overall performance of firms. The complete lack of any rigorous criteria for judging the behaviour of various ratios in univariate financial ratio analysis came under staunch criticism and motivated attempts to combine the information in several financial variables into a single multivariate prediction model.
Multivariate Models Of Distress Prediction

In the last two decades or more, numerous rigorous multivariate techniques have been developed and discussed in the financial distress literature. Most of these are statistical classification models which typically link a set of independent variables to a dependent variable; with the latter taking two or more discrete values. They are usually based on two groups, where by observations are assigned to one of the groups (say, sick and non-sick firms) after data analysis. With respect to the explanatory variables, multivariate techniques have replaced univariate approaches.

The most commonly used multivariate classification technique has been Discriminant Analysis (DA). Multiple Discriminant Analysis (MDA) was introduced by Altman in his pioneering 1968 work on prediction of corporate bankruptcy. MDA is a statistical technique used to classify an observation into one of several a priori groupings dependent upon the observations individual characteristics. It is primarily used to classify and/or make predictions in problems where the dependent variable appears in qualitative form; e.g., male or female, bankrupt or non-bankrupt etc.

Altman considered two groups consisting of bankrupt firms and non-bankrupt firms. His sample consisted of 66 manufacturing corporations with 33 firms in each of the two groups. From an original list of 22 potentially helpful variables (ratios) which were classified into five standard ratio categories, liquidity, profitability, leverage, solvency and activity ratios, he chose 5 variables as doing the best overall job together in the prediction of corporate bankruptcy. The final discriminant fraction was as follows.

\[ Z = 0.012.X_1 + 0.014.X_2 + 0.033.X_3 + 0.006.X_4 + 0.999.X_5 \]

Where

\( X_1 = \text{Working capital/total assets} \)
\( X_2 = \text{Retained earnings/total assets} \)
\( X_3 = \text{Earnings before interest and tax/total assets} \)
\( X_4 = \text{Market value equity/Book value of total debt} \)
\( X_5 = \text{Sales/total assets and} \)
\( Z = \text{Overall index or the discriminant score.} \)
The study showed that the lower the discriminant score of a firm, the greater was its bankruptcy potential. It was concluded that all firms having a Z-score of greater than 2.99 clearly fell into the non-bankrupt sector, while those having a "Z" below 1.81 were all bankrupt. It was found that the model was an accurate forecaster of failure unto two years prior to bankruptcy and that accuracy diminished substantially as the lead time increased. Further, the area between 1.81 and 2.99 was defined as the "zone of ignorance" or "grey areas" because of the susceptibility to error classification. 2.675 was chosen as the Z-value that discriminated best between the bankrupt and non-bankrupt firms.

A limitation of this study which Altman himself admitted was that the five member variable profile finally established did not contain the most significant variables among the 22 original ones measured independently. Therefore this would not necessarily improve upon the univariate traditional analysis. However, Altman established that ratios, if analysed within a multivariate framework, will take on greater statistical 'significance than the common techniques of sequential ratio comparisons.

There have been several alternative multivariate parametric classification techniques suggested in the literature to overcome some of the perceived shortcomings in the discriminant methodology. Two group regression analysis can provide a more accepted method for evaluating an individual variable's relative contribution. Multi-group logit models have been used to provide a model realistic and explicit interval measure between adjacent groups in bond rating studies. Probit models attempt to provide explicit probabilities to group membership.

One thing that all these models have in common is the parametric quality of the linkage between the explanatory variables and the groupings. While this enables explicit linkages, a host of statistical problems have been cited as rendering the results somewhat problematic. The potential problems can be categorised as i) violations of the underlying normality and independence assumptions of the classical linear regression of discriminant approaches, ii) reduction of dimension issues iii) interpretation of the relative importance of individual variables iv) specification of the appropriate classification algorithm and v) time-series prediction test interpretation (Frydman, Altman and Kao, 1984). Despite these problems and the perceived lack of a formal theoretical underpinning of most of the
model multivariate parametric procedures have flourished, distinguished by a number of attempts over time to improve classification.

Frydman, Altman and Kao (1984) put forth a new classification procedure called Recursive Partitioning Algorithm (RPA) for analysis and compared it to Discriminant Analysis (DA). RPA is a computerised non-parametric classification technique, based on pattern recognition. It has attributes of both the classical univariate approach to classification and the multivariate procedures. The model which results from RPA is in the form of a binary classification tree which assigns objects into selected a priori groups. (Frydman, Altman and Kao. 1984). They showed that while both RPA and DA techniques lead to rather accurate classification results on a data set of bankrupt and non-bankrupt firms (the ratios considered were cash flow/total debt, cashflow total sales, total debt/total assets, market-value of equity/total capitalisation, log (interest coverage + 15) and quick assets/total assets), the RPA usually dominates the DA. The magnitude of dominance, which depends on the specification of costs of misclassification and prior probabilities, varies from slight to large. At the same time, they admitted that RPA's simple unambiguous binary classification scheme does not have a precise scoring system that is associated with DA. The DA scoring system is very precise in that it allows for relative ranking between firms and within a firm over time. However, they claimed that new techniques like RPA could be presented and evaluated in a rigorous framework without the necessity of proving its absolute superiority over existing procedures. They suggested using a technique like RPA as a practical decision tool in tandem with another procedure.

The relative effectiveness of parametric, non-parametric and judgmental classification procedures was examined by Srinivasan and Kim (1984), on a sample of corporate credit data. The parametric and non-parametric methodologies considered were MDA and logistic regression (logit) and Goal Programming (GP) and RPA. MDA, logistic regression (logit) and Goal Programming were characterised as simultaneous partitioning procedures since they consider all the potential discriminatory variables simultaneously in the classification model. However, models like the RPA were characterised as sequential partitioning procedures that are combinatorial in nature. The judgmental model considered was based on the Analytical Hierarchy Process (AHP).
AHP is a Multi Attribute Modelling (MAD) approach that has substantial intuitive appeal. AHP attempts to resolve conflicts and analyse judgements through a process of determining the relative importance of a set of criteria. AHP starts by decomposing the principal problem into a hierarchy. Each level consists of a set of elements and each element, in turn, is broken into sub-elements for the next level of the hierarchy. The final level consists of the specific courses of actions that are being evaluated for adoption. Within each hierarchical level, priorities are established for each of the elements using a measurement methodology. In the context of the credit granting problem, the final level in the hierarchy will consist of two elements whose relative weights can be interpreted as the subjective probabilities of granting and rejecting the full requested credit. (Srinivasan and Kim, 1984)

In their study, Srinivasan and Kim considered a total of 215 borrowers out of whom 39 were high risk customers and the remaining 176 were non-high risk customers. For each of them they calculated current ratio, quick ratio, net worth to total assets, net income to sales and net income to total assets. In addition to the above financial variables, two non-financial variables were also included: (i) pay record which is in of the firm's past collection experience; and (ii) customer background proxied by the number of years the customer has been in business. Pay record was treated as a categorical variable with dual possible values: good, fair and poor. Similarly, customer background was also treated as a categorical variable with three values: (a) less than 2 years; (ii) 2 to 5 years; and (c) greater than 5 years. The real test of the classification models in the context of this study was their ability to replicate an expert's judgement.

Srinivasan and Kim established that the parametric recursive partitioning method provide greater information than simultaneous partitioning procedures. Further, the judgmental model was found to perform as well as statistical methods. It was suggested that statistical models like the RPA can perhaps be used with significant success to isolate from a universe of potential factors those few variables that have significant bearing on the default risk of the customer. This information can then be used in a judgmental model like the AHP, where objective measurements are considered along with subjective measurements that are difficult to quantify, to provide an optimal setting for corporate credit granting decisions.
A recent work by Platt, Platt and Pedersen (1994) examines how early warning model (i.e. bankruptcy prediction) classification results are substantially improved when raw data are adjusted for possible destabilising effects over time or across industries. Temporal distortion in data is removed by transforming nominal values into real values using variable-specific deflators. Non-stationarity, in coefficients due to the aggregation of data across industries is controlled by considering only independent oil and gas companies. Further, to account for the effects of external economic forces, two economic indicators (viz. prime interest rate and the oil price) are also included in the model. Thus, the variables used were non-deflated and deflated values of net cashflow/total assets, total debt/total assets, exploration expense/total reserves current liabilities/total debt, as well as prime interest rate, oil price and change in oil price. They estimated a multi-variate logit model for each of the four different multi-variate models, models with and without real (deflated) variables and models including and excluding economic indicators. The total sample included 124 companies-35 failures and 89 survivors. The results of the study demonstrated that the model including deflated financial and reserve ratios and also the economic indicators not only achieved the highest classification accuracy, but also indicated significantly more explanatory power than the model based upon unadjusted financial and reserve ratios. This study has thrown light on the possibility to separately assess the independent effects of a firm's financial decisions as well as general economic changes on the firm's probability of failure.

In a significant departure from the traditional financial ratio analysis, Audretsch (1991) identified industry-specific characteristics and differences in the underlying technological regime as determinants of the variation in 10 year survival rates across industries. He compared the survival rates of over 11,000 manufacturing firms established in 1976. It was found that new-firm survival is promoted by the extent of small-firm innovative activity. The existence of substantial scale economies and a high capital-labour ratio tended to lower the likelihood of firm survival. Market concentration was found to promote short-run survival while it had no impact on long-run survival. The results were obtained estimating a logit model.

Audretsch and Mahmood (1995) put the likelihood of firm survival into the context of the hazard model. They estimated a hazard duration function for more than 12,000 individual establishments in US manufacturing started in 1976, by tracking their
subsequent performance over a ten year period. They concluded that the post-entry performance of individual establishments is related not only to their technological and market structure environments, but due to establishment-specific characteristics such as organisational structure and size. They found that the exposure to risk confronting a new establishment rises as the size falls. Also, the hazard rate would be expected to be systematically greater for new establishments which are independent enterprises and systematically lower for new branch or subsidiary plants opened by an incumbent enterprise. Further, they explicitly examined the link between the business cycle and exposure to risk, by including the macro economic unemployment rate and the real interest rate (6 month treasury bill) both of which may elevate the hazard rate. Both of these were found to be constant across establishments and industries and varied only with respect to time. Studies mentioned above are worthy of special attention in their success in including industry specific characteristics and general economic indicators into models of distress prediction and firm survival.

At this juncture in our discussion, it is worthwhile to mention a paper by Zmijewsky(1984) in which he makes some important observations on issues related to the estimation of financial prediction models. This paper examines two potential biases caused by sample selection/data collection procedures used in most financial prediction studies. The first bias, a choice-based sample bias results when a researcher first observes the dependent variable and then selects a sample based on that knowledge. The second bias, a sample selection bias, results when only observations with complete data are used to estimate the model and incomplete data observations occur non randomly. Both biases result in asymptotically biased parameter and probability estimates.

The first bias is examined by comparing probit estimates for a financial distress model to estimates from an adjusted probit assessment of the model (weighted exogenous sample maximum likelihood probit) across alternative samples designed to, induce increasing amounts of the bias. The sample selection bias is examined by comparing the probit estimates of a financial distress prediction model conditional on complete data to estimates from a bi-variate probit assessment of the model which incorporates the probability of an observation having complete data into the estimation of the financial distress model parameters. The adjusted estimation techniques appear to estimate probability distributions which fit the population distribution better. However, these
estimation techniques do not appear to provide different qualitative results from the results provided by techniques that assume random sampling. Only the individual group error rates are significantly affected. (Zmijewski 1984).

Indian Studies

A study of financial ratios for monitoring sickness by Gupta (1983) for Indian firms, tested 56 financial ratios and found the following two ratios to be the best among all of them based on their ability to differentiate the potentially sick firms from the non-sick ones as perfectly and as quickly as possible before sickness. They were: a) Earnings before depreciation, interest and tax/sales b) Operating Cash flow/sales. Both of these belong to the profitability group. The empirical tests irrefutably showed that none of the balance sheet ratios were even half as good as the best profitability ratios in terms of predictive lower. All liquidity ratios proved to be very poor predictors. Bankers invariably place great stress on liquidity analysis believing it to be the foundation of a firm’s financial soundness. However this was found to be a delusion from the prediction point of view in the Indian context (Gupta, 1983).

A basic drawback of Gupta’s 1983 study is that he used the univariate ratio analysis with all its consequent methodological limitations. In a more recent study, Gupta (1993) showed how financial ratios may be used to construct a “financial health scale” which can then be used to measure the relative financial health of individual companies within each industry group. Empirical data from three industry groups, viz. paper, and pharmaceutical has been used to illustrate the method. He used the “Delphi” method of obtaining independent ranking of three different samples of companies according to over-all financial health. Then each set of sample companies were ranked by each of the ratios and ratio-combinations to be tested. The ranks of the companies by each ratio were compared with the expert’s average rank for each company. The degree of agreement was statistically measured by computing the Spearman’s Coefficient of Rank Correlation between the two sets of rankings. The ratios which consistently showed the closest agreement with the expert’s ranking were adjudged as the most reliable proxy measures of over-all corporate financial health.

Gupta (1993) claims to have significantly improved upon existing studies in his selection of the ratios to be used. He designed three new ratios: Earning before Interest,
Dividend and Tax (EBDIT)/Sales net of excise (gross margin on sales), EBDIT/Total Assets (Return on Assets-ROA) and EBDIT/Standardised Debt Service Burden; to represent "corporate health fundamentals". The Return on Assets (ROA) ratio computed on gross basis and as 5-year average was found to be the most reliable instrument for ranking of companies by their over-all financial health. Further, it was found to have comparability across industry-groups. A composite ratio, viz., the Triple-Check ratio combining three aspects viz. productive efficiency, investment servicing ability and debt-financing ability in a single ratio was also found to be very close to ROA in terms of its reliability.

Computing ratios for an individual company does not give us an evaluation unless there is some method for comparison. Gupta used the ROA data as a scale for evaluating individual performance, after converting this in the form of deciles and quartiles. For evaluating a particular company not included in the sample used for budding the scale, the method is to first compute 5-year average ROA of that company and then, from the relevant scale, to ascertain as to which decile or quartile of the scale it belongs on the basis of its ROA. The deciles give a 10-point-scale grade to any company. Thus, Gupta's study, though based solely on financial ratios, is a major advancement in that it permits explicit ranking of companies by their over-all financial health.

We shall now go on to explain how a particular model/method for predicting the credit risk of a firm can be validated and also compared with other methods.

Validation And Comparison

Once a model/method is constructed, the next stage in its development is validation. The essence of the procedure is to develop the model based on one set of data and validate the model on subsequent samples. As we have seen, most of the studies have used the estimated regression equation or discriminant function to classify firms into a unique ranking category. One of the ways of evaluating rating predictions is to look at the percent of firms correctly classified. The model/method developed is employed to classify the original test group from which it was developed. However, when the original is reclassified by the model, the resulting accuracy of the classification is biased upward by: 1) sampling errors in the original sample; and 2) search bias. Therefore, it is important to use other firms than those employed to develop the model for validation.
purpose. The total number of firms correctly rated can be obtained by comparing the model predicted ratings with the actual (usually, the attempt is to replicate a rating agency's ratings) ratings. The ability of the model to correctly rate within one classification (either higher or lower) of the actual rating can also be determined in a similar manner.

Although the percentage error classification is not an unreasonable way to proceed, it may not be the best way to evaluate a model-based rating prediction. This is because, use of agencies' ratings as a standard of comparison carries with it an implicit assumption of the superiority of agencies' ratings. However, agencies' ratings are also predictions and the crucial question of whether the statistical models or the agencies' ratings are superior should be answered first.

Therefore, another consideration in evaluating a rating prediction model is to determine whether it is the rating agency that may have misclassified. The same question can be raised in the case of the "Delphi" method for obtaining independent ranking of companies, for the purpose of validating a certain method. In "Delphi" method, an expert or experts' panel is asked to give independent ranking of the sample companies according to their financial health, and this is used as a test instrument for validating the method. Here again, the problem is that of assumed accuracy and superiority of the expert's judgement over any statistical method. Since the ultimate objective of statistical rating methods is the prediction of financial distress of firms, the ideal test of rating methods is their ability to predict actual financial distress.

To compare the ex post accuracy of each rating method, a convenient procedure is to calculate the squared difference between the actual financial distress experience of firms assigned by each rating method and the average of the reference group with the same rating to obtain a reference value of financial loss for each rating class, we first list and rank all firms in a given cross section according to their ex post measure of financial loss. Then, the firms are assigned to a reference rating class, from high to low. The reference rating classes are assumed to be uniformly distributed. Finally, an average measure of financial loss is calculated for each reference group by averaging the measure of financial loss for all firms in the group. Then, the overall predictive accuracy of each rating method is summarised as the sum of the squared differences between the actual
financial distress experience of firms assigned by each rating method and the average of the reference group with the same rating.

\[ \text{MSE} = \frac{1}{N} \sum_{i=1}^{n} \sum_{j=1}^{k} (D_{ij} - \text{Ref}_j)^2 \]

where \( N \) is the total number of firms being validated for a given rating method. \( k \) is the number of firms assigned by the method to the \( i^{th} \) rating and \( n \) is the number of rating groups. \( D_{ij} \) is the coded value of financial loss, (i.e., default rate or loss rate) and \( \text{Ref}_j \) is the reference for the \( j^{th} \) rating.\(^\text{(Ang and Patel 1975)}\),

It is possible to develop at least two measures of ex-post financial distress. Following the classification by Bidani and Mitra (1982) which is based on RBI's definition of a sick unit, the under mentioned weights in Table - 3.1 could be assigned to facilitate computations.

**Table - 3.1 : Measure of Financial Health Status**

<table>
<thead>
<tr>
<th>Financial Health Status</th>
<th>Value Assigned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generating profits, current ratio is more than one, net worth is positive and debt ratio is satisfactory.</td>
<td>0.00</td>
</tr>
<tr>
<td>Decline in profit during the last year, and losses estimated in the current year.</td>
<td>0.25</td>
</tr>
<tr>
<td>Cash losses incurred in the last year are expected in the current year, deterioration anticipated in the current year although current ratio is more than one during year and deterioration anticipated in debt/equity ratio during the current year.</td>
<td>0.50</td>
</tr>
<tr>
<td>Cash losses incurred in the last year are expected in the current year, current expected in the current year, current ratio is equal to one and deterioration expected the coming year.</td>
<td>0.75</td>
</tr>
<tr>
<td>Cash losses incurred in the last year, expected in the current year and the year expected in the current year and the ye current ratio is less than one and worsening debt/equity ratio.</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Another measure is the loss rate which is the difference between the realised yield and the promised yield, out of the loan.

**Comparison Of Different Rating Methods**

To investigate the degree of significant differences among different methods in predicting financial distress, three statistical tests can be performed. i) Test for equality of group means. See if the calculated F-values for both tables exceed the theoretical F values at the 5% level. If so, reject the null hypothesis that there is no significant difference between the different methods. ii) Test the equality of group means among groups. The purpose of this test is to cluster homogenous groupings and differentiate dissimilar groupings. iii) The final test is the kappa statistic which measures nominal
scale agreed upon by the rating agencies and the extent of agreement in assigning a firm to a given category or rating class. Under the hypothesis of no agreement beyond chance, \( k/\text{SE}(k) \) will he approximately distributed as a standard normal variable.

To sum up the review on methodology, we can say that research on financial distress has come a long way since the time of Altman’s pioneering work of 1968. Most progress has been made, as Foster(1986) observes, in documenting empirical regularities in the profiles of financially distressed and non-distressed firms. Remarkable refinement also has been achieved over time in the statistical techniques used in model development. Research has generally concluded that “the classification performance of multi-variate models is not highly sensitive to the choice of the statistical technique.” (Foster, 1986).

There is also very little evidence that placing all firms on a consistent set of accounting methods, significantly improves the predictive ability of multi-variate bankruptcy prediction models. Then, the major issue faced by researchers in this area is choice of variables important in detecting bankruptcy potential.

As there exists no well-developed theory of credit risk to guide the selection of independent variables, most studies have relied on extensive data searching and the results of prior studies. Studies examining financial statement variables report that as early as three to five years prior to bankruptcy, the financial ratios of bankrupt firms to exhibit behaviour different from those of non-bankrupt firms. Studies on the behaviour of the security returns of bankrupt stocks likewise report that the capital market revises downward its valuation of these companies well before the date bankruptcy is announced.(Foster, 1986). Another set of studies have stressed the need for including industry-specific factors as well as macro-economic variables, into financial distress models. Recent developments in the banking and bank lending literature (Short, 1994; Stiglitz, 1981; Petersen and Rajan, 1995; Holland, 1994; Boot and Thakor, 1994 etc.) have highlighted the significance of bank-corporate relations. Thus, although independent variables examined typically have continued to be financial ratios and other firm-oriented variables, general economic indicators, industry-specific factors, measure of credit-market concentration, number of lenders to the firm, number of years of the firm’s association with the bank, have all become relevant factors in assessing the bankruptcy potential of firms.
However, there is a complete lack of any hypotheses to support the usage of various ratio and non-ratio variables. In an attempt to wester this criticism on research on financial distress, Craycraft, Etebari and Horrigan(1995) put forward an Optimal Ratio Hypothesis in order to provide a basis for the use of financial ratios. It is argued that rational optimising behaviour on the part of firms would lead to clustering around optimal financial ratios. In effect, industry average ratios would be efficient estimates of optimal ratios and ratio criteria could be specified in terms of deviations from average ratio levels. Extremely low or extremely high ratios should be viewed as non-optimal situations. Empirical analysis of a sample of industries showed that average ratios were indeed associated with higher probability in many cases. However, the mixed nature of the results for the different industries neither rejected nor confirmed the Optimal Ratio Hypothesis. They clearly demonstrated why simple ratio hypothesis would not suffice in all cases and there ought to be further research on the basic question of the relationship of financial ratio to measures of achievements of similar firms. Ideally, economic theory should provide the guidelines as to the choice of variables in the development of distress predictions models. In this context, our attempt in this study is to propose the framework of the theory of growth of the firm, to understand the dynamics within firms and to provide a rationale for the choice of variables used in distress prediction models.

In the following section, we take a look into the theoretical framework of the issue.

The Theoretical Framework: Theories of Growth of the Firm

As we have discussed in the preceding part of the chapter, in the methodological studies on corporate credit risk analysis, the choice of variables (ratios and others) has not been guided by a theoretical model linking the firm’s performance and hence its creditworthiness to its production, investment and financing decisions. Financial ratios undoubtedly provide valuable information while assessing a firm’s performance. However, it is essential to have an understanding of the working of the firm before we use financial and non-financial information available on it. Further, a firm's financial statements reflect its managerial decisions on production, investment and finance along with the general economic environment and financial market structure. Therefore, we need to look at the motivations and objectives guiding this decision-making process if we
are to understand the behavioural performance of a firm. This work is an attempt to use the framework of theory of growth of the firm in determining the growth potential of the firm and thus to assess its creditworthiness. First, we shall look at the traditional theory of the firm and explain how it is inadequate to study the growth process of the firm. We shall go on to the development of growth theories of the firm next and then review the empirical studies which draw their intuitions from these growth theories. (to be deleted if necessary)

Theory of the firm

In the traditional theory of the firm "the appropriate model of the firm is a model representing the forces determining the prices and quantities produced of particular products in the individual firm" (Penrose, 1959, p. 11). It is a profit, maximising firm, which will produce that output forms marginal cost is equal to the price of the product. where price is determined by the general demand-supply relationship for the product in the market. The equilibrium of a firm is the equilibrium output for a given product and growth of the firm is nothing more than an increase in the output (and therefore the size) of the firm. The concept of optimum size of the firm - the level of output at the lowest point on the average cost curve for the given product - provides an explanation of the limited size of the firm. A firm producing an output below the optimum size will endeavour to grow to reach the least cost size.

Thus the theory of the firm in essence, is the static partial equilibrium analysis of the profit maximising firm operating in an exogenously given environment (Prem Kumar, 1985, p. 14). The conditions of equilibrium require that there be something to prevent the indefinite expansion of the output of the individual firm (Penrose, 1959). Without some such limit to the output of a given product - which in this context means the size (Growth) of the firm --- no determinate equilibrium position can be posited in the static theory. (Penrose, 1959. For the firm in 'pure competition', this limit to output is given by the assumption that the cost of producing the individual product must rise after a point as additional quantities of it are produced, due to diseconomies of scale. However, in the actual market several firms may be operating at what is apparently their equilibrium size, while average and marginal costs are still falling. This incompatibly between theoretical deduction and actual observation led to the emergence of the theories of imperfect
competition. In these models the size of the firm is restricted by limitations of the market; that is, the fact that larger output can be sold only at progressively lower prices leading to falling marginal revenue. “Under these conditions, firms would reach their most profitable output while average cost is still fading, the economy of lower costs being offset by the necessity to accept lower prices. Thus the firm may be in equilibrium at less than the least cost size” (Prem Kumar, 1985, p. 16).

The inability of the orthodox theory of the firm to help in the analysis of the firm in the real world which adapts itself to a constantly changing environment and is rarely in equilibrium arises because it “views the firm as a black box operated so as to meet the relevant marginal conditions with respect to inputs and outputs, thereby maximising profit” (Short, 1994). Few theorists at the time enquired what happened inside the firm and as Penrose (1995) puts it, “their ‘firm’ had no ‘insides’ so to speak”. However, it was increasingly recognised that for an “analysis of the expansion of the innovating, multi-product, ‘flesh-and-blood organisations’ that business men call firms, we have to study the firm as a growing organisation with an understanding of the decision-making process within it” (Penrose, 1959).

Attacks on the approach in the traditional theory of the firm (with its assumption of profit maximisation as the objective of the firm) led to the incorporation of other goals besides money profits into expanded objective functions. New approaches were aimed at more “realism in motivation”. Such realism in motivation is felt to be needed chiefly because of the separation of ownership and control in the modern corporation, whose management have great power and wide discretion". (Machlup, 1967, p. 5) Managerial theorists (Baumol, 1959; Marris, 1964; Williamson, 1966 etc.) argued that “the mature corporation operated with the intention of maximising managerial, not stockholder welfare.” (Mueller, 1971). They propounded that while owners (shareholders) may reasonably be assumed to be profit maximises, managers are likely to have one or more other objectives like maximisation of gross revenue (sales), maximisation of the growth rate of sales etc.

Behavioural theorists (Simon, Cyert and March) tried for “realism in process” in contrast to the proponents of managerial discretion models who aimed at “realism in motivation”. Their models of decision making process within a firm based on four major sub-theories regarding organisational goals, expectations, choice and control represented
a major advancement in theoretical attempts to study and explain firm behaviour in terms of its ‘insides’. It assumed that five organisational goals- a production goal, an inventory goal, a sales goal, a market share goal and the profit goal- become the subject of bargaining among the various members of the ‘coalition’ which make up the business organisation; but that the goals are continually adapted and are being pressed with varying force. There is a “quasi resolution of conflict” within the organisation, of an "adaptively rational, multiple-objective process" with responses to “short-run feedback on performance” and with continuing “organisational learning”. (Machlup, 1967.)

However, it came to be stressed that though the managers may have multiple objectives, the one objective which dominate the management of the firm is growth - expansion of the firm through time. (Bridge and Dodds, 1978, p.74) Mueller argued that the non-pecuniary rewards (e.g. status power) of the managers are also directly associated with size and growth, and not with profitability.

The pursuit of an objective of growth is important in its own right too. Growth has been argued to be a necessary condition for the long run survival of the firm in an uncertain and constantly changing environment.(Downie, 1958; Marris, 1964) It has also been contemplated that the decision to grow is a response to particular opportunities or pressures like when new markets and investment opportunities arise. The growth of the enterprise has also been emphasised as a means of using more extensively or more effectively existing productive resources. It has also been suggested that the effects of technological change leading to rising productive efficiency meant that there is an increase in the real capacity of firms, including management and that there are, therefore, pressures in the firm to find way of using itself (Prem Kumar, 1985, p. 16-17). All these discussions triggered off a great deal of interest in growth of firms and led to the development of a distinct theory of growth of the firm for analysing the process of growth. We now turn to these.

THEORIES OF GROWTH OF THE FIRM

Growth, in theories of growth of the firm connotes a natural or 'normal internal process of development, which occurs whenever conditions are favourable because of the nature of the organism; and size at any given point of time is the incidental result of a continuous process of growth through time. This is in contrast to 'the way size of firms is
looked at in the traditional theory of the firm which examines the advantages and disadvantages of being a particular size and explains movement from one size to another in terms of the net advantages of different sizes'. In the orthodox theory, 'growth becomes merely an adjustment to the size appropriate to given conditions’ (Penrose, 1959, p.1). Further, the concept of optimum size as we have explained earlier, says why firms are of limited size. Once this concept is abandoned, the issue is whether there is any limit to the size/growth of the firm. It is assumed in the theories of growth of the firm that although there may be no effective constraints on the size of firms, there are constraints on their rates of growth because “growth is subject to various dynamic constraints” (Prem Kumar, 1985, p.18). The interaction between these restraints essentially necessitate a trade-off between the means and costs of growth and this sets an effective limit to the rate at which the firm can grow. Ultimately, the deciding factor in this trade-off and hence the growth rate of the firm will be the objective or goal pursued by the managerial team. The theory of growth of the firm provides the framework within which the broad spectrum of parameters which the growth process involves, the nature of the various constraints to growth and the several qualitatively different kinds of growth can be analysed. The foundation of an explicit theory of growth of the firm has been laid by Downie (1958), Penrose (1959) and Marris (1964, 1971).

Downie (1958) postulates that within an industry defined in terms of similarity of technical progress, there exist firms of differing efficiency levels. The differences in efficiency emerge due to “advantageous access of some firm to technological superior processes and/or products, e.g. from past innovation” (Prem Kumar, 1985, p. 18). The Downie firm finds itself within an industry in which the more efficient firms are expanding their market share at the expense of the less efficient ones. This transfer from less to more efficient firms may lead to the less efficient either dying completely or being forced to innovate, which can reverse ‘the transfer process as they then recover market share and profitability’. In Downie’s formulation, the means of growth are capacity and customers. In order to extend capacity, finance is required and access to finance depends on the rate of profitability, whether it is raised internally or externally. This growth of capacity is related to the profit rate. Further, new customers can be attracted from rivals only by price reduction which will bring down the rate of profit. Thus, since the rate of capacity expansion varies directly with the rate of profit and the rate of profit varies
inversely with the rate of customer expansion, there will be a maximum sustainable rate of growth at which the simultaneously determined price and rate of profit are such to enable sales and capacity to grow at the same rate. The more efficient the firm, the higher the maximum sustainable rate of growth. (Prem Kumar, p. 19)

The relationship between growth and profitability as emphasised by Downie, remains the cornerstone of all theories of growth of the firms. However, the transfer mechanism has been criticised on the ground that it does not encompass diversification outside the industry, which may remove the demand constraint.

Penrose (1959) does not construct a formal model of the growth of the firm but gives a verbal description. She conceives the firm as a pool of productive resources organised within an administrative framework. Her emphasis on the internal resources of a firm - on the productive services available to a firm from its own resources, particularly the productive services available from management with experience within the firm - which make each firm unique in its performance, has set the tenor for most of the subsequent literature on growth of firms.

Penrose assumes that there exists opportunities for profitable investment for the firm given the prevailing resources and products. She disposes of the financial and demand restraints by assuming that resources required for expansion are available at a price. Thus, in any given period, the planning and execution of expansion in order to take advantage of these productive opportunities is undertaken by the existing managerial team. Then, the fundamental limit to the productive opportunity of the firm is not set, according to her, by the external supply and demand conditions. This limit is imposed by the amount of managerial time which is, and can be devoted to the strategic decisions of the firm and the time required for new recruits to be absorbed into the existing management team as the firm expands. This is so because, for each firm the rate and direction of its expansion is shaped by the character and extent of its existing managerial services, both entrepreneurial and administrative. Even if appropriate changes in the administrative structure are made to facilitate the integration of the new staff, time is required for outsider to become insider by working with the existing managerial team. Penrose notes that “if a firm deliberately or inadvertently expands its organisation more rapidly than the individuals in the expanding organisation can obtain the experience with each other and with the firm that is necessary for the effective operation of the group, the
efficiency of the firm will suffer” (Penrose, 1959, p. 47). Thus the managerial restraint ensures an upper limit to the rate of growth of the firm.

The direction of growth, however, depends on the external and internal inducements and obstacles to expansion. Externally the firm may find that changes in demand and technological innovations offer the firm opportunities to grow, but there are limits here in terms of barriers to entry into new markets and industries. Internally the main obstacle as we have seen, is the managerial limit, but the firm may have a pool of unused productive services which can be used and these Penrose sees as “a challenge to innovate, an incentive to expand, and a source of competitive advantage”, for the enterprising firm (Penrose, 1959, p. 85).

In Penrose's analysis, diversification is a significant way in which firms grow, and an explanation of the extent and nature of diversification becomes an important part of the explanation of the growth of firms. A firm diversifies in view of the changing opportunity costs to the firm of its own resources which may occur when existing markets become relatively less profitable than opportunities for new investment elsewhere. Diversification may take place within a firm’s existing areas of specialisation (horizontal and vertical integration) or it may result in a firm going into new areas. In either case, diversification is significant, for it frees the firm from the restrictions on its expansion imposed by the demand for its existing products.

The firm may also grow by external expansion via mergers and acquisitions, when it has reached the profitable growth by internal expansion and has come up against the managerial restraint. Penrose discusses mergers and acquisitions as the means by which a firm expands by acquiring existing capacity as opposed to installing new capacity in internal expansion.

Marris’s 1964 work has been seminal in its conceptualisation where by he incorporated the critical features of managerial capacity, finance and demand into a formal model. He specifies an objective function of ‘balanced’ growth maximisation arguing that for growth to be sustainable, “the firm must simultaneously maximise the rate of growth of the demand for its products and the rate of growth of capital supply to finance the growth process” (Bridge and Dodds, 1978, p. 78). Following Penrose, Marris also says that the planning and execution of expansion can be undertaken only by the existing management team. Even if the management team may expand continuously over
time, the mere addition of extra employees will not necessarily increase its effective capacity immediately. Thus, at any moment in time the management team is a fixed factor which sets an effective constraint on the growth of the firm.

The second constraint in Marris's model is financial in nature. The financing of expansion is treated as a part of the balanced growth equation and the need to provide a return to investors enters the model in the form of a 'constraint'. The major source of finance in Marris's model is internal and it is here that the financial security constraint enters. This he splits into three ratios: liquidity, leverage and retention.

The liquidity ratio is liquid assets/ total assets, and too high or too low liquidity is dangerous to a firm from the point of view of take-overs and liquidity respectively. The leverage ratio - value of debt/ total assets - indicates the extent of the firm's contractual obligations. The retention ratio is given by the ratio of retained profits to total profits and is determined effectively by pressures on the management team. "It is not entirely free to choose the level of retention since there is a need to distribute some profits to shareholders in order to satisfy their aspirations and more particularly to maintain the share price in line with the value of the assets" (Bridge and Dodds, 1978, p. 89). If the shareholders are satisfied about the profitability of new projects (for expansion), they will be content. Otherwise they may dismiss the management or sell their shares. If sales occur on a large enough scale, the market values of the firm's shares will fall. If the stock market valuation of the firm's shares fall too low, the situation is ripe for a take-over raid, which will result in rapid shredding of the firm's management. Thus, the threat of a take-over bid acts as a restraint on the firm's management, preventing it from raising finance externally or retaining profit internally for use on what the stock market regards as inadequately profitable projects. Hence, there is a trade-off between dividends and retained profits.

Marris combines these three critical ratios i.e.; liquidity, leverage and retention, in a single financial security measure, which we shall denote by 'a'. The value of the latter is inversely related to the liquidity ratio, and positively related to the other two ratios. "A high value of a could be indicative of a low liquidity ratio, high leverage or retention ratios, or some combination of these, such that security would be low, but, financial supply would be favourable and conducive to expansion. Exactly how 'a' is determined
depends on the managerial attitudes towards risk and also on the market contentions and constraints with respect to dividend policy and leverage” (Bridge and Dodds, 1978, p.99).

Marris adopts the Penrose-ian concept of managerial restraint which limits the extent to which diversification can overcome the demand constraint without fall in profitability. As soon as profitability starts falling, the financial constraint in the form of take-over threat becomes operative. Here again, the relative efficiency of the existing management will have an important influence on the rate of growth that can be undertaken without fear of the firm being taken over. Relatively efficient management will be able to grow more rapidly with safety.

The most sufficient aspect in Marris’s model is the way the threat of insolvency and take-over has been taken care of by incorporating the security constraint into the model. This has important implications in analyses of bankruptcies and mergers and acquisitions. In approaches significantly departing from the traditional methods of analysing the behaviour of firms there have been attempts to develop theories of growth of firms using biological analogies and treating firms as organisms whose processes of growth are essentially the same as those of the living organisms of the natural world. Penrose (1959) rejected such theories criticising that human motivation and conscious human decision have no place in the process of growth in such theories and much is lost if this fact is not explicitly recognised.

Muller (1971) developed a life cycle theory of a growth-maximising firm. He said that the management-stockholder conflict that accompanies separation of ownership from control arises only over time as the firm expands and matures. Therefore, he argued, the tendency of managers to pursue growth rather than stockholder welfare, increases as the firm grows and matures. The life cycle theory of the growth of firm implied a positive relationship between growth and age of the firm.

Recent interests in the processes by which organisations adapt to changing environments have led to significant developments in the areas of game theory and evolutionary theory. Game theoretic students of the firm have come to recognise the numerous game theory situations that have multiple equilibria and the difficulty of specifying the conditions under which one equilibrium rather that another, will be realised. At the same time, learning and evolutionary thinking in economics has led to more precise specification of the conditions and consequences of history dependent
change. The evolutionary theory developed by Nelson and Winter (1982) which emphasises differential survival as a primary basis for changing populations of firms, views as being selected upon by virtue of their fit to the environment. The two key concepts in this approach are: (1) that "organisation.; develop, stabilise and follow routines. The routines may change over time, but in the short run they function as carriers of knowledge and experience; and (2) that organisations are not strictly invariant but change as a result of search for new solutions as old ones fad to work. Search follows routines and in that way, is similar to other objectives in the firm but the outcomes of search are subject to stochastic variation. Differential outcomes from search result in differential rates of survival and growth in firms. These differences, in turn, affect the distribution of activities and interactions at the industry level" (Cyert and March, 1992, p. 224). Jovanovic (1982) provides a theory of selection with incomplete information that is consistent with empirical evidence on faster growth rates and worse likelihood to fail of small firms than of large firms. According to him, firms learn about their efficiency as they operate in the industry. The efficient grow and survive and the inefficient decline and fail.

In a different strand of literature at the relationship between size and growth of firms, growth is regarded as a purely stochastic phenomenon resulting from the cumulative effect of the chance operation of a large number of forces acting independently of each other. It has been suggested that during any particular of time some of these factors would tend to increase the size of the firm and others would tend to cause a decline; but their combined effect would yield a probability distribution of the rates of growth for firms of each given size. It is commonly asserted that this probability distribution is the same for all size-classes of firms. This is the well-known Law of the Proportionate Effect (LPE, or, Gibrat's Law), which in its strong form simply states that "the probability of a firm growing at a given proportionate rate during any specified period of time is independent of the initial size of the firm" (Singh and Whittington, 1975, p. 16).

The LPE asserts two immediately testable hypotheses concerning the cross-section relationship between the size and growth of firms: (a) "that firms of different size classes have the same average proportionate growth rate; and (b) that the dispersion of growth rates about the common mean is the same for all size-classes" (Singh and
Whittington, 1975). Both (a) and (b) are necessary conditions for the validity of LPE in its most stringent form. Another implication of the strongest form of this law which can be directly tested is: (c) "that the rate of growth of the firm in one period should be independent of its growth rate in subsequent periods, i.e: there should be no serial correlation in firm growth rates" (Singh and Whittington, 1975).

Apart from yielding some accurately testable hypotheses as described above, the LPE has some important economic implications. First as in the managerialist approach, the LPE also implies that there is no optimum size of the firm although, unlike that approach; it does not imply that size and growth should be positively related. Secondly, in its strongest form it suggests that the rate of growth of the firm in one period has no influence on its growth in the subsequent periods. [This assumption enables the LPE to be treated as a first order 'Markov Process'. However a less stringent version of this law does not require serial independence of growth rates(Sing and Whittington, (1975)]. Thirdly, in its strong fore the Law implies increasing concentration in a constant population of firms over time.

A Review Of The Empirical Literature

Looking at the empirical literature, we come across a whole series of studies some conflicting, and covering many different time periods with different samples of companies. These studies relate to the importance of size and age in growth performance. the relationship between birth and death of firms to their growth rates, the effect of innovations, research and development (R&D) etc. on a firms growth rate, the implication of growth of firms for industrial concentration etc.

The majority of studies have concentrated on the issue "whether there is any evidence that the rate of growth of firms are systematically associated with the size of firms" (Prem Kumar 1985, p.23)), and have involved testing the validity of the LPE-the postulate that the expected rate of growth is independent of present size.

In 1962, Hymer and Pashigian, in their article summarised the results of previous studies and pointed out that all the earlier studies except one, had found no relationship between size of firm and mean rate of growth thus confirming Gibrat's Law. In their own study, Hymer and Pashigian computed and compared the distribution of growth rates for different size-classes of firms, for one thousand largest manufacturing firms in the US for
the period between 1946 and 1955. They found that the average growth rates did not differ for firms of different sizes. There was, however, a systematic tendency for the variance of the growth rates to be larger for small firms than it was for large firms.

Ijiri and Simon (1964) described a new stochastic process, where the change in size (i.e., growth) of each firm depends not only on the size to which it has grown, but also upon the times at which its growth has taken place. They assumed that the probability that a firm would experience an increment in size during the next time period is proportional to a weighted sum of the increments it has experienced in the past, where the weight of an increment decreases geometrically at a rate with the lapse of time since its occurrence. Thus the process incorporated a significant modification.

The growth experience over the period 1948-60 of nearly 2000 industrial firms in the UK divided into 21 industrial groups was studied by Singh and Whittington in 1975. The evidence, both for the individual industries and for the aggregate of industries, pointed to the conclusion that there is a weak positive relationship between firm size and average growth rate. 'It may be recalled that the LPE in its strongest form (a first-order Markov Process) implies no serial correlation between firm growth rates. However, the results of a regression as well as a correlation analysis carried out by them pointed to a definite but relatively small degree of persistence in the growth of firms, where growth was measured in terms of net assets. A limited analysis of 'births' and 'deaths' showed that i) although the incidence of births declines with an increase in firm size, a considerable number of births occur in all size classes; ii) that the incidence of deaths also declines with an increase in firm size, and among the largest firms alone it declines more sharply as the size of the firm increased. They also pointed out take-overs as the major means by which the surviving companies grew.

Kumar (1985) found evidence of a negative relation between firm growth and size. This evidence is based on some 2000 quoted manufacturing companies in the UK and covers the period 1960-76. He used net assets, employees, physical assets and sales as measures of size. In addition to rejecting Gibrat's Law for growth of firms by internal expansion, he found that in general there is a weak negative relation between size and growth by acquisition also for firms in manufacturing, which was again found to persist over time.
The 1987 paper by Evans makes several contributions to the empirical literature on firm growth. His study tests some of the assumptions and implications of Jovanovic's model of firm learning and the Gibrat's Law. His study found that for young firms, firm growth decreases with firm age when firm size is held constant; and it decreases with firm size when firm age is held constant. This study is based on a sample of approximately 20,000 small manufacturing firms in the US over the period 1976-1982 and he used employment as the measure of firm size.

Gibrat's Law predicts that firm growth is independent of firm size. However, Evan's study found that firm growth decreases with firm size. Studies of large firms by Kumar (1985), Evans (1987) and Hall (1987) also found that Gibrat's Law fails for several different measures of firm size, over longer periods of time than is considered in this paper.

Dunne, Roberts and Samuelson (1989) used the theoretical model of Jovanovic (1982), which relies on employer, heterogeneity and market selection to generate patterns of employer growth and failure, as the basis of their empirical work. They analysed the employment and failure patterns of over 20,000 plants that entered the US manufacturing sector in the 1967, 1972 or 1977 Census of Manufactures. The results indicate that plant size, age and ownership type, as well as interaction terms are determinants of plant growth and failure. Failure rates decline with increases in plant size and age as do the growth rates of non-failing plants. The expected growth rate of a plant which depends on the net effect of these two factors, declines with size for plants owned by single-plant firms but increases with size for plants owned by multi-plant firms.

In another paper published in 1994, Dunne and Hughes examines growth and survival among quoted and non-quoted UK companies in the period 1975-85. An examination of death rates show that smaller companies had higher death rates, but the largest and smallest companies are least vulnerable to take-over. It is shown that smaller companies grew faster than larger companies, that Gibrat's Law does not hold among smaller firms, that age is negatively related to growth and that these results are not an artefact of sample selection bias.

Concluding Remarks

Theories of firm growth are rich in their analysis of firm growth behaviour. They provide us a wide range of variables which are influential in determining the direction
and extent of firm's growth. They discuss the various constraints faced by a firm in its expansion plans namely, demand constraint, financial constraint, managerial constraint etc. Stock market valuation is another significant deciding factor which has been discussed and needs to be studied further. Size and age of the firm are two other variables whose relationship with growth has been studied much in the empirical literature.

In the Indian context, there have not been many studies on the growth behaviour of individual firms. One important study has been done by Prem Kumar (1985), in which he examined the pattern of growth of large Indian firms covering the period 1969-70 to 1978-79. The present study is an attempt to examine the determinants of firm growth in five manufacturing industries in India for a more recent period 1980-1991. We devote the following chapter towards explaining the methodology for this analysis.