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UMI

THE EFFECT OF SMALLER FIRM SIZE AND CHANGE IN FIRM SIZE ON

ALTMAN'S REVISED BANKRUPTCY PREDICTION MODEL

by

Jess W. Levins

A DISSERTATION

Submitted to
School of Business and Entrepreneurship
Nova Southeastern University

in partial fulfillment of the requirements
for the Degree of

.

DOCTOR OF BUSINESS ADMINISTRATION

SPECIALTY: FINANCE

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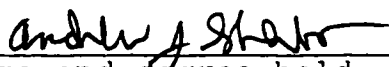
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THE EFFECT OF SMALLER FIRM SIZE AND CHANGE IN FIRM SIZE ON
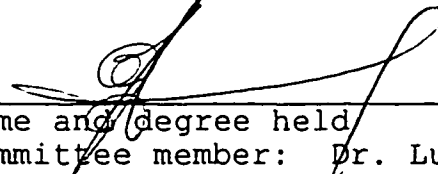ALTMAN'S REVISED BANKRUPTCY PREDICTION MODEL

by

Jess W. Levins

We hereby certify that this Dissertation submitted by Jess
W. Levins conforms to acceptable standards, and as such is
fully adequate in scope and quality. It is therefore
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for the degree of Doctor of Business Administration.
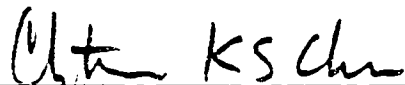
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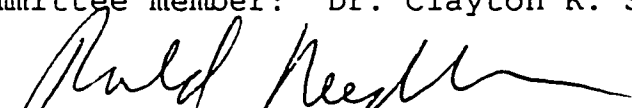
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1997

CERTIFICATION STATEMENT

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Jess W. Levins

ABSTRACT

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Numerous researchers have studied bankruptcy prediction
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five ratios and served as a highly accurate prediction of
bankruptcy or financial distress for large manufacturing
firms.

Altman developed a new model in 1983 for small
manufacturing firms. The 1983 model was similar to the 1968
model, but substituted book value or net worth for market
value in the fourth ratio. Also, new weights were
established for each ratio.

This study used Altman's 1983 five factor model to
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$100 million value in asset value. Two samples were
involved in the study.

The first sample, Sample A, contained 54 bankrupt and
54 nonbankrupt firms from the 1987 to 1990 period. Sample A
served as a validation sample. The model yielded accuracy
of 75 percent, 67 percent and 61 percent for periods of one,
two, and three years prior to bankruptcy using Altman's cut-
off values of less than 1.10 for bankrupt firms, 1.10 to
2.60 as a gray area and more than 2.60 for healthy firms.
This study established new cut-off values of less than 2.0
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2.3 for healthy firms. The new cut-off values yielded an
accuracy of 91 percent, 84 percent, and 78 percent for the
period one, two, and three years prior to bankruptcy.

The second sample, Sample B, contained 70 bankrupt and
70 nonbankrupt firms and was used as a holdout sample.
Three hypotheses were tested using the second sample. H_1:
The mean Z-scores for failed and nonfailed firms are not
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sample divided by asset size are not equal. H_3: The mean Z-scores for each one-third of the sample divided by growth, measured as change in revenue, are not equal.

Altman's 1983 Z-score model, with revised cut-off values, can be used for bankruptcy prediction for publicly traded manufacturing firms below $100 million in asset value.

The difference in asset value within the sample was not significant at the 5 percent or 10 percent level.

The growth rate was significant at the 10 percent level, but was not significant at the 5 percent level.

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This dissertation is dedicated to my wife: Nancy Jean Levins.

TABLE OF CONTENTS

LIST OF TABLES

ix

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Background of the Study

Numerous researchers have studied bankruptcy prediction for the past sixty years. As a result, various theories have evolved in an effort to explain or distinguish between firms that fail and those that do not. P. J. FitzPatrick (1932) appears to be the first recorded researcher to use univariate analysis in a comparison of ratios of successful industrial enterprises with those of failed firms. However, many researchers mistakenly acknowledge the work of William H. Beaver (1966) as being the first to empirically test for bankruptcy prediction due his more fully developed use of statistical methods. Also, his work essentially represented the end of univariate or one ratio analysis. Beaver advocated the use of cash flow as a starting point for failure research. He used cash flow divided by total debt, only one variable, as his model. Beaver was able to achieve a high level of success in predicting firm failure, but his model was not as accurate or as robust as the later models

1

that used multiple ratios. Edward I. Altman (1968) improved on Beaver's work by using discriminant analysis and had five variables in his model. Altman's base theory was that a combination of financial ratios could be used to predict or distinguish between firms that would fail and those firms that would not fail. Altman's studies stimulated others to look for methods to further advance bankruptcy prediction models.

Purpose of the Study

The purpose of this study was to determine if Altman's revised 1983 bankruptcy prediction model can be used to distinguish between bankrupt and nonbankrupt publicly traded small firms. This study specifically analyzes the impact of small firm size and change in firm size on the revised 1983 bankruptcy prediction model. Small firm size for this study is defined as firms below $100 million in asset size.

Altman's original model is:

$$Z = .012X_1 + .014X_2 + .033X_3 + .006X_4 + .999X_5$$

where

Z = Overall Index

X_1 = Working Capital/Total Assets

X_2 = Retained Earnings/Total Assets

X_3 = Earnings Before Interest & Taxes/Total Assets

X_4 = Market Value Equity/Book Value of Total Debt

X_5 = Sales/Total Assets

Unlike Altman's original model, the revised model used book value instead of market value for net worth. Altman's revised model was designed for non-publicly traded companies that are typically smaller in size (Altman, 1983, pp. 120-124). It was felt that the revised model would be more appropriate for the smaller firms being analyzed in this study.

Altman's revised model is:

$$Z = .717X_1 + .847X_2 + 3.107X_3 + .420X_4 + .998X_5$$

where

Z = Overall Index

X_1 = Working Capital/Total Assets

X_2 = Retained Earnings/Total Assets

X_3 = Earnings Before Interest & Taxes/Total Assets

X_4 = Net Worth (i.e. Book Value)/Total Liability

X_5 = Sales/Total Assets

The ratio and weights for the revised model are different from the original model. This is due: 1) to the replacement of the ratio X_5, 2) the use of a different data set (i.e. small firms versus large firms), and 3) possible

time related changes associated with the approximately twenty year span between the original model and the revised model. For the revised model, a Z-value below 1.10 indicates that the specific firm has those characteristics similar to failed firms, a value between 1.10 and 2.60 is in the gray area, and above 2.60 is a healthy company (Altman, 1983). In the original model, the ratios for X_1 through X_4 should be expressed as a percent when multiplying the discriminant coefficients by the relevant ratios, 20 percent would be expressed as 20, while X_5 should be expressed in decimal form such that 20 percent would be expressed as .2 (Altman, 1970). No adjustment is needed in the revised model.

Altman (1968), concluded that X_1 or Working Capital (i.e. current assets less current liabilities) divided by Total Assets was the most valuable of the liquidity ratios in predicting bankruptcy. This ratio was selected over the current ratio and the quick ratio since the working capital to total assets ratio provided higher predictive power both on a univariate and multivariate basis. Altman did not use cash flow to debt, as used by Beaver, because of the lack of precise depreciation data that could distort the ratio.

Retained Earnings divided by Total Assets, or X_2, gives more weight to the older firms that have accumulated a higher net worth as a result of passing the test of time.

Altman (1968), et al, provides that smaller firms with lower net worth would have a higher incidence of bankruptcy. Altman's research was based on an analysis of 66 manufacturing firms. This ratio indicates that service firms with lower capital needs should have a lower level of bankruptcy while capital intensive manufacturing type firms have a higher probability of bankruptcy.

Earnings Before Interest & Taxes divided by Total Assets, or X_3, is a measure of the earning power of the firm's assets. This ratio addresses the issue of whether the firm is receiving a sufficient return on its assets to maintain solvency. This profitability ratio contributes the most to group separation in the discriminate function.

Book Value of Equity divided by Total Liability, or X_4, measures the net worth or book value of all shares of stock to the current and long-term debt. This ratio requires that the size of the initial investment (i.e. Common Stock plus Paid-in Capital), plus earnings left in the business (i.e. Retained Earnings less Dividends less Treasury Stock), be a good indicator of bankruptcy.

Sales divided by Total Assets, or X_5, is the capital turnover ratio and though it ranked low in statistical significance compared to the other ratios, it was ranked second by Altman as a predictor of bankruptcy.

In this study, a validation was made of the model by using a sample of 54 bankrupt firms and 54 nonbankrupt firms from the 1987 to 1990 time period. The model successfully distinguished between bankrupt and nonbankrupt firms. However, new cut-off values were established to improve model accuracy. The new cut-off values were less than 2.0 for bankrupt firms, a value between 2.0 and 2.3 is in the gray area, and more than 2.3 for healthy firms. The model with the new cut-off values was tested against a holdout sample of 70 bankrupt firms and 70 nonbankrupt firms for the time period 1991 through 1996.

Justification of the Study

Altman's original model was derived from large publicly traded manufacturing firms during the period 1946 to 1965 and used the market value of the firm's equity as the numerator in the fourth ratio. This study examines smaller publicly traded firms as contrasted to the Fortune 500 firms that are normally used in the various bankruptcy studies.

The market value of small publicly traded firms are characterized by higher volatility and can vary due to causes that are unrelated to financial performance. For example, the share price of a narrowly traded firm can overreact to the trades by a small number of buyers or sellers. The market efficiency for small firms is suspect

due to the wide bid to ask spread as compared to the narrow spread for larger firms. The 1996 investigation of the NASDAQ by the SEC for excess spreads provides support for a lower market efficiency for smaller firms. Altman's revised model was selected because: the model is unaffected by market share price, it was specifically designed for smaller firms, it is more current when compared to his 1968 model and has yet to be subjected to the rigors of replication when contrasted to his earlier model.

Small Firm Relevance

The sample for this study is composed of publicly traded manufacturing firms with asset size below $100 million. Publicly traded companies are required to follow Generally Accepted Accounting Principles and must meet certain requirements for the timely filing of financial reports. Data on publicly traded firms is readily available. Also, a larger number of smaller firms go bankrupt compared to the Fortune 500 type firms. The performance of publicly traded firms and private firms affects the employees, creditors, suppliers, and customers. However, the performance of publicly traded firms is also important to stockholders, analysts, and certain government and non-government agencies.

Organizations and individuals could use a prediction model: to take preemptive measures through the exercise of action to prevent the occurrence of bankruptcy, as an additional business tool to minimize or manage risk, to evaluate employment risk, as an investment tool, and for a myriad of other uses.

Limitations and Assumptions

Altman's revised bankruptcy prediction model that is replicated in this study used a small sample size of 33 bankrupt firms and 33 nonbankrupt firms. The small sample size requires a higher level of model accuracy to meet the 5 percent confidence level required for normal research acceptance. Altman did not test the model on a secondary sample which means it may be valid on an ex post basis and not on an ex ante basis.

Altman's discriminant analysis method assumes that the independent variables are normally distributed. Also, the use of an equal number of samples from failed firms and nonfailed firms can cause bias in discriminant analysis, since the number of failed firms in the sample is not the same as that in the population. This results in an over sampling of the bankrupt firms. However, the matched pair sampling technique continues to be the more common research approach and is the method used in this study.

This study selected companies from a general population of small publicly traded manufacturing companies. Ratios in the same industries may be subject to manipulation by management to meet requirements contained in loan covenants or other commitments.

A center point cut-off establishes an equal probability for Type I and Type II errors which would imply that the cost of each of these errors would be the same. A Type I error would represent the cost associated with incorrectly classifying a failing firm as a nonfailing firm. A Type II error would represent the opportunity cost of incorrectly classifying a nonfailing firm as a failing firm. A Type I error is generally more expensive to an investor or a lender than a Type II error whereas the reverse would be true for the firm's management. Altman, et. al. (1977) supported a Type I to Type II error cost ratio of 35 to 1, whereas Diamond (1976) supported a ratio range of 20 to 1 to 38 to 1. This study established a new gray area for those troubled firms that are neither bankrupt nor healthy.

Since there are a large number of available financial ratios, any model is dependent on the various ratios selected by the researcher. Therefore the number of potential models is quite large.

Another possible problem is the level of multicollinearity among the variables. Multicollinearity

occurs when two or more of the independent variables are highly correlated such that one variable can be highly explained or predicted by the other variables resulting in little or no improvement in model predictability (Hair, Anderson, Tatham, & Black, 1995). However, Cochran (1964) supported that multicollinearity does not necessarily affect model predictability, and that both positive and negative correlation of ratios may be exploited to increase model discrimination. However, as Zavgren (1980) pointed out, if multicollinearity is present, the intercorrelations of the independent variables must be reasonably stable or the model could be sample dependent and would not serve as a predictive tool.

An assumption is made that firms with different year-end dates will not be significantly different in computing Z-Scores. Also, depending on the number of available firms, there is a limitation associated with small sample size.

There are always inherent limitations in using static models developed from failed companies for a specific time period. This study will determine whether Altman's revised model can be applied to a later time period.

Evaluating bankruptcy prediction in a changing environment associated with economic cycles, changing interest rates, changing monetary conditions, new accounting procedures, and changing regulatory policy is an additional

limitation. Bernardi (1990) found that accounting
pronouncements had no significant effect on computed Z-
scors.

CHAPTER II

REVIEW OF LITERATURE

Introduction to Bankruptcy Prediction

The number of business failures has continued to

increase when examined on the basis of total failures per

year as reported by "Dun and Bradstreet Business Failure

Record" (hereafter referred to as D&B). The failure rates

are summarized in Table 1.

Table 1

Firm Failure Rate

YEAR	NUMBER OF FAILURES	FAILURE RATE PER 10,000	YEAR	NUMBER OF FAILURES	FAILURE RATE PER 10,000
1925	21,214	100	1982	24,908	88
1930	26,355	122	1983	31,334	110
1935	12,244	62	1984	52,078	107
1940	13,619	63	1985	57,078	115
1945	809	4	1986	61,616	120
1950	9,162	34	1987	61,111	102
1955	10,969	42	1988	57,098	98
1960	15,445	57	1989	50,361	65
1965	13,514	53	1990	60,747	74
1970	10,748	44	1991	88,140	107
1975	11,432	43	1992	97,069	109
1980	11,742	42	1993	86,133	90
1981	16,794	61	1994	71,520	74

12

The bankruptcy rate per 10,000 firms has remained fairly level during the 45 year period from 1935 through 1980. However, the rate has doubled during the 1980's and 1990's to a level experienced during the Great Depression. Also, the total number of bankruptcies per year is quite large and has been increasing. The D&B classification of business failure is satisfied if any of the following conditions exist: "The firm has gone bankrupt, the firm's assets have been assigned to creditors, the firm has been reorganized, or the firm has terminated business without fully satisfying all creditors' claims" (D&B Failure Record, 1994). Although bankruptcies have increased, the number of business formations has also increased each year. Business failures represent approximately 10 percent of the new business formations (e.g. new business formations in 1990 was 647,366 compared to business failures of 60,432).

There is a strong relationship between a firm's age and firm failure rate. Over one-half of all failures occur within the first five years of a firm's formation and approximately one-third fail within the first three years (Altman, 1983).

Most of the prior research focused on the micro-economics of the individual firms. However, certain historical macro-economic events can impact the number of bankruptcies. Some of these events include: The stock

market crash of 1929 that lead to the Great Depression which resulted in larger number of firm failures, the effects of World War I and II that stimulated the national economy resulting in a lower number of bankruptcies, changes in the monetary policy by the Federal Reserve Board of Governors, changes in governmental regulations, changes in the international value of the U.S. dollar, and other events.

There are many bankruptcy prediction models. A summary of the more important models is presented in Table 2. This represents only a very small sample of the many individuals that have performed various levels of research in preparing or refining bankruptcy prediction models.

Most bankruptcy models use a paired-sample technique. One sample group contains firms that eventually fail, while another sample contains nonfailed firms that have characteristics similar to the first sample group. Each firm in the second sample is paired or matched against a firm in the first sample. However, a possible problem with the matched paired-sample approach is over-sampling bias by not selecting failed companies in the same quantity relative to the ratio of failed firms to nonfailed firms in the population. This could make the model more susceptible to Type II errors.

Small firms are more volatile than large firms when examining percent change in financial data and percent

change in market share pricing. Ratio analysis is used to compare different size firms using a common base. However, a small absolute change in a financial report for a small firm can make a rather large change in a specific ratio. A small firm with less inertia may respond quicker to both positive and negative impacts associated with economic changes and management decisions.

Bankruptcy prediction has evolved from univariant analysis to regression analysis, to discriminant analysis, to logit/probit, to recursive partitioning to neural networks. Also, expert systems can be designed using any of these various techniques. Using these analysis techniques, one can build a rather large number of models due to the magnitude of ratios that can be chosen for model consideration.

It is, therefore, difficult to directly compare bankruptcy prediction models since the models use different ratios, sampling techniques, time periods, firm selection criteria, and statistical modeling approaches.

Table 2

Bankruptcy Prediction Models

TYPE OF MODEL	AUTHOR	DATE
Univariate	FitzPatrick	1932
	Merwin	1942
	Walter	1957
	Beaver	1966
	Casey & Bartczak	1984
Regression	Meyer & Pifer	1970
Discriminant Analysis	Altman	1966
	Deakin	1972
	Blum	1974
	Libby	1975
	Altman, Haldeman, & Narayanan	1977
	Dambolena & Khoury	1980
	Gombola & Ketz	1983
	Casey & Bartczak	1985
	Gentry, Newbold, & Whitford	1985
	Poston, Harmon, & Gramlich	1994
Logit/Probit	Ohlson	1980
	Zavgren	1985
	Gentry, Newbold, & Whitford	1985
	Lo	1986
	Lau	1987
	Platt & Platt	1990
	Johnsen & Milicher	1994
	Laitinen	1994
	Sheppard & Fraser	1994
Recursive Partitioning	Marais, Patell, & Wolfson	1984
	Frydman, Altman, Kao	1985
Neural Networks	Tam	1991
	Coats & Fant	1992
	Salchenbergeer, Cinar, & Lash	1992
	Boritz & Kennedy	1995

Bankruptcy Theory

The predominant approach in bankruptcy research has been in the generation of statistical models constructed through empirical analysis. Researchers have generated various theories to mathematically explain the empirical results. A very brief non-exhaustive overview is presented below.

Ratio analysis that is used in much of the modern bankruptcy theory can be traced to Book V of Elements that was first written about 300 BC by Euclid. Euclid used ratios to develop many of his 465 theorems that serve as the basis for Euclidean geometry. Ratio analysis though used extensively for over two thousand years in the development of scientific theories, has only been used for financial statement analysis since the early 1870s. The current ratio was the first ratio to gain wide spread use during the last few years of the 1890s (Foulke, 1961). Much of the early study in the application of ratios to business was in the establishment of average ratios for various industries and geographical locations such as the work performed by Alexander Wall (1919). Wall laid the foundation for discriminant analysis by developing a ratio index composed of the weighted average of different ratios. Bliss (1923) developed a theory during this same period using a system of ratios that was believed to be the fundamental relationship

within business which would be created by competitive conditions. Later, this theory was mathematically modeled by the du Pont ratio system (i.e. the du Pont model).

James Scott (1981) reviews bankruptcy theory development and how the theory is supported by empirical research. Scott presents a new theory of bankruptcy to support the various models based on financial ratios. He provides theory that supports models developed by Altman (1968), Deakin (1972), Sinkey (1975), and Altman, Haldeman, & Narayanan (1977). Scott presents the Single-Period Theoretical Model which is a simple theory based on the premise that a firm goes bankrupt if its liquidation value is less that its debt load. This theory contains only limited information with no flow data and assumes that firms are created to last for only one period. Scott (1981) also presents the Perfect-Access Theory which he believes is a better model than the Single-Period Theory since it includes flow variables and firm resources. However, his conclusion was that the imperfect-access theory tended to have the greatest empirical support. Scott concluded that "Bankruptcy prediction is both empirically feasible and theoretically explainable" (Scott, 1981, p. 341). Future research will determine which theoretical models work best.

The Black-Scholes (1973) Option Pricing Theory is well known and provides a framework for bankruptcy prediction but

does not contain any earnings or cash flow variables. This theory has not been used in bankruptcy prediction thus far.

The Gambler's Ruin Theory or Model has been used with limited success in bankruptcy prediction by Wilcox (1973), et al. This theory assumes that the firm has a given amount of capital, that changes in capital are random, and that bankruptcy occurs when the capital becomes negative. This theory has been used by a number of authors to explain bankruptcy prediction models.

Jarrod Wilcox (1971) devised a theoretical model to explain the empirical results obtained from the cash flow ratios used by Beaver. He used a Markov approach in setting up a probability derivation that utilized the one-dimensional Random Walk Theory with an absorbing barrier at one end and no barrier at the other which is the gambler's ruin model mentioned earlier.

Falk and Heintz (1975) developed a ranking of various industries using five ratios. They used the scalogram technique that is primarily based on facet theory (Bhattacharya, 1995) such that the industries with the higher ratio represented higher risk.

Robert Scapens, Robert Ryan and Leslie Fletcher (1981) used a catastrophe theory approach involving three dimensional analysis for explaining corporate failure. The

catastrophe model is concerned with sudden changes in credit worthiness.

Mark Tippett and Geoffrey Whittington (1995) viewed ratios as induced measures that could be derived from techniques available through the use of stochastic calculus. They empirically tested the Elastic Random Walk Theory and the Logarithmic Random Walk Theory with some success.

Hrishikes Bhattacharya(1995) used 11 fund theorems in establishing two ratios for determining the specific point in the life cycle for a firm. He used these funds ratios to derive a single health ratio curve that could be used for failure prediction.

Many approaches have been made in developing various bankruptcy theories. However, bankruptcy theories based on the use of financial ratios have dominated the research. This study is based on Altman's bankruptcy theory that uses five financial ratios in the establishment of a prediction model. Altman's theory is based upon the premise that five selected ratios can be used to successfully predict firms that are likely to go bankrupt and firms that are unlikely to go bankrupt through the use of a Z score. He supports the hypothesis that the Z score for bankrupt firms are not equal to the Z score for nonbankrupt firms.

Univariate Analysis

The early uses of financial ratios were for comparison purposes. The profitability ratios were the first ratios to emerge. The current ratio, one of the oldest ratios, was used for credit evaluation as early as 1908 (Beaver, 1966). Records show that commercial subjected financial statements to ratio analysis as early as 1870 (Bhattacharya, 1995).

Paul J. FitzPatrick (1932) was the earliest recorded researcher to use univariate analysis in a comparison of ratios of successful industrial enterprises with those of failed firms during the period just prior to the Great Depression. FitzPatrick used thirteen financial ratios to compare forty firms in nineteen distinct industries for the period of 1918 to 1928. He matched failed firms to healthy firms by size, volume of sales, section of the country, and financial statements from the same period. Most of the firms were listed on the New York Stock Exchange. He successfully supported the premise that the financial ratios of successful firms were different than those of failed firms during the three year period preceding bankruptcy. The thirteen ratios used by FitzPatrick were: 1) current ratio, 2) quick ratio, 3) sales to fixed assets, 4) sales to inventories, 5) sales to accounts receivable, 6) sales to net worth, 7) net worth to debt, 8) net worth to fixed assets, 9) inventories to accounts receivable, 10) net

profits to net worth, 11) current assets to total assets, 12) fixed assets to total assets, and 13) other assets to total assets. FitzPatrick (1932) compared the differences between the ratios for the failed firms and the successful firms, provided an explanation for these differences, and gave generalized cut-off points for the ratios. Additionally, he analyzed the firms by the trend of the ratios and provided explanations for understanding the impact of the trend on the various ratios. FitzPatrick's study did not use any statistical analysis, which is standard in present studies, but his study was well-developed for this period of time.

The 1932 study was timely since the stock market crashed in 1929. The market crash marked the beginning of the Great Depression that covered the period from 1929 through 1933. During this period the unemployment rate approached 25 percent and corporate bankruptcies reached unprecedented levels (see Table 1).

However, it should be pointed out that FitzPatrick built upon a study by Smith and Winakor (1930) that analyzed a sample of 29 firms using 21 ratios and found that net working capital to total assets was the most accurate indicator of failure. However, unlike FitzPatrick, Smith and Winakor, did not compare their sample against successful firms which limited the usefulness of their study.

Charles Merwin (1942) analyzed continuing and discontinuing firms over a six year period and determined that net working capital to total assets, net worth to debt and the current ratio were predictors of discontinuance up to five years out. He compared the industry normal mean against the mean ratios of discontinuing firms covering a six year period.

The balance sheet was modified significantly following the World War II period. The T form of balance sheet was replaced by the fund statement balance in an effort to provide more information for business evaluation (Bhattacharya, 1995). Walter (1957) was one of the first to specifically incorporate funds data into ratios for determination of solvency.

The theory of ratio analysis used by Beaver (1968) was a cash-flow model. Beaver used a univariate statistical distribution approach to test 22 financial ratios before selecting Cash Flow/Total Debt as the most accurate, single predictor of firm distress. Beaver's study consisted of 79 failed and 79 nonfailed firms drawn from Moody's Industrial Manuals for the period 1954 through 1964. The sample of nonfailed firms were matched to failed firms of approximately the same asset size and from the same industry. Though Beaver used only one variable, the overall error rate, measured against a holdout sample, was only 13

percent. As explained by Beaver, "The theory of ratio analysis is an extremely simple one and can best be explained within the framework of a cash-flow model . . . Beaver viewed the firm as a reservoir of liquid assets, which is supplied by inflows and drained by outflows. The solvency of the firm can be defined in terms of the probability that the reservoir will be exhausted" (Beaver, 1966, p. 79-80).

From this theory of ratio analysis, four propositions were stated (Beaver, 1966, p. 80):

(1) The larger the reservoir, the smaller the probability of failure.

(2) The larger the net liquid-asset flow from operations (i.e. cash flow), the smaller the probability of failure.

(3) The larger the amount of debt held, the greater the probability of failure.

(4) The larger the fund expenditures for operations, the greater the probability of failure.

Beaver's study was the first to use well-developed, detailed statistical analysis in the preparation of bankruptcy analysis. Beaver's study was presented at the Conference on Empirical Research in Accounting held at the University of Chicago in May, 1966. Written critical

evaluations by two discussants along with Beaver's written reply were published concurrently. Discussant John Neter (1966) prepared an excellent review that included the reply from Beaver. Neter had an interesting suggestion for future research: "I would certainly be interested to know how effective is the use of multivariate analysis, utilizing a number of ratios . . . instead of simply using ratios for one period of time, would using them for, say, the last five years be of significant help" (Neter, 1966, p. 117). Also, Beaver, in his study stated: "It is possible that a multi-ratio analysis, using several different ratios and/or rates of change in ratios over time, would predict even better than the single ratios" (Beaver, 1966, p. 100). Beaver ignored Neter and his own suggestion for future research which left a gap that was quickly and successfully filled by Altman. Once Altman presented the multivariate analysis model, Beaver was left defending a weakening position with a less robust model.

Casey and Bartczar (1985) performed a univariate study of the predictive ability of cash flow from operations and related cash flow ratios. Then, they applied cash flow as an additional variable to multivariate models for bankruptcy prediction and found no improvement in the accuracy of the models.

Discriminant Analysis

Discriminant analysis, as developed by R. A. Fisher in the 1930's, was first applied to bankruptcy prediction by Edward I. Altman.

Altman (1968) improved on Beaver's work by using discriminant analysis to create a failure likelihood or Z-Score based on five financial ratios. He used bankruptcy as the definition for failure. Altman, in developing his multivariate model, selected 5 of the 22 original financial ratios considered by Beaver (Altman, 1968). The model was developed from a sample consisting of 33 bankrupt firms and 33 nonbankrupt firms from the period of 1946 to 1965 with an error rate of 4 percent (i.e. the model correctly classified 96 percent of the firms in the sample) when tested against a secondary sample. Many researchers followed in Altman's footsteps in the use of discriminant analysis to create bankruptcy prediction models. The original discriminant function developed by Altman (1968) is as follows:

$$Z = .012X_1 + .014X_2 + .033X_3 + .006X_4 + .999X_5$$

where

Z = Overall Index

X_1 = Working Capital/Total Assets

X_2 = Retained Earnings/Total Assets

X_3 = Earnings Before Interest & Taxes/Total Assets

X_4 = Market Value Equity/Book Value of Total Debt

X_5 = Sales/Total Assets

Altman proposed that a Z-value below 1.81 indicates that the specific firm has those characteristics similar to failed firms, a value from 1.81 and 2.99 is in the gray area, and above 2.99 is a healthy company (Altman, 1983).

Altman, concluded that X_1 or Working Capital (i.e. current assets less current liabilities) divided by Total Assets was the most valuable of the liquidity ratios that were considered for inclusion in his bankruptcy model. The current ratio and the quick ratio were evaluated and discarded in favor of the selected ratio which provided greater discriminate value.

Retained Earnings divided by Total Assets, or X_2, gives more weight to the older firms that have accumulated a higher net worth as a result of passing the test of time. Altman (1968), et al, provides that smaller firms with lower net worth would have a higher incidence of bankruptcy. Altman's research was based on an analysis of 66 manufacturing firms. This ratio would indicate that service firms with lower capital needs should have a lower level of bankruptcy while capital intensive manufacturing type firms would have a higher probability of bankruptcy.

Earnings Before Interest & Taxes divided by Total Assets, or X_3, is a measure of the earning power of the firm's assets. This ratio addresses the issue of whether the firm is receiving a sufficient return on its assets to maintain solvency. This profitability ratio contributes the most to group separation from the discriminate function.

Market Value of Equity divided by Book Value of Total Debt, or X_4, measures the market value of all shares of stock to the current and long-term debt. This ratio requires that market value be a good indicator of bankruptcy.

Sales divided by Total Assets, or X_5, is the capital turnover ratio and though it ranked low in statistical significance on a univariate basis (i.e. F ratio equal to 2.84 compared to a range of 26.56 to 58.86 for the remaining ratios) compared to the other ratios, it was ranked second on a multivariate basis as a predictor of bankruptcy (Altman, 1983).

Altman (1968), calculated a scaled vector for each variable to determine its relative contribution to the discriminate function. The relative contributions of the variables in order of their scaled ranking are X_3, X_5, X_4, X_2, and X_1. The scaled ranking is determined by calculating the mean of the value of each ratio multiplied by its respective weight.

As supported by Altman's dissertation, "results of the study indicate that it is possible to classify successfully corporations into either bankrupt or nonbankrupt groups . . . . the model correctly classified 94 percent of the original sample one year prior to bankruptcy" (Altman, 1988, p. 130). Altman's study used a sample of 66 companies equally divided into failures and survivors during the period from 1946 through 1965. Not everyone agrees with Altman's results. According to Platt (1986) the two best reasons for questioning the usefulness of his model are that today's companies are different from those in the 1940's or 1950's and that the model is derived from only 66 cases. The same question could be raised concerning any static model in predicting future events. The model was successfully re-examined by Altman and McGough (1974) and resulted in an accuracy rate of 82 percent for predictions one year out and 58 percent for two years prior to bankruptcy.

Altman, Haldemen, and Narayanan (1977), developed a new model with seven financial ratios using failed companies during the period 1969 through 1975. The seven variables are return on assets, stability of earnings, debt service, cumulative profitability, liquidity, capitalization, and size. They market a product based on this new model on a subscription basis to financial institutions, bond analysts,

and others. Altman, Haldeman, and Narayanna have not published the discriminant weights for this newer model.

Robert Edmister (1972) developed a stepwise multiple discriminant analysis using a seven-variable function that correctly discriminates at the 93 percent level for small business. Edmister selected his seven ratios by examining nineteen ratios. "Ratios selected for this study have been advocated by theorists or have been found to be significant predictors of business failure in previous empirical research. While the list of ratios is not exhaustive, it does contain all ratios emphasized by the theorists except those requiring accounts receivable and accounts payable information" (Edmister, 1972, p. 1479). The ratios were selected using the normal step-wise procedure to select the most predictive variables while limiting multicollinearity. The regression dependent variables were given the dichotomous values of 0 and 1 based on each variable being above or below a certain value. For example, X_1 is equal to 1 if the annual funds flow divided by current liabilities is less than .05, but is equal to 0 for all other values. Each of the ratio variables of 0 or 1 is multiplied by a given weight. The seven calculated values and a constant are added together to arrive at a Z value. Edmister supported that the predictive power of ratios was cumulative and that no single ratio could predict as well as a group of combined

ratios, but the ratios must be independent or the predictive power of the function would not increase. Also, a small group of carefully selected ratios is as useful as a larger number due to the law of diminishing returns and the problem with multicollinearity. The ratios used in the model were based on a three year average since his small business function failed to discriminate when only one financial statement was used. He determined that three consecutive financial statements are required for analysis of a small business. The ratios for the specific firm are divided by the industry average ratio as provided by Robert Morris Associates. This industry adjustment proved to significantly improve model predictability. The sample base used very small businesses with an average sales volume of $407,460 and profit before tax of $14,635. The sample contained 42 borrower firms selected from 192,000 statements provided by the Small Business Administration and Robert Morris Associates during the period from 1954 to 1969. All of these firms had met SBA screening requirements in qualifying for an SBA loan.

Edward B. Deakin (1972) used Altman's multivariate approach, but used fourteen of the ratios which Beaver had identified as predictors of bankruptcy and used a probabilistic classification rule instead of a critical cut-off point. Deakin applied the chi-square classification

method to assign probabilities which requires that the population be normal. The study used thirty-two failed firms between 1964 and 1970 matched against nonbankrupt firms with similar characteristics. Deakin used a model with different coefficient weights for each of the five years prior to bankruptcy. The study yielded error rates of 3 percent, 4½ percent, 4½ percent, 21 percent, and 17 percent for years 1 through 5. Deakin tested the model on an ex ante basis and correctly classified 90 percent of all firms in the one to three year period. Deakin supported that failed firms tended to expand rapidly in total assets in the third and fourth year prior to failure. The increase in total assets was primarily associated with long-term or capital assets as opposed to inventory and other short-term assets. The higher debt associated with the increase in total assets could not be supported by the failing firms. This resulted in a required reduction in short-term assets which tended to decrease sales due to less inventory and the inability to purchase adequate supplies of raw materials for meeting production requirements.

Marc Blum (1974) developed a failing company model that expressed variables in terms of change over time. He used 115 failed and 115 nonfailed firms in his study. Failure was defined as "an inability to pay debts as they come due, entrance into a bankruptcy proceeding, or an explicit

agreement with creditors to reduce debts" (Blum, 1974, p. 3). Blum achieved a predictive accuracy of 93 percent for one year prior to bankruptcy, 80 percent for two years, and 70 percent for the third, fourth, and fifth year prior to bankruptcy. However, Blum did report multicollinearity between his variables, but felt that it was not as high as expected for the twelve variables chosen.

Charles Moyer (1977) replicated Altman's study on an ex ante basis by using a sample of 27 bankrupt and 27 nonbankrupt firms with $15 million to $1 billion in assets and from the 1965 to 1975 time period. The original model yielded a 75 percent success rate, but yielded a 39 percent Type I error rate and a 12 percent Type II error rate. Moyer revised the model using new weights and achieved a 88.1 percent accuracy one year prior to bankruptcy. However, using a stepwise procedure, he supported that the model contained superfluous variables in the form of X_4 (market value of equity to book value of total debt) and X_5 (sales to total assets). Recalculating the weights using only the first three variables yielded an accuracy of 90.5 percent for one year prior to bankruptcy, 83.3 percent two years out, and 73.8 percent three years out. This compares to 75 percent one year out, 83.3 percent two years out, and 71.4 percent three years out for the five variable model. This contrasts sharply with Altman's position that the sales

to total assets ratio was the second most important discriminator in his original model.

In 1983, Altman revised his original model using the same or similar ratios, but with different weights for use in private firm applications (1983, p.121). Altman used 33 failed firms and 33 nonfailed firms. The new model was "not tested on secondary sample bankrupt and nonbankrupt entities. We await tests by practitioners on this relevant alternative" (1983, p. 124).

The revised discriminant function developed by Altman is as follows:

$$Z = .717X_1 + .847X_2 + 3.107X_3 + .420X_4 + .998X_5$$

where

Z = Overall Index

X_1 = Working Capital/Total Assets

X_2 = Retained Earnings/Total Assets

X_3 = Earnings Before Interest & Taxes/Total Assets

X_4 = Net Worth (i.e. Book Value)/Total Liability

X_5 = Sales/Total Assets

A Z-value below 1.10 indicates that the specific firm has those characteristics similar to failed firms, a value between 1.10 and 2.60 is in the gray area, and above 2.60 is a healthy company (Altman, 1983).

Booth (1983) developed a multivariate model using decomposition theory. The measures used were based on balance sheet data. This data was used to gauge the change in the composition of the financial figures between financial statement dates. His "conclusion from the multivariate analysis is that the financial failure prediction model using the size and stability attributes of decomposition measures has little useful predictive ability" (Booth, 1983, p.80). However, Booth confirmed prior research that decomposition measures have different attributes for failed and non-failed firms. He stated that decomposition theory may still be useful in bankruptcy prediction and suggests that additional research may be warranted for testing financial statements other than balance sheet information.

Abdul Aziz, David Emauel, and Gerald Lawson (1988) developed cash flow based discriminant models for each of the five years prior to bankruptcy with each model containing five cash flow variables. In addition, the authors used logit analysis as a secondary method to verify the cash flow approach. The predictive accuracy for the discriminant analysis ranged from 72.5 percent to 88.8 percent while the logit analysis ranged from 78.6 percent to 91.8 percent. "The Cash Flow Based model compares favorably with the ZETA and Z-models" (1988, p.435). This is in

contrast to earlier studies by Cornelius Casey and Norman Bartczak (1985) supporting that "operating cash flow data do not provide incremental predictive power over accrual-based ratios" (1985, p. 395).

Richard Bernardi (1990) in an unpublished dissertation, tested the effects of accounting pronouncements, firm size, and firm industry on Altman's 1968 model. Surprisingly, he tested three of the major accounting changes and found no support for his hypothesis that accounting pronouncements effected the Z-Score values. However, Bernardi supported that industry size and asset size significantly effected the Z-Score values.

Many others have used a myriad of ratios to generate bankruptcy models based on discriminant analysis techniques including: Libby (1975), Scipper (1977), Dambolena & Khoury (1980), Gombola & Ketz (1983), Casey & Bartczak (1985), and Aziz, Emanuel, & Lawson (1988).

Logit and Probit Analysis

Linear discriminant analysis becomes suspect if the multivariate normal and equal covariance assumptions are violated. However, these assumptions are usually violated in bankruptcy studies associated with discriminant analysis.

Probit and logit analysis are referred to as conditional probability models. These models estimate the

probability of the outcome, conditional on the attribute of
the independent variables. These models are based on a
cumulative probability function that does not require
independent variables to be multivariate normal or that the
groups have equal covariance matrices. Logit analysis is
more robust than discriminate analysis since it is
applicable to a wider class of distributions. They are
generally solved using the maximum likelihood method. In
logit analysis the dependent variable is nonmetric and
dichotomous, but the independent variable can be either
metric or nonmetric. A positive coefficient for an
independent variable increases the probability, while a
negative coefficient decreases the probability.

The simplest form of the conditional probability model
is the linear probability model of the form:

$$Y_i = \alpha + \beta X_i + \varepsilon_i$$

where

Y_i =   represents an alternative of 0 or 1 as alternative
        dichotomous choices

α =   intercept

β =   coefficient for the attribute vector

X_i =   attribute vector for the ith variable

ε_i =   error term

The linear probability model has limited use and is not appropriate for bankruptcy prediction modeling. The more advanced conditional probability models are based on a cumulative function.

Like discriminant analysis, the logit technique weights the independent variables and creates a score for each company. The I-score is used in the following equation to determine the probability of membership in a bankruptcy group.

$$P(B) = \frac{1}{1 + e^{-I}} \quad \text{where } I = a + \beta_1 X_1 + \ldots \beta_p X_p$$

where

P(B) = the probability of bankruptcy

I = the probability index or I-score determined by the financial ratios and factor weights

The b coefficients are weighted to maximize the joint probability of bankruptcy for the known bankrupt firms. Similarly, the b coefficients are weighted to minimize the probability of nonbankruptcy for the known healthy firms. The probit model behaves in the same fashion, except that instead of using the logistical cumulative function, the nearly identical normal cumulative probability function is used" (Jones, 1987, p. 146). Due to the shape of the cumulative probability curve, a small change in the

independent value in the mid-range of the curve will result in a large change in probability as shown in Figure 1. Correspondingly, the cumulative probability is less sensitive at values approaching zero or one.

FIGURE 1

Cumulative Probability Curve
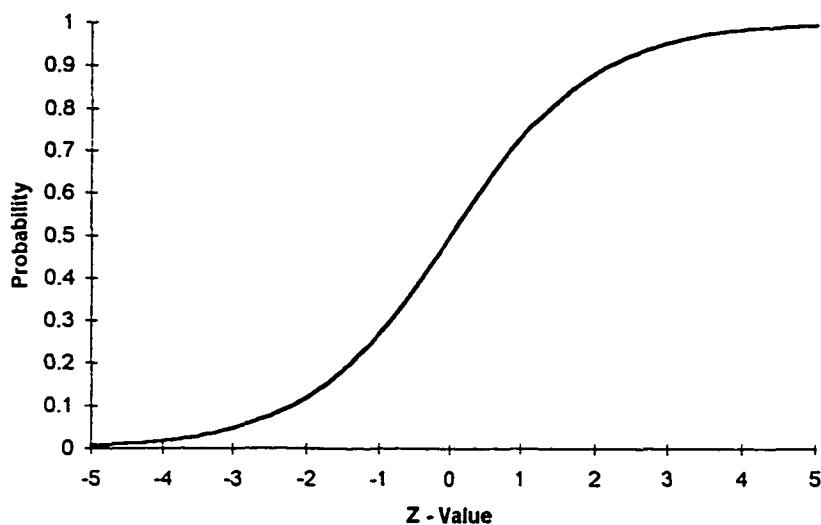
A probability model has certain advantages over the restrictive dichotomous classification available through discriminate analysis. One example is the ability of a lender or investor to establish a risk with a higher expected return requirement. Another major advantage of both logit and probit is the ability to determine the importance of each ratio in the model.

Ohlson (1980) was one of the first to use logit analysis in bankruptcy prediction modeling. He designed a model with nine variables using 105 bankrupt firms and 2,058 nonbankrupt firms from 1970 through 1976. Ohlson's model had classification error rates in the sample of 12.4 percent of bankrupt firms and 17.4 percent of nonbankrupt firms. Ohlson has been criticized for failing to use matched sample technique, for his use of asset size as a variable and as a scale factor in other ratios, and for his failure to use a theoretical approach in setting up his model (Zavgren, 1985 et al). Ohlson suggested that other models may have a bias towards higher predictive accuracy since 17 percent of the bankrupt firms in his study issued the final financial report after the filing for bankruptcy. Ohlson's model served as the starting point for additional research using conditional probability in bankruptcy prediction.

Gentry, Newbold and Whitford (1985) used a probit model to generate coefficients for twelve funds flow components. The probit model successfully identified failed and nonfailed companies with an 83.3 percent accuracy one year out and a 78.8 percent accuracy using a three year average of the components. Not surprising, they supported that: Failing firms tend to experience a shortfall for cash inflows from operations which force a reduction in dividend payments. Bankrupt firms were reducing the level of

accounts receivable to generate cash while healthy firms were investing in accounts receivable, and healthy firms invested a substantially higher percentage of funds in plant and equipment than failed firms.

Unfortunately, dividends/total cash flow, was the only variable that was statistically significant at the 0.05 level. A change in the dividend policy, unassociated with firm distress could lead to a misclassification of financial distress when none exists (i.e. Type I error). The authors state that the small sample size consisting of 33 failed and 33 nonfailed firms prevented the use of a holdout sample (Gentry, Newbold, & Whitford, 1987).

Cornelius Casey, Victor McGee and Clyde Stickney (1986) used probit analysis in testing a model proposed by Michelle in 1981, that discriminated between reorganized and liquidated firms in bankruptcy. The model successfully classified 69 percent of the successfully reorganized firms in the estimation sample and 59 percent in the holdout sample. They found that the proportion of assets not secured at bankruptcy and the change in profitability prior to bankruptcy were significant in discriminating firms that were able to successfully reorganize compared to those that liquidated.

Christine V. Zavgren (1980, 1982, 1983, 1985) used logit analysis to create a seven ratio bankruptcy model.

Logit analysis is less affected by data sets which are not normally distributed. Zavgren's logit model is as follows:

$$I = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7$$

where

I = probability index

α = intercept

β_i = the coefficient for the financial ratio i

X_i = the ith financial ratio (Inventory Turnover, Receivable Turnover, Cash Position, Short-Term Liquidity, Return on Investment, Financial Leverage, and Capital Turnover)

Zavgren (1985) developed five different sets of coefficient values to represent each of the years one through five prior to firm bankruptcy. Seven ratios were selected using factor analysis. The seven ratios selected were total income to total capital, sales to net plant, inventory to sales, debt to total capital, accounts receivable to inventory, quick assets to current liabilities, and cash to total assets. Testing a firm against each of the models could potentially indicate the number of years a firm may have before entering bankruptcy. For example, if a specific firm fits the profile of the firms that are more likely to become bankrupt in the next

three year period then the creditors would have the opportunity to limit their risk. Additionally, the firm could possibly take corrective action to avert a possible bankruptcy scenario. She supported that the financial leverage variable was significant for each of the five years, the asset turnover ratio was significant only in the fourth and fifth year before bankruptcy, and the acid test variable was significant only during the last three years before bankruptcy.

Casey and Bartczak (1985) used logit analysis and discriminant analysis to test eight models utilizing three cash flow variables in combination with six other ratios for the effect of single cash flow ratios on bankruptcy prediction. The cash flow ratios evaluated were: cash flow from operations, cash flow from operations divided by current liabilities, and cash flow from operations divided by total liabilities. They used a sample of 60 bankrupt and 230 nonbankrupt firms with half the sample used as a holdout. Their results showed no apparent improvement in prediction accuracy.

Andrew Lo (1986) compared discriminant analysis to logit analysis. Lo felt that logit analysis provided a more robust approach, since it can be shown to be more applicable to a wider class of distribution. Discriminant analysis assumes that the distribution is normal, whereas "logit

analysis involves the distribution of Y conditional on the X's which is assumed to be logistic" (Lo, 1986, p. 151). Lo used the MLOGIT computer package developed by Bronwyn H. Hall to analyze 36 failed firms and 36 nonfailed firms. She concluded that the null hypothesis, discriminant analysis and logit are equivalent, may not be rejected. However, "The result of the specification test for the data set used in this paper seems to support the use of discriminant analysis . . . non-normality may be less problematic as Amemiya and Powell's (1983) study suggests" (Lo, 1986, p.174).

Amy Hing-Ling Lau (1987) also used logit analysis to develop a five-state financial distress prediction model. The five states ranged from 0 to 4 with state 0 representing financial stability, state 1 being companies that reduce their annual dividend rate per share, state 2 being companies that had defaulted on loan payments or were in technical default, state 3 being companies that had filed for bankruptcy prediction under Chapter X or XI of the bankruptcy act or had C rated bonds, and state 4 being companies that were bankrupt or being liquidated. The prediction model contained ten variables or ratios and a separate model was created for each of the five states. A sample of 400 firms was used to construct the model while a second sample of an additional 400 firms was used as a

holdout sample to test the validity of the model on an ex ante basis. Each sample consisted of 350 firms classified as state 0, 20 firms classified as state 1, 15 firms classified as state 2, 10 firms classified as state 3, and 5 firms classified as state 4. While the division does not completely eliminate the over-sampling of distressed firms, the approach is superior to the many approaches that make no attempt to account for the normal distribution of distressed firms within the population. Lau evaluated the sample using discriminant models developed by Beaver (1966), Altman (1968), Deakin (1972), Altman, Haldemen & Narayanan (1977), Ohlson (1980), and Zmijewski (1984). Lau's five-state logit model provided an accuracy of 96 percent one year out, 92 percent two years out and 90 percent three years out. The five-state logit model outperformed the discriminant analysis models with significant differences in the holdout sample.

K. Keasey and R. Watson (1987) used logit analysis to test Argenti's hypothesis that nonfinancial information could be used as predictors of firm failure. The sample consisted of 73 failed and 73 nonfailed firms consisting of small, independently owned, single plant firms in northeast England from the 1970 to 1983 time period. A total of 18 nonfinancial ratios and 28 financial ratios were evaluated using Stepwise Logistic Regression techniques in

establishing three models. Model I was based exclusively on financial ratios. Model II was based exclusively on nonfinancial ratios. Model III used both financial ratios and nonfinancial ratios. Model I yielded a 76.7 percent prediction accuracy, Model II was nearly identical at 75.3 percent, but Model III was clearly superior at 82.2 percent. However, on a holdout sample of 20 firms, the accuracy dropped to 55 percent for Model I while Model II and III were identical at 65 percent. The hypothesis for the study though quite interesting requires further study due to the poor showing of the holdout sample. The nonfinancial variables found to have the greatest prediction accuracy were: financial statement submission lag, number of directors, receiving a going concern qualification, having a qualified audit report in the current year, having a qualified audit report in the prior two years, time between auditor's signature and submission of financial report, and the existence of bank financing.

Monty Lynn and Paul Wertheim (1993) used logit analysis to develop a model for predicting hospital closures. They used a sample of seventy-one small to medium sized hospitals that closed between 1986 and 1987. A sample of open hospitals was collected and matched to the closed hospitals according to geographical status, bed size, and urban or rural location. Twenty-one financial ratios were divided

among four categories of leverage, liquidity, capital efficiency, and resource availability. Each of the ratios was evaluated before selecting one ratio from each of the four categories that provided the best combination for predictive accuracy. The logit model with its four ratios provided a 75.0 percent accuracy one year out and 73.8 percent accuracy two years out. This compares to the highest single factor ratio or 69.2 percent that was achieved using net income to total revenues. This is a very high accuracy rate considering that nonprofit hospital continuation can be influenced by nonfinancial factors. However, a major problem with this model is that it was not tested using a holdout sample. F-tests showed that the liquidity measure ratio failed to add significantly to the model, but was not eliminated from the model. The authors point out that the liquidity ratio could be eliminated and the resulting three ratio model would retain a high predictive accuracy, but this was not verified.

Thomajean Johnsen and Ronald Melicher (1994) used logit analysis to develop a three state multinomial logit model that classified firms as nonbankrupt, financially weak, and bankrupt. This compares to the more traditional binomial logit models that classify a firm as either nonbankrupt or bankrupt. The study developed one model using six ratios from Beaver (1966) and a second model using the seven ratios

developed by Altman (1977) in his Zeta model. The sample contained 112 bankrupt firms, 293 nonbankrupt firms, and 255 financially weak firms. Financially weak firms were defined as having a common stock rating of B, B-, or C as reported by Standard & Poor's Corporation in its Security Owner's Stock Guide. Their study supported that: The addition of the third classification of a weak state reduced the standard error rate, the three states of financial health are independent, and significant information can be gained from the weak state in predicting either an improving or deteriorating financial condition.

Recursive Partitioning

Recursive partitioning uses an iterative approach to select a single independent variable at a time to further divide or partition the group. Recursive partitioning, unlike discriminant analysis or logit, makes no assumptions about the distribution of the independent or dependent variables.

Some of the shortcomings of recursive partitioning are the difficulty in determining the relative importance of the various variables, the lack of a probability estimate for the various classifications, and the possibility of overfitting the model by performing too many partitionings.

Marais, Patell, & Wolfson (1984) compared recursive partitioning to probit analysis and found the two approaches to be equivalent in classification results.

However, Frydman, Altman, & Kao (1985) compared recursive partitioning to discriminant analysis and supported the position that recursive partitioning yielded better predictive results. They developed their recursive partitioning algorithm model using financial data on 58 bankrupt firms and 142 nonbankrupt firms from the period 1971 to 1981. The model successfully classified 90 percent of the firms with cash flow to total debt being the most important discriminator. They point out that recursive partitioning as a nonparametric technique eliminates many of the statistical problems associated with discriminant analysis. Whereas discriminant analysis provides a relative ranking among firms through the assignment of a discrete numerical value, recursive partitioning cannot compare firms within the same partition. A major advantage of recursive partitioning is its simplicity.

ID3 is similar to recursive partitioning in that the method calls for generating a discriminant tree with a non-backtracking splitting procedure that recursively partitions a set into subsets. The ID3 is designed to maximize the entropy of the split compared to recursive partitioning that

is designed to minimize the cost of misclassification (Tam, 1991).

Neural Network Models

During the 1990's, neural networks have received significant attention in the literature. Various studies have been performed by Tam (1991), Tam & Kiang (1992), Salchenberger, Cinar & Lash in (1992), Johnsen & Milicher (1994), Boritz & Kennedy (1950) and others.

Neural networks have the possible advantage of adapting with the environment to continually provide a higher level of accuracy by continuing to add new data. However, a neural network is only as good as the base design that controls the model. The typical neural network is trained by using a learning algorithm and consists of homogeneous processing units interconnected in a network (Tam, 1991). Two learning algorithms typically used are the perception convergence procedure and the back-propagation learning algorithm. Tam, et al, have empirically tested the use of neural networks for bankruptcy prediction and support that "neural networks offer better predictive accuracy than DA, factor-logistic, Knn and ID3" but "training a neural network demands more computation effort than the other methods" (Tam, 1991, 441).

A neural network is made up of layers as shown in Figure 2. The financial ratios represent the input layer. The hidden layer or invisible layers are so called because they do not have direct interaction with the environment and are thus invisible to the environment (Tam, 1991). The number of hidden layer nodes is determined by trial and error. The output layer consists of one node composed of a single response or condition reflecting the situation's outcome. For a bankruptcy model, the output would reflect either a healthy or failed firm (Coats and Fant, 1992).

The strength of the connection between the nodes are revised by a training algorithm until the weights produce the best forecasts. Neutral network computing is an outgrowth of artificial intelligence. It can deal with data that is not linearly separable or independent and can use fuzzy set theory to manage noisy or inconsistent data which do not have crisp boundaries (Coats and Fant, 1992).

Tam, used 59 failed banks and 59 nonfailed banks as a training sample involving the utilization of 19 input nodes, 10 hidden nodes, and 1 output node. The trained neural network model was compared against: a number of discriminant analysis models using the Fisher procedure which maximizes the ratio of between-group and within-group variances, a ID3 model, a 9 ratio logit analysis model, and a KNN nearest neighbor nonparametric model. Statistical

testing showed that 13 of the 19 ratios were not normally
distributed, in the one year period prior to bankruptcy,
when tested using the Kolmogorov-Smirnov test. It was
supported that neural networks provided a better predictive
accuracy with the lowest Type I error rate and the lowest
overall misclassification rate when applied to the holdout
sample.

FIGURE 2

Neural Network

Input
Layer

Hidden
Layer

Output
Layer
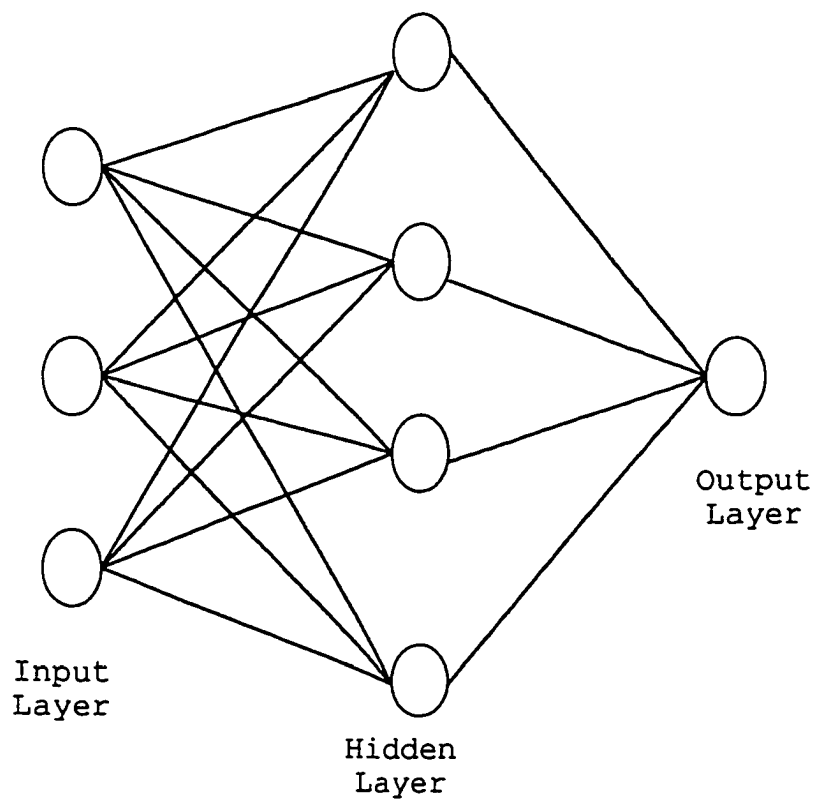
Salchenberger, Cinar & Lash (1992) developed a neural network for thrift (i.e. saving and loan institutions) failure prediction and compared the results against a logit model. The neural network was trained using 100 failed and 100 surviving thifts from 1986 and 1987. Overall, the neural network performed as well or better than the logit model when tested against two holdout samples. The authors state that a rule of thumb calls for setting the number of hidden nodes at 75 percent of the number of input nodes for the first evaluation. The actual or final number of hidden nodes is determined through a trial and error process to arrive at the best model.

Pamela Coats & Franklin Fant (1991/92) used software Neural Works Professional II/Plus to develop a neural network model using a sample of 47 distressed firms and 47 healthy firms. The model used three years with five ratios to represent the fifteen input nodes. The output layer had one node and the hidden layer contained five nodes. This arrangement represented eighty connection points or weights that the model calculated (i.e. 15 input nodes times 5 hidden nodes plus five hidden nodes times one output node). The trained neural network was able to deliver a model with a 100 percent accuracy for the training sample of 94 firms. A second holdout sample of 94 firms yielded an accuracy of

91 percent for the distressed firms and 96 percent for the healthy firms.

J. Ffrim Boritz and Duane Kennedy (1995) conducted one of the more exhaustive studies which analyzed 171 bankrupt companies and 6,153 nonbankrupt companies. The authors used 15 models based on discriminant analysis, logit, probit, and neural networks. The models included Altman's 1968 model, Ohlson's 9 variable model, Ohlson's 11 variable model, linear discriminant analysis, quadratic discriminant analysis, nonparametric discriminant analysis, 4 different Back-Propagation neural network models, 3 different Optimal Estimation Theory neural network models, logit, and probit. Neural Works Professional II was the software package used for the back-propagation construction while a specialized Fortran program was used for the Optimal Estimation Theory neural network. The SAS statistical package was used for construction of the other models. The study supported that the Optimal Estimation Theory neural networks produced the lowest Type I error (predicting a healthy firm for firms that are bankrupt), but the highest Type II error (predicting bankruptcy for nonbankrupt firms) while the statistical techniques had the reverse relationship. The study showed a wide range in Type I and Type II error among the various models. Optimal Estimation Theory is an alternative approach to training a feed-forward neural

network which provides a set of least squares estimators for the interconnection weights which allow the optimal set of weights to be determined in a single pass compared to the multiple passes required in other approaches. The study noted that neural networks, while performing reasonably well in predicting business bankruptcy, did not provide a dramatic improvement over conventional techniques. This is significant since the traditional models can be easily applied using readily available statistical packages, whereas neural networks are more difficult and time consuming to construct. However, Boritz and Kennedy (1995) point out that they did not attempt to develop optimal neural network architectures for addressing bankruptcy prediction.

Other Models

Many authors over the years have developed a wide range of models using various analysis techniques discussed above. This is due to the large number of financial ratios that are available for firm evaluation. The data in financial reports is widely available for constructing these ratios. It is possible to develop a large number of reasonably accurate models within the same framework analysis.

A number of alternative analysis techniques were reviewed, but not included due to low bankruptcy

predictability, lack of detail in the literature, or a low number of supporting articles. Some of these alternate approaches include: the Cox proportional hazards model by Luoma and Litineu (1991), et al using; the use of induction by McKee (1995); nonfinancial bankruptcy methods by Keasey & Watson (1987), Houghton & Woodliff (1987), et al; the incorporation of variables based on macroeconomics in bankruptcy models by Foster (1986), and Rose, Andrews & Giroux (1982); and the use of the mathematically sophisticated catastrophe theory approach by Scapens, Ryan & Fletcher (1981).

Robert Libby (1975), Abdel-Khalik (1972), et al, have conducted studies to determine if practitioners can successfully use financial ratios. Abdel-Khalik concluded that loan officers use of financial ratios in the predictors of bankruptcy was suspect in an ex ante situation. However, Libby supported that "A small empirically derived set of accounting ratios allowed bankers ranging widely in background to make highly accurate and reliable predictions of business failure" (Libby, 1975, p. 160).

Comparison of Bankruptcy Models

Various approaches have been employed to support a number of different bankruptcy theories. There are many bankruptcy prediction models as shown above. Many of the

models do an excellent job of predicting bankruptcy one year
out. Models generally have a higher level of accuracy at
predicting bankruptcy within specific time horizons and
within specific industries. Most models have a higher ex
post versus ex ante predictive power. The approaches that
use separate models for each year have a higher accuracy for
earlier prediction compared to one model approaches, but no
improvement for accuracy one year out. It is rather
surprising that models developed thirty years ago still have
reasonable levels of accuracy in bankruptcy prediction.

The period of evolution in bankruptcy prediction has
been from univariate analysis, to discriminant analysis, to
logit/probit analysis, to recursive partitioning, to neural
networks, with a scattering of other theories and
approaches spread throughout this period. The best model
fit for bankruptcy prediction is based upon the correctness
of the chosen parameters for the specific population under
study.

Bankruptcy prediction models represent a major tool for
use by investors, auditors, bond analysts, insurance
companies, financial institutions, business managers, and
others.

Problems in Bankruptcy Prediction

In bankruptcy prediction, the costs associated with a Type I error are generally more costly than a Type II error. Hsieh (1993), attempts to address this in establishing an optimal cut-off point for bankruptcy prediction models. A Type I error cost is the return difference between correctly selling short, failing securities and incorrectly holding a long position in these failing firms. A Type II error is the return difference between holding a long position in the securities of healthy firms and the incorrect action of holding a short position in these securities. "This ratio implies that the cost of incorrectly classifying bankrupt firms as healthy firms is more than three times as costly as the cost of incorrectly classifying healthy firms as bankrupt firms" (Hsieh, 1993, p. 462).

Linear discriminant analysis cannot be relied upon if the multivariate normal and equal covariance assumptions are violated. However, these assumptions are usually violated in bankruptcy studies associated with discriminant analysis. If the equal covariance assumptions are violated, the quadratic function should be used instead of the linear function, but the quadratic functions are not as accurate as linear functions when applied to holdout samples (Tam, 1991).

In neural networks, care must be taken not to overfit the model by including too many hidden nodes which would reduce the generalizability of the model. At present there is not a formal theory for determining the number of layers or the number of nodes in the middle layers and the model results are sensitive to the learning parameters. However, there is a tentative theory that the number of nodes should be 75 percent of the number of input nodes. Additional research is needed to see if this tentative theory can be supported.

Another problem in bankruptcy prediction is that not all firms file bankruptcy due to poor operating results. For example, a firm may file for bankruptcy to block a lawsuit, to void costly union contracts, or to mitigate large pension liabilities. Some firms choose bankruptcy voluntarily in a Chapter XI filing, while other firms are forced into a Chapter X nonvoluntary filing. Another problem is that many of the prediction models used different bankruptcy definitions.

Small sample size has been used in many of the more publicized studies. "For example, Altman (1968), Deakin (1972), Altman, Haldeman and Narayannan (1977), Dambolena and Khoury (1980), and Hamer (1983) rely on samples of bankrupt firms numbering only 33, 32, 53, 23, and 44, respectively" (Jones, 1987, p. 133).

An additional problem in bankruptcy analysis is the ability of larger firms to avoid a bankruptcy filing by reorganizing, spinning-off the unprofitable parts of the business, or being acquired by another firm. Also, many small firms shutdown without going bankrupt in the traditional sense. These small firms pay off the creditors and cease to do business because the rewards of business ownership are not providing sufficient incentives compared to working fewer hours often for a higher income with a larger firm.

Over-sampling bias can be a problem in model creation by including more bankrupt firms relative to nonbankrupt firms than occur in the population. The coefficients of probit models and logit models would be biased by over-samplings along with the constant in discriminant analysis (Dietrich, 1984).

The reduced accuracy of early prediction using longer lead times is appropriate when considered that one of the reasons for having a prediction model is to give management time to take steps to prevent bankruptcy.

The large number of ratios that are available for selection has resulted in a myriad of models. As mentioned earlier, the use of multiple discriminant analysis is based on the assumption that the variables or ratios of the groups be distributed multivariate normal and that the groups have

equal covariance matrices. Gordon Karels and Arun Prakash (1987), analyzed 50 ratios to determine which ratios were multivariate normal. They first tested the ratios for univariate normality with only nine of the fifty ratios indicating evidence of univariate normality and only seven ratios indicating evidence of lognormality. They used the semi-qualified ratios to develop twelve sets of ratios for multivariate testing. Karels and Prakash (1987) determined that none of the sets were multivariate normal in the strict sense, but the sets exhibited a closer approximation than the sets used in the existing traditional models. A multiple discriminant analysis model was created using five of these qualified ratios which consisted of the working capital ratio, gross profit margin, cash flow per share, market value of common stock, and sales per inventory. A sample size of 71 nonbankrupt and 5 bankrupt firms from 1972 were used to develop the model. A holdout sample was prepared from 175 nonbankrupt and eleven bankrupt firms from 1976. The model correctly identified 98.4 percent of the 1972 development sample on an ex post basis. The model correctly identified 96 percent of the nonbankrupt firms and 55 percent of the bankrupt firms from the holdout sample on an ex ante basis. Whereas Altman's original model identified only 29 percent and 38 percent for four and five years out. Karels and Prakash, a priori, stated that with

group mean values for the bankrupt and nonbankrupt firms being disparate, no significant overlap existed, and the use of quadratic discriminate analysis would not improve the results (the quadratic approach would be indicated for equal covariance matrices).

Harlan and Marjorie Platt (1991), used logit analysis to support that the use of industry-relative ratios provided an improvement in bankruptcy prediction. This is in agreement with the a priori position, but only a few of the bankruptcy models are industry specific. It should be pointed out that though the J-test and forecast results obtained by Platt and Platt (1991) supported their hypothesis, the Chow's predictive test of parameter stability could not differentiate between the generic model and the industry adjusted model. However, Jerry Sheppard (1992) used logit analysis and supported that profitability and solvency were the most significant predictors of bankruptcy in his model and that with many large diversified firms, the non-industry specific model was comparable to the industry adjusted model.

How this dissertation extends existing research

This study chose Altman's revised model for specific evaluations. Altman's models were the most referenced in the literature. Altman's revised 1983 model was chosen over

his original 1968 model because it was specifically modified for smaller firms, it is not affected by stock price data, and according to Altman, yielded a 94 percent prediction accuracy. However, Altman did not test his revised model against a holdout sample.

Prior to this dissertation, research has focused on the larger publicly traded firms and on the very small non-traded firms. Also, no study has been made to determine the effect of growth rate on firm survival.

This study addresses whether Altman's revised bankruptcy prediction model can be used to successfully predict failure for publicly traded firms below 100 million in asset size. In addition, this study specifically addresses the effect of smaller firm size and percent change in firm size on Altman's revised model. This study focuses on small firms because approximately three-fourth of all business failures are classified as small businesses.

Publicly traded firms were selected because of the overall higher level of accounting review that is required to meet listing requirements.

CHAPTER III

METHODOLOGY

Hypotheses

This dissertation examines the Z-Score in Altman's
revised model for samples of manufacturing firms that have
less than $100 million in asset value. An analysis was
performed to determine if Altman's revised model could be
used to successfully distinguish between failed firms and
nonfailed firms. A further analysis was performed to
determine the difference in Z-Scores resulting from firm
size based on asset value and change in firm size based on
revenue (i.e. net sales). Three hypotheses were tested at
the .05 significance level. The null hypotheses (Ho) hold
that there is no difference in the Z-Scores for the various
samples. The alternate hypotheses (Ha) hold that there is a
significant difference in Z-Scores.

Research Hypothesis One: The mean Z-Scores for failed
and nonfailed firms are not equal.

64

$$H_o: \quad Z_1 = Z_2$$

$$H_a: \quad Z_1 \neq Z_2$$

Research Hypothesis Two: The mean Z-Scores for each one-third of the sample divided by asset size are not equal.

$$H_o: \quad Z_1 = Z_2 = Z_3$$

$$H_a: \quad Z_1 \neq Z_2 \neq Z_3$$

Research Hypothesis Three: The mean Z-Scores for each one-third of the sample divided by growth are not equal. Growth is measured as percent change in revenue.

$$H_o: \quad Z_{g1} = Z_{g2} = Z_{g3}$$

$$H_a: \quad Z_{g1} \neq Z_{g2} \neq Z_{g3}$$

The data needed for the calculations of the Z-Score are current assets, total assets, current liabilities, total liabilities, sales, earnings before interest and taxes, retained earnings, and net worth.

The Basis for Analysis

The basis for the analysis is Altman's revised model. Altman developed this model using 33 bankrupt firms matched to 33 nonbankrupt firms, but the model was not tested

against a holdout sample, "we have not tested this model on secondary sample bankrupt and nonbankrupt entities" (Altman, 1983, p. 124).

Sample Selection and Data Collection

The study used data collected from Compact Disclosure. A sample of 54 failed manufacturing firms with assets below $100 million was selected for the period 1987 to 1990. A second sample of 70 failed firms was selected from the period 1991 to 1996. The manufacturing firms were identified using SIC Codes between 2000 and 3999. The search criteria involved selecting firms that filed for bankruptcy. It included firms that filed for Chapter 7 or Chapter 11 bankruptcy between 1987 and 1996 and were publicly traded. All firms were included that had three or more years of complete financial data. Revenue or Net Sales was recorded for five years prior to bankruptcy when available.

Matching Sample Selection

An equal number of nonfailed firms was selected based on similar characteristics. Qualification as a nonfailed firm required a net worth or book value greater than zero and no bankruptcy filing during the time period studied. Firms having a negative net worth were excluded since such

firms are technically insolvent, would be in default under most covenants associated with institutional loans, and would not fit the description of being healthy. However, firms with losses were included in the matching sample as long as no bankruptcy filing was made during the period studied. The first step in selecting the matching firm was based on the first two digits of the SIC Code since this establishes the specific industry within the manufacturing field. Table A-1 summarizes the SIC Codes for the manufacturing field. The second step involved selecting the firms with the asset value closest to that of the failed firms. Asset value was used since total assets appear in the denominator of four out of the five ratios used in calculating Altman's Z-Score.

Recording Methods

The firms were selected using a search of various Compact Disclosure disks dated 1990 through 1996. Three years of financial data for the qualified firms was entered into a Microsoft Excel spreadsheet specifically designed to calculate the Z-Score and individual ratio values for each firm. Three Z-Scores were calculated for each firm to cover the three years prior to bankruptcy. Revenue data, when available, was entered for up to five years prior to

bankruptcy. A compound annualized growth rate was calculated for revenue.

Division of Sample

The sample was separated into two groupings. Sample A contained the bankrupted and matching nonbankrupted firms in the period from 1987 to 1990. Sample B contained the bankrupt and matching nonbankrupt firms from the period 1991 to 1996.

Sample A: 1987-1990 Evaluation Sample

Sample B: 1991-1996 Holdout Sample

Sample A was used to validate the model and cut-off points for distinguishing bankrupt and nonbankrupt on an ex post basis. Sample A was also established to develop new weights for the model if needed to improve model prediction accuracy. However, the establishment of new weights was not necessary, but the establishment of new cut-off points was appropriate. Sample B served as a holdout sample to determine model accuracy for prediction using a future time period on an ex ante basis.

Research Methodology for Hypothesis One

The Z-Scores for the failed and nonfailed firms were calculated using the spreadsheet Microsoft Excel. Statistical calculations were performed using SPSS and Statistix. Sample A and Sample B were tested at the 5 percent level.

Research Methodology for Hypothesis Two

Sample B contained 70 failed firms and was divided by asset size. The size was broken down as follows: less than $8 million in asset size, $9 million to $35 million in asset size, and greater than $35 million in asset size. The Z-Scores for the failed firms were calculated using the spreadsheet Microsoft Excel. Statistical calculations were performed using SPSS and Statistix. Sample A and Sample B were tested at the 5 percent and 10 percent level.

Research Methodology for Hypothesis Three

Sample B contained 70 failed firms was divided by annual compound change in growth based on revenue. The size was broken down as follows: greater than 10 percent annual decline in revenue, plus or minus 10 percent annual change in revenue and greater than 10 percent annual increase in revenue. The Z-Scores for the failed firms were calculated using the spreadsheet Microsoft Excel. Statistical

calculations were performed using SPSS and Statistix. Sample A and Sample B were tested at the 5 percent and 10 percent level.

The calculation used for the growth rate was of the form:

$$g = (S_t/S_{t-n})^{1/n} - 1$$

where:

g   = growth rate

S_t = the sales for the most recent year reported

S_{t-n} = sales n years prior to most recent year reported

n   = the number of years

CHAPTER IV

ANALYSIS AND PRESENTATION OF FINDINGS

Hypothesis One Computations

Sample A was used to test the accuracy of the Altman's revised model and evaluate the cut-off values. The sample contained 54 bankrupt firms matched to 54 nonbankrupt firms for a sample total of 108 firms.

The first evaluation was made using Altman's cut-off values of below 1.10 for bankrupt firms, between 1.10 and 2.60 as a gray area, and above 2.60 for healthy firms. The analysis using these cut-off values yielded an accuracy of 75 percent, 67 percent, and 61 percent for the period one, two, and three years prior to bankruptcy. Adjusting the cut-off values to yield the lowest error rate produced an accuracy rate of 91 percent, 84 percent, and 78 percent for the period one, two, and three years prior to bankruptcy. The revised cut-off points were less than 2.0 for bankrupt firms, 2.0 to 2.3 as a gray area, and above 2.3 for healthy firms. The reason for the higher cut-off values is primarily due to the enhancement of the equity section of

71

the balance sheet due to share capital associated with public firms (i.e. the Common Stock and Paid-in Capital increases the Net Worth value used in ratio X_4 which increases the cut-off value).

Sample A was used for evaluation on an ex post basis and for establishment of the new cut-off values. Sample B served as the hold out sample to evaluate the model and for evaluating the revised cut-off values on an ex post basis. The results for Sample A are provided in Appendix C as Tables C-1 through C-6 and the results for Sample B are in Tables C-7 through C-12.

Sample B containing 70 failed firms matched to 70 healthy firms was used for the hypotheses testing. A 95 percent confidence level was used to evaluate the hypothesis that the mean Z-Scores for failed and nonfailed firms are equal.

$$\sigma_{x-z} = \{\sigma_1{}^2/n_1 + \sigma_2{}^2/n_2\}^{1/2} = .854358$$

$$H_o : \mu_1 = \mu_2 \qquad H_a : \mu_1 \neq \mu_2$$

The critical Z-Scores are: $0 \pm 1.96(.854358) = \pm 1.666$

The difference in the means = $4.1647 - (-3.3576) = 7.5224$

Since 7.5224 is greater than 1.666, the difference is significant at the 5 percent level. Therefore, the null hypothesis is rejected and the alternative hypothesis is not

rejected. The difference was also significant at the 1 percent level. There is evidence to support that the means for the bankrupt and nonbankrupt samples are different.

The model yielded a 93 percent, 84 percent, and 84 percent accuracy for one, two, and three years prior to bankruptcy using the revised cut-off values on an ex ante basis.

For bankrupt firms one year prior to bankruptcy, X_2 or retained earnings divided by total assets was the greatest contributor to the Z-Score, X_3 or EBIT divided by total assets is the second leading contributor, followed by X_5 or sales divided by total assets in third place, X_1 or working capital divided by total assets in fourth place, and X_4 or equity divided by total liability in last place.

For nonbankrupt firms one year prior to bankruptcy, X_4 or equity divided by total liability was the greatest contributor to the Z-Score, followed by X_5 in second place and with X_1, X_2, and X_3 contributing equally.

The gray area range is larger using Altman's cut-off compared to the revised cut-off values. Although the gray area is larger for Altman's cut-offs, the Type I and Type II errors are lower for all periods using the revised cut-offs.

Table 3

Error type evaluation

Altman's Cut-Off Values	Year 1	Year 2	Year 3
Type I	7.2%	21.4%	18.6%
Type II	2.9%	5.7%	5.7%

Revised Cut-Off Values	Year 1	Year 2	Year 3
Type I	7.1%	15.7%	17.1%
Type II	1.4%	0.0%	1.4%

Hypothesis Two Computations

A 95 percent confidence level was used to evaluate the hypothesis that the mean Z-Scores for each one-third of the sample divided by asset size are not equal.

Sample B was used for the analysis. The sample was divided into three groupings. The low group consisted of those firms that had total assets below $9 million. The middle group consisted of those firms with total assets from $9 million to $35 million. The high group consisted of those firms with total assets above $35 million. The low group consisted of 24 firms, the middle group consisted of 23 firms and the high group consisted of 23 firms.

The computations using the t-test failed to find support at the 5 percent or the 10 percent level. The null hypothesis is not rejected. There is no evidence to support the research statement that a difference in asset size has significantly affected the value of the Z-Score.

Hypothesis Three Computations

A 95 percent confidence level was used to evaluate the hypothesis that the mean Z-Scores for each one-third of the sample divided by growth are not equal.

Sample B was used for the analysis. The sample was divided into three groupings. The low group consisted of those firms that had declining sales of 10 percent or more per year. The middle group consisted of those firms with compounded annual change in sales of a minus 10 percent to a plus 10 percent. The high group consisted of those firms with a positive compound growth rate greater than 10 percent. Each group contained 22 firms. From the original sample of 70 firms, 4 were eliminated that had less than five years of sales data.

The t-test was used since the sample sizes were less than 30.

$$\sigma_{x-z} = \left\{ \left[(n_1-1) s_1^2 + (n_2-1) s_2^2 \right] / (df) \right\}^{1/2} x \left(1/n_1 + 1/n_2 \right)^{1/2}$$

= 1.6399 or 1.64 for low compared to medium growth

$$df = (n_1-1) + (n_2-1) = 42$$

The critical t-score = ± 2.021 for two tailed analysis .025

± 1.684 for two tailed analysis .050

The critical difference = (1.684)(1.64) = ± 2.762

at the 5 percent level

The critical difference = (2.021)(1.64) = ± 3.314

at the 10 percent level

The difference in the means = -1.9071 - (-4.7379) = 2.83

A 95 percent and a 90 percent confidence level was used to evaluate the hypothesis that the mean Z-Scores for each one-third of the sample divided by growth are not equal. A comparison of the means of the Z-Scores for the low sample compared to the medium sample was significant at the 10 percent level, but not at the 5 percent level. This study is based upon acquiring a 95 percent confidence level. Therefore, the null hypothesis is not rejected. The analysis fails to support a difference in the sample means. Similar calculations were conducted comparing the high group to the middle group and the high group to the low group. The analysis failed to find support at either the 5 percent level or the 10 percent level. A summary of the statistical results are shown in Table 4. Additional results are summarized in Appendix D.

Table 4

Growth rate comparison

	LOW	MEDIUM	HIGH
NUMBER	22	22	22
MEAN	-4.7379	-1.9071	-3.2755
STD DEVIATION	6.12	4.66	9.37
VARIANCE	37.5	21.7	87.7
RANGE	-21.7 TO 2.89	-14.8 TO 2.10	-35.2 TO 6.41

The mean, variance and standard deviation for both the low group and the high group was higher than the middle group.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary of Dissertation

A review of the literature determined that numerous authors had researched and introduced bankruptcy prediction methods and models over the past seventy-five years, but no one had specifically studied the application of prediction models to small publicly traded manufacturing firms and the effect of change in revenue on these models. Altman's 1983 revised model was chosen since it was specifically designed for smaller firm evaluation and had not been subjected to the rigors of evaluations as his original 1968 model.

This study tested three hypotheses. Two data sets were used to evaluate the analysis on both an ex post and ex ante basis.

The study found support for Hypothesis One that the Z-Score for small publicly traded manufacturing firms below $100 million in asset size is significantly different for bankrupt firms compared to nonbankrupt firms.

78

The study failed to find support at the .05 level for Hypothesis Two that the Z-Scores are significantly different based on asset size.

The study found mixed results for Hypothesis Three. The Z-Score comparing each one-third of the sample based on growth was not significant at the .05 level. However, the Z-Score for the low group with declining sales of 10 percent or more was significantly different that the Z-Score for the middle group at the .10 level.

Conclusions

Altman's 1983 revised model can be used to evaluate firms below 100 million in asset value. However, this study supports using a set of cut-off values that are different from those proposed by Altman.

The effect of asset size within the small range of 0 to $100 million is not significant at the 5 percent or 10 percent level. The model appears to be significantly accurate throughout the researched range.

The effect of growth on the Z-Score values was tested at the 5 percent and 10 percent level. A priori, firms unable to provide sufficient operating profit to cover the fixed or overhead costs as sales decline past a critical point should experience a higher failure rate and a lower Z-Score measure. Also, firms with high growth rates as

measured by increases in sales should create financial instability when growth results in cash requirements above the sustainable growth rate for the firm (Higgins, 1977). However, this research failed to find support at the 5 percent level, that the Z-Score is different for: 1) firms with high declining sales, 2) firms with average or little change in sales volume, or 3) firms with high sales growth.

Recommended Additional Research

Given the limited results of Hypothesis Three, additional research seems warranted to further develop the effect of change in revenue on model predictability. It is suggested that a model be tested using change in revenue divided by revenue as an additional ratio or replacement ratio in the model. Another method would involve using the change in revenue or growth divided by the sustainable growth rate as an additional ratio or as a replacement ratio in the model.

This study concerned the manufacturing industry. The opportunity exists to extend this study by developing models for small publicly traded firms in other industries.

APPENDIX A

SELECTED FIRMS

TABLE A-1:   SIC CODE FOR MANUFACTURING FIRMS

TABLE A-2:   GROUP 1 MATCHED FIRMS

TABLE A-3:   GROUP 2 MATCHED FIRMS

TABLE A-1

SIC CODES FOR MANUFACTURING FIRMS

2000-2099	Food and kindred products
2100-2199	Tobacco Products
2200-2299	Textile mill products
2300-2399	Apparel and other textile products
2400-2499	Lumber and wood products
2500-2599	Furniture and fixtures
2600-2699	Paper and allied products
2700-2799	Printing and publishing
2800-2899	Chemicals and allied products
2900-2999	Petroleum and coal products
3000-3099	Rubber and misc. plastics products
3100-3199	Leather and leather products
3200-3299	Stone, clay, and glass products
3300-3399	Primary metal industries
3400-3499	Fabricated metal products
3500-3599	Industrial machinery and equipment
3600-3699	Electronic & other electric equipment
3700-3799	Transportation equipment
3800-3899	Instruments and related products
3900-3999	Miscellaneous manufacturing industries

TABLE A2
GROUP 1 MATCHED SAMPLES
1987-1990

	SYMBOL	COMPANY	SIC CODE	ASSETS DOLLARS
01	D.CKK	CARIBBEAN SELECT INC.	2033	7,981
02	PVNA	PROVENA FOODS INC.	2013	9,475
03	D.BGX	BAYLY CORPORATION	2325	25,362
04	D.BBW	BRENNER INTERNATIONAL INC.	2337	18,090
05	D.RCK	ROBERT BRUCE INDUSTRIES INC.	2329	30,113
06	ANDO	ANDOVER TOGS INC.	2369	41,810
07	D.VHI	VOGART CRAFTS CORPORATION	2395	3,342
08	HOWA	HOWARD B. WOLF INC.	2335	6,695
09	D.BFI	BUFFALO INC.	2396	2,021
10	HBW	HOWARD B. WOLF INC.	2335	6,051
11	NEI	NATIONAL ENTERPRISES INC.	2452	31,064
12	PATK	PATRICK INDUSTRIES INC.	2434	43,273
13	GFB	GF CORPORATION	2522	63,553
14	BSH	BUSH INDUSTRIES INC.	2511	58,683
15	D.HSS	HAUSERMAN INC.	2542	44,216
16	D.DTZ	DRESHER INC.	2514	49,282
17	D.NXI	NIAGARA CORPORATION	2599	5,802
18	WELL	WELLINGTON HALL LTD.	2511	5,956
19	COKN	CONSOLIDATED PACKAGING CORPORATION	2653	45,233
20	BPMI	BADGER PAPER MILLS INC.	2621	50,614
21	D.SLL	SORG INC.	2752	33,698
22	GIB	C. R. GIBSON COMPANY	2782	37,487
23	UGPH	UNIVERSITY GRAPHICS INC.	2791	2,317
24	D.ERX	EDUCATION SYS. & PUBLICATIONS CORP.	2759	1,026
25	BIOR	BIO RESPONSE INC.	2833	11,326
26	KITS	MERIDIAN DIAGNOSTICS INC.	2834	8,969
27	D.BES	BARRIER SCIENCE AND TECHNOLOGY INC.	2842	1,995
28	STCP	STEPHAN COMPANY	2844	3,627

29	D.SIH	SUMMIT OILFIELD CORPORATION	2869	15,780
30	ADMG	ADVANCED MAGNETICS INC.	2835	16,937
31	TNDS	TS INDUSTRIES INC.	3086	30,856
32	CIMC	CIMCO INC.	3089	38,289
33	D.PRC	PHENIX MEDICAL TECHNOLOGY INC.	3089	11,878
34	D.MAB	M. KAMENSTEIN INC.	3089	15,252
35	D.OIK	OLSON INDUSTRIES INC.	3089	26,901
36	VUL	VULCAN INTERNATIONAL CORPORATION	3069	22,870
37	D.JPF	JUMPING JACKS SHOES INC.	3149	24,377
38	WLKR	B.B. WALKER COMPANY	3143	25,418
39	D.VOE	VALLEY INDUSTRIES INC.	3312	29,043
40	CABL	COMMUNICATION CABLE INC.	3357	23,007
41	D.GAP	G.C. INTERNATIONAL INC.	3363	5,700
42	STLO	ST. LOUIS STEEL CASTING INC.	3324	8,715
43	D.PDL	PREWAY INC.	3433	26,508
44	HOW	HOWELL INDUSTRIES INC.	3465	25,400
45	D.BHK	MAXON INDUSTRIES INC.	3491	20,474
46	MCCL	MCCLAIN INDUSTRIES INC.	3469	20,450
47	MAXN	MAXON INDUSTRIES INC.	3537	10,955
48	DKEY	DATAKEY INC.	3571	11,768
49	D.EUR	EQUIPMENT COMPANY OF AMERICA	3537	11,763
50	QUIP	QUIPP INC.	3559	11,471
51	OMCOQ	OVERMYER CORPORATION	3544	17,201
52	AROS	ADVANCED ROSS CORPORATION	3564	16,387
53	D.EDF	ENGINEERED SYS. & DEVELOPMENT CORP.	3559	14,585
54	DESI	DESIGNATRONICS INC.	3566	13,975
55	D.VIR	VAC TEC SYSTEMS INC.	3563	7,312
56	D.CKC	CORKEN INTERNATIONAL CORPORATION	3561	8,012
57	D.HUS	HITECH ENGINEERING COMPANY	3571	1,517
58	CDIT	COMPUTER DEVICES INC.	3571	3,031
59	D.ESA	EECO INC.	3571	25,593
60	FICI	FAIR ISAAC & COMPANY INC.	3577	25,883
61	D.VHS	VISUAL TECHNOLOGY INC.	3575	2,942
62	IMTEC	IMTEC INC.	3579	3,573

63	D.MCY	MONITERN CORPORATION	3577	12,200
64	VTC	VITRONICS CORPORATION	3548	12,392
65	D.MDA	MINISCRIBE CORPORATION	3577	55,990
66	D.EPT	ENTWISTLE COMPANY	3549	57,133
67	D.FAS	FLOATING POINT SYSTEMS INC.	3577	62,273
68	SBS	SALEM CORPORATION	3549	65,835
69	D.CTX	CPT CORPORATION	3579	30,371
70	GPAR	GENERAL PARAMETRICS CORPORATION	3577	29,768
71	D.DWF	DIGITAL OPTRONICS CORPORATION	3585	5,846
72	BURP	BURNLEY CORPORATION	3523	3,813
73	D.NBZ	NAMSCO CORPORATION	3651	22,280
74	TSNG	TSENG LABS INC.	3674	22,484
75	D.DXV	DIGITAL TRANSMISSION INC.	3661	7,090
76	WTRS	WATERS INSTRUMENTS INC.	3672	7,329
77	D.BEA	BUNTING INC.	3663	3,102
78	AND	ANDREA RADIO CORPORATION	3669	3,571
79	CHY	CHYRON CORPORATION	3663	61,796
80	PSI	PORTA SYSTEMS CORPORATION	3661	66,523
81	D.ABP	ADVANCE DISPLAY TECHNOLOGIES INC.	3669	2,794
82	FIFTH	FIFTH DIMENSION INC.	3625	2,581
83	A.IWP	INTERNATIONAL CMOS TECHNOLOGY INC.	3674	7,880
84	LDII	LARSON DAVIS INC.	3610	7,915
85	D.LRU	LASERMETRICS INC.	3679	3,661
86	CYBE	CYBEROPTICS CORPORATION	3699	3,964
87	D.GYO	GEOTEL INC.	3699	4,446
88	MFCO	MICROWAVE FILTER COMPANY INC.	3663	5,769
89	D.KGO	KENILWORTH SYSTEMS CORPORATION	3699	7,846
90	ASYS	AMTECH SYSTEMS INC.	3679	7,476
91	SDA	SCAT HOVERCRAFT INC.	3721	1,103
92	DGIX	DYNA GROUP INTERNATIONAL INC.	3751	4,800
93	TNIB	TRANSCISCO INDUSTRIES INC.	3743	71,228
94	MLD	MALLARD COACH COMPANY INC.	3792	67,303
95	CDYN	CHRONODYNAMICS LTD.	3845	1,877
96	D.HWW	HART TECHNOLOGIES INC.	3821	2,052

97	IMPN	IMPLANT TECHNOLOGIES INC.	3845	2,105
98	OPTS	OPT SCIENCES CORPORATION	3827	3,083
99	D.CXK	CLINT THERM CORPORATION	3845	4,007
100	SEAS	SCIENCE ACCESSORIES CORPORATION	3812	3,850
101	CLRQC	COLOROCS CORPORATION	3861	29,907
102	D.AUB	ANDROS ANALYZERS INC.	3845	31,983
103	TOWL	TOWLE MANUFACTURING COMPANY	3914	50,435
104	SIGN	PLASTIC LINE INC.	3993	53,263
105	D.KFS	KURZWELL MUSIC SYSTEMS INC.	3931	1,253
106	D.CVG	CECO FILTERS INC.	3999	2,153
107	D.SLR	SILK INTERNATIONAL INC.	3999	1,531
108	DYNA	DYNA GROUP INTERNATIONAL INC.	3914	4,802

TABLE A3
GROUP 2 MATCHED SAMPLES
1991-1996

	SYMBOL	COMPANY	SIC CODE	ASSETS DOLLARS
01	RYR	RYMER FOODS INC	2013	95,308
02	BJICA	BEN & JERRY'S HOMEMADE INC	2024	88,207
03	D.FKE	F & C INTERNATIONAL INC	2087	56,547
04	D.JRI	JIMBO'S INC	2068	55,380
05	MUN	MUNSINGWEAR INC	2329	16,720
06	SPAN	SPAN AMERICA MEDICAL SYSTEMS INC	2329	16,371
07	D.GLS	GOTHAM APPAREL CORP	2339	11,280
08	KNIT	TECHKNITS INC	2339	13,702
09	CHKE	CHEROKEE	2339	93,700
10	HAI	HAMPTON INDUSTRIES INC	2321	90,616
11	D.CTI	CHESAPEAKE INDUSTRIES INC	2431	24,060
12	CVCO	CAVCO INDUSTRIES INC	2452	20,889
13	FAIR	RENAISSANCE ENTERTAINMENT CORP	2512	53,421
14	OAKS	RIVER OAKS FURNITURE INC	2512	59,312
15	D.CEK	CRAFTMATIC INDUSTRIES INC	2515	10,389
16	MITY	MITY LITE INC	2522	9,090
17	FPHI	FOUNTAIN PHARMACEUTICALS INC	2834	535
18	NRDC	NATURADE INC	2844	2,565
19	CELP	CELLULAR PRODUCTS INC	2835	3,273
20	FAME	FLAMEMASTER COPR	2891	5,549
21	CBCX	CAMBRIDGE BIOTECH CORP	2836	83,651
22	WEST	WEST ONE BANCORP	2835	74,417
23	BIOS	BIOSYS INC	2879	16,357
24	GBL	GAMMA BIOLOGICALS INC	2835	18,384
25	D.NBG	NVF CO	3083	99,223
26	AEPI	AEP INDUSTRIES INC	3089	84,393
27	D.AVU	APL CORP	3085	43,612
28	VRSA	VERSA TECHNOLOGY INC	3069	46,884

29	D.CTW	CPC REXCEL INC	3089	43,671
30	SNTC	SYNETIC INC	3089	46,233
31	RAY	RAYTECH CORP	3292	73,287
32	ODC	OIL DRILL CORP OF AMERICA	3295	95,018
33	D.SDF	SIMETCO INC	3339	14,564
34	MXC	MATEC CORP	3315	17,868
35	EAC	EAC INDUSTRIES INC	3429	16,079
36	THMP	THERMAL INDUSTRIES INC	3442	15,356
37	PRCE	PEARCE SYSTEMS INTERNATIONAL INC	3441	3,141
38	D.GCB	GODDARD INDUSTRIES INC	3494	4,691
39	NATTQ	NORTH ATLANTIC TECHNOLOGIES INC	3443	2,070
40	GODD	GODDARD INDUSTRIES INC	3494	5,151
41	SONAC	SONIC ENVIRONMENTAL SYSTEMS INC	3443	4,718
42	CDAL	COEUR D ALENES CO	3448	5,277
43	D.SXD	SANBORN INC	3443	31,608
44	HST	C H HEIST CORP	3471	29,895
45	D.AEB	ADACORP INC	3446	11,803
46	ASON	AEROSONIC CORP	3462	12,854
47	D.AQZ	ALLECO INC	3452	36,894
48	APR	AMERICAN PRECISION INDUSTRIES INC	3443	36,725
49	CCXI	CCX INC	3496	46,376
50	FSCR	FEDERAL SCREW WORKS	3452	49,205
51	D.ACQ	APOGEE ROBOTICS INC	3535	2,157
52	ESVC	ENHANCED SERVICES CO INC	3577	2,082
53	ASI	ASTREX INC	3542	9,725
54	MSYS	MEDICAL TECHNOLOGY SYSTEMS INC	3559	9,953
55	QPDC	QUALITY PRODUCTS INC	3542	30,445
56	CSPI	CSP INC	3571	29,936
57	D.GEX	GEO INTERNATIONAL CORP	3555	55,985
58	TNL	TECHNITROL INC	3596	55,708
59	D.RTJ	RAGEN CORP	3559	4,130
60	IMTC	IMTEC INC	3579	4,117
61	MTGYQ	MACHINE TECHNOLOGY INC	3559	10,699
62	DKEY	DATAKEY INC	3571	11,363

63	D.CNP	CRITICAL INDUSTRIES INC	3564	8,573
64	D.SJR	SUNSHINE FIFTY INC	3559	8,076
65	D.RSU	RADIANT TECHNOLOGY CORP	3567	1,413
66	CECF	CECO FILTERS INC	3564	4,680
67	CSMT	CONSUMAT SYSTEMS INC	3567	1,435
68	IMSG	IMAGE SYSTEMS CORP	3577	2,297
69	D.ANY	ARIX CORP	3571	9,700
70	ESEX	ESSEX CORP	3589	9,830
71	SMBXQ	SYMBOLICS INC	3571	14,460
72	ARTW	ART S WAY MANUFACTURING CO INC	3523	11,758
73	D.AAN	ALLIANT COMPUTER SYSTEMS CORP	3571	40,739
74	CME	CMS ENHANCEMENTS INC.	3577	40,747
75	KRSC	KAISER VENTURES INC	3571	47,377
76	LAN	LANCER CORP TEXAS	3556	46,896
77	CICIQ	COMMUNICATION INTELLIGENCE CORP	3577	10,158
78	D.MNP	MOREHOUSE INDUSTRIES INC	3569	9,394
79	CEXY	CELEREX CORP	3578	1,419
80	IMTC	IMTEC INC	3579	4,407
81	D.SYK	SYNTECH INTERNATIONAL INC	3578	2,788
82	TOPM	TOP AIR MANUFACTURING INC	3523	3,377
83	ENVH	ENVIROMINT HOLDINGS INC	3581	7,045
84	WBTK	WESTERBEKE CORP	3519	8,772
85	D.DDT	DYNASTY CLASSICS CORP	3645	41,040
86	CSII	COMMUNICATIONS SYSTEMS INC	3661	41,211
87	D.TQL	TRI LITE INC	3646	19,507
88	KOSS	KOSS CORP	3651	19,220
89	RYDN	RADYNE CORP	3661	1,355
90	ELST	ELECTRONIC SYSTEMS TECHNOLOGY INC	3661	1,540
91	SPCLQ	SPECTRUM INFORMATION TECH. INC	3661	30,875
92	D.EEX	ESQUIRE RADIO & ELECTRONICS INC	3661	32,639
93	CMPX	COMPTRONIX CORP	3661	47,711
94	ILCT	ILC TECHNOLOGY INC	3648	47,185
95	D.SSL	SYSTEMS INDUSTRIES INC	3674	22,614
96	DETC	DETECTION SYSTEMS INC	3669	22,543

97	SODI	SOLITRON DEVICES INC	3674	38,159
98	VIDE	VIDEO DISPLAY CORP	3671	38,469
99	D.AFV	ALGOREX CORP	3679	1,355
100	CRLI	CIRCUIT RESEARCH LABS INC	3663	2,611
101	PEPI	PIEZO ELECTRONIC PRODUCTS INC	3679	1,431
102	ZVXI	ZEVEX INTERNATIONAL INC	3679	1,329
103	MWVL	MICROWAVE LABORATORIES	3679	3,144
104	OPTC	OPTELECOM INC	3663	3,115
105	D.DUO	DATAMAG INC	3695	3,213
106	MSIE	MSI ELECTRONICS INC	3674	3,584
107	CODE	CODED COMMUNICATIONS CORP	3699	3,475
108	MTRO	METRO TEL CORP	3661	3,306
109	ASBG	AMERICAN SHIP BUILDING CO	3731	77,147
110	COLL	COLLINS INDUSTRIES INC	3711	72,879
111	D.CVD	COBRA INDUSTRIES INC	3792	77,562
112	DRKN	DURAKON INDUSTRIES INC	3714	77,057
113	GAPI	GAP INSTRUMENT CORP	3812	209
114	D.SAV	SCIENTIFIC INDUSTRIES INC	3821	934
115	PRTC	PROTECH INC	3825	1,369
116	SYMT	SYMETRICS INDUSTRIES INC	3812	2,623
117	D.SDN	SYM TEK SYSTEMS INC	3825	13,685
118	MOCO	MODERN CONTROLS INC	3829	14,077
119	OPTOQ	OPTO MECHANIK INC	3827	25,991
120	CXIM	CRITICARE SYSTEMS INC	3841	25,171
121	D.ABF	AMERICAN BODY ARMOR & EQUIPMENT INC	3842	5,410
122	BNSOF	BONSO ELECTRONICS INTERNATIONAL INC	3821	4,905
123	D.BIO	BIOPLASTY INC	3842	9,382
124	D.NFN	NUCLEAR RESEARCH CORP	3829	9,158
125	AMER	AMERICA ONLINE INC	3842	78,416
126	RESP	RESPIRONICS INC	3842	78,039
127	D.IIE	IRT CORP	3844	17,309
128	DAIG	DAIG CORP	3845	17,117
129	D.BEF	BOMED MEDICAL MANUFACTURING LTD	3845	2,034
130	D.ANS	ANGHEL LABORATORIES INC	3812	2,941

131	D.WXF	WORK RECOVERY INC	3845	15,659
132	MRM	MERRIMAC INDUSTRIES INC	3679	15,189
133	HAPY	HAPPINESS EXPRESS INC	3944	41,373
134	PNTK	PENTECH INTERNATIONAL INC	3951	42,200
135	LRC	LORI CORP	3961	42,818
136	AORGB	ALLEN ORGAN CO.	3931	53,581
137	VICT	VICTORIA BANKSHARES INC	3961	47,951
138	FTSP	FIRST TEAM SPORTS INC	3949	45,864
139	FINX	FINGERMATRIX INC	3999	2,316
140	D.WHE	WASATCH FIBER GROUP INC	3949	1,996

APPENDIX B

.

DATA FORM

TABLE B-1:   DATA INFORMATION COLLECTED

TABLE B-1
DATA INFORMATION COLLECTED

Company_____   Ticker Symbol_____

City_____   State_____

Primary SIC Code_____   Status_____

Disclosure Company Number_____

Five Year Sales Summary   _____

                                 _____

                                 _____

                                 _____

                                 _____

Balance Sheet Information Downloaded and Used in the Study

    Total Current Assets
    Total Assets
    Total Current Liabilities
    Total Liabilities
    Retained Earnings
    Shareholders Equity (Net Worth, Book Value)

Income Statement Information Downloaded and Used in the
Study

    Net Sales
    Interest Expense
    Income Before Taxes

Management Discussion: For information on date of
bankruptcy filing.

Note: The above information was not recorded on a form, but
was downloaded and printed out directly from search routines
using Compact Disclosure.

APPENDIX C

CLASSIFICATION RESULTS

TABLE C-1: 1987-1990 CLASSIFICATION RESULTS ONE YEAR PRIOR
TO BANKRUPTCY USING ALTMAN'S CUTOFF VALUES

TABLE C-2: 1987-1990 CLASSIFICATION RESULTS TWO YEAR PRIOR
TO BANKRUPTCY USING ALTMAN'S CUTOFF VALUES

TABLE C-3: 1987-1990 CLASSIFICATION RESULTS THREE YEAR
PRIOR TO BANKRUPTCY USING ALTMAN'S CUTOFF VALUES

TABLE C-4: 1987-1990 CLASSIFICATION RESULTS ONE YEAR PRIOR
TO BANKRUPTCY USING REVISED CUTOFF VALUES

TABLE C-5: 1987-1990 CLASSIFICATION RESULTS TWO YEAR PRIOR
TO BANKRUPTCY USING REVISED CUTOFF VALUES

TABLE C-6: 1987-1990 CLASSIFICATION RESULTS TWO YEAR PRIOR
TO BANKRUPTCY USING REVISED CUTOFF VALUES

TABLE C-7: 1991-1996 CLASSIFICATION RESULTS ONE YEAR PRIOR
TO BANKRUPTCY USING REVISED CUTOFF VALUES

TABLE C-8: 1991-1996 CLASSIFICATION RESULTS ONE YEAR PRIOR
TO BANKRUPTCY USING REVISED CUTOFF VALUES

TABLE C-9: 1991-1996 CLASSIFICATION RESULTS ONE YEAR PRIOR
TO BANKRUPTCY USING REVISED CUTOFF VALUES

Table C-1
1987-1990 CLASSIFICATION RESULTS ONE YEAR PRIOR TO BANKRUPTCY USING ALTMAN'S CUTOFF VALUES

	ONE YEAR PRIOR TO BANKRUPTCY			
Actual	Classified			
	Bankrupt	Gray Area	Nonbankrupt	Total
Bankrupt	39	13	2	54
	72.2%	24.1%	3.7%	
Nonbankrupt	0	12	42	54
	0%	22.2%	77.8%	

Table C-2
1987-1990 CLASSIFICATION RESULTS TWO YEAR PRIOR TO BANKRUPTCY USING ALTMAN'S CUTOFF VALUES

	TWO YEAR PRIOR TO BANKRUPTCY			
Actual	Classified			
	Bankrupt	Gray Area	Nonbankrupt	Total
Bankrupt	30	24	0	54
	55.6%	44.4%	0%	
Nonbankrupt	1	13	40	54
	1.9%	24.1%	74.0%	

Table C-3
1987-1990 CLASSIFICATION RESULTS THREE YEAR PRIOR TO BANKRUPTCY USING ALTMAN'S CUTOFF VALUES

	THREE YEAR PRIOR TO BANKRUPTCY			
Actual	Classified			
	Bankrupt	Gray Area	Nonbankrupt	Total
Bankrupt	24	22	8	54
	44.4%	40.8%	14.8%	
Nonbankrupt	0	12	42	54
	0%	22.2%	77.8%	

Table C-4
1987-1990 CLASSIFICATION RESULTS ONE YEAR PRIOR TO BANKRUPTCY USING REVISED CUTOFF VALUES

	ONE YEAR PRIOR TO BANKRUPTCY			
Actual	Classified			
	Bankrupt	Gray Area	Nonbankrupt	Total
Bankrupt	49	2	3	54
	90.7%	3.7%	5.6%	
Nonbankrupt	2	3	49	54
	3.7%	5.6%	90.7%	

Table C-5
1987-1990 CLASSIFICATION RESULTS TWO YEAR PRIOR TO BANKRUPTCY USING REVISED CUTOFF VALUES

	TWO YEAR PRIOR TO BANKRUPTCY			
Actual	Classified			
	Bankrupt	Gray Area	Nonbankrupt	Total
Bankrupt	44	5	5	54
	81.5%	9.3%	9.2%	
Nonbankrupt	1	6	47	54
	1.9%	11.1%	87.0%	

Table C-6
1987-1990 CLASSIFICATION RESULTS THREE YEAR PRIOR TO BANKRUPTCY USING REVISED CUTOFF VALUES

	THREE YEAR PRIOR TO BANKRUPTCY			
Actual	Classified			
	Bankrupt	Gray Area	Nonbankrupt	Total
Bankrupt	38	1	15	54
	70.4%	1.9%	27.8%	
Nonbankrupt	4	4	46	54
	7.4%	7.4%	85.2%	

Table C-7
1991-1996 CLASSIFICATION RESULTS ONE YEAR PRIOR TO BANKRUPTCY USING ALTMAN'S CUTOFF VALUES

	ONE YEAR PRIOR TO BANKRUPTCY			
Actual	Classified			
	Bankrupt	Gray Area	Nonbankrupt	Total
Bankrupt	56	9	5	70
	80.0%	12.9%	7.1%	
Nonbankrupt	1	9	60	70
	1.4%	12.9%	85.7	

Table C-8
1991-1996 CLASSIFICATION RESULTS TWO YEAR PRIOR TO BANKRUPTCY USING ALTMAN'S CUTOFF VALUES

	TWO YEAR PRIOR TO BANKRUPTCY			
Actual	Classified			
	Bankrupt	Gray Area	Nonbankrupt	Total
Bankrupt	48	11	11	70
	68.6%	15.7%	15.7%	
Nonbankrupt	0	13	57	70
	0.0%	18.6%	81.4%	

Table C-9
1991-1996 CLASSIFICATION RESULTS THREE YEAR PRIOR TO BANKRUPTCY USING ALTMAN'S CUTOFF VALUES

	THREE YEAR PRIOR TO BANKRUPTCY			
Actual	Classified			
	Bankrupt	Gray Area	Nonbankrupt	Total
Bankrupt	38	20	12	70
	54.3%	28.6%	17.1%	
Nonbankrupt	1	9	60	70
	1.4%	12.9%	85.7%	

Table C-10
1991-1996 CLASSIFICATION RESULTS ONE YEAR PRIOR TO
BANKRUPTCY USING REVISED CUTOFF VALUES

	ONE YEAR PRIOR TO BANKRUPTCY			
Actual	Classified			
	Bankrupt	Gray Area	Nonbankrupt	Total
Bankrupt	64	1	5	70
	91.4%	1.4%	7.2%	
Nonbankrupt	2	2	66	70
	2.9%	2.9%	94.2	

Table C-11
1991-1996 CLASSIFICATION RESULTS TWO YEAR PRIOR TO
BANKRUPTCY USING REVISED CUTOFF VALUES

	TWO YEAR PRIOR TO BANKRUPTCY			
Actual	Classified			
	Bankrupt	Gray Area	Nonbankrupt	Total
Bankrupt	55	0	15	70
	78.6%	0%	21.4%	
Nonbankrupt	4	4	62	70
	5.7%	5.7%	88.6%	

Table C-12
1991-1996 CLASSIFICATION RESULTS THREE YEAR PRIOR TO
BANKRUPTCY USING REVISED CUTOFF VALUES

	THREE YEAR PRIOR TO BANKRUPTCY			
Actual	Classified			
	Bankrupt	Gray Area	Nonbankrupt	Total
Bankrupt	54	3	13	70
	77.1%	4.3%	18.6%	
Nonbankrupt	4	3	63	70
	5.7%	4.3%	90.0%	

APPENDIX D

TABLE D-1: BANKRUPT FIRMS Z-SCORE VS FIVE YEAR GROWTH RATE 1991-1996

TABLE D-2: NONBANKRUPT FIRMS Z-SCORE VS FIVE YEAR GROWTH RATE 1991-1996

TABLE D-1
BANKRUPT FIRMS 1991-1996
Z-SCORE VS FIVE YEAR GROWTH RATE

	GROWTH RATE LESS THAN -10%			GROWTH RATE -10% TO +10%			GROWTH RATE MORE THAN 10%		
	Growth Rate	Z-Score	Sorted	Growth Rate	Z-Score	Sorted	Growth Rate	Z-Score	Sorted
1	-47.53	-2.5293	-21.3844	-9.61	-1.5226	-14.7561	11.08	0.2850	-35.1825
2	-37.38	-7.8003	-18.6986	-7.37	-11.3842	-11.3842	12.08	-0.7470	-21.6037
3	-37.08	-4.0048	-10.0121	-7.33	-0.5400	-11.2557	13.59	-12.3620	-12.3620
4	-33.87	-0.0636	-9.8736	-6.02	-4.3055	-4.3055	16.25	-1.7019	-8.8100
5	-31.82	-6.2037	-8.0251	-5.69	1.0530	-2.9096	16.90	-2.6239	-4.3806
6	-28.48	-18.6986	-7.8003	-4.71	-2.2835	-2.7242	17.32	-3.8032	-3.8032
7	-38.34	-4.6456	-6.2037	-3.34	0.3334	-2.2835	17.73	0.7964	-3.0046
8	-25.97	-1.7821	-5.3948	-2.03	0.6406	-1.9470	18.39	1.2510	-2.6239
9	-24.48	-3.7627	-4.6456	0.96	1.0389	-1.5226	18.61	-0.7674	-1.7019
10	-18.11	-0.1398	-4.0048	0.98	1.2281	-0.5400	18.73	-3.0046	-0.7674
11	-17.26 *	-10.0121	-3.7627	1.75 *	-0.0457	-0.0457	22.92 *	-21.6037	-0.7470
12	-16.97 *	-5.3948	-2.9487	3.30 *	1.9105	0.2953	24.05 *	3.4303	-0.1893
13	-16.63	1.5971	-2.5293	3.72	2.0982	0.3334	27.59	3.6426	0.2850
14	-16.52	-0.7747	-1.7821	4.25	1.3733	0.6358	58.32	-4.3806	0.7964
15	-15.38	-2.9487	-0.9546	4.67	-14.7561	0.6406	62.29	1.2343	0.9169
16	-15.16	-8.0251	-0.7747	5.02	1.1113	1.0389	69.90	0.9169	1.0598
17	-14.64	2.8879	-0.2970	5.76	-2.7242	1.0530	72.23	-8.8100	1.2343
18	-14.00	0.5762	-0.1398	5.84	-2.9096	1.1113	80.26	1.0598	1.2510
19	-13.11	-0.2970	-0.0636	6.65	-11.2557	1.2281	82.76	-0.1893	3.4303
20	-12.68	-9.8736	0.5762	6.72	0.2953	1.3733	85.70	6.4080	3.6426
21	-12.13	-0.9546	1.5971	8.00	0.6358	1.9105	203.21	4.0898	4.0898
22	-11.80	-21.3844	2.8879	9.78	-1.9470	2.0982	254.20	-35.1825	6.4080
Mean	-22.70		-4.7379	0.97		-1.9071	54.73		-3.2755
Medium	-17.12		-3.36	2.53		0.12	23.49		-0.47
Z-Score Range		-21.38 to 2.89			-14.76 to 2.10			-35.18 to 6.41	

TABLE D-2
NONBANKRUPT FIRMS
Z-SCORE VS FIVE YEAR GROWTH RATE
1991-1996

	GROWTH RATE -10% TO +10%			GROWTH RATE MORE THAN 10%		
	Growth Rate	Z-Score	Sorted	Growth Rate	Z-Score	Sorted
1	-4.84	0.9539	0.9539	10.26	6.5451	2.0217
2	-4.77	2.5795	2.3727	10.27	3.6674	2.2992
3	-4.24	2.3831	2.3831	11.22	2.2992	2.3895
4	-2.94	15.1031	2.5795	11.36	3.4616	2.5553
5	-1.65	5.2430	2.7024	11.52	3.1090	2.5991
6	-1.01	2.9361	2.8626	14.10	4.9271	3.0006
7	-0.59	3.4282	2.8955	14.56	4.9249	3.0239
8	-0.34	2.9224	2.9224	14.68	3.0006	3.0417
9	-0.03	2.7024	2.9361	14.90	3.0239	3.0787
10	0.05	4.8034	3.0813	15.11	6.0315	3.1090
11	0.70	3.9162	3.1576	15.31	3.5176	3.1169
12	0.76	3.1576	3.4282	17.02	3.0787	3.1298
13	1.51	6.6014	3.5770	17.64	3.6595	3.2030
14	1.79	5.2757	3.9156	18.22	2.0217	3.4231
15	2.21	4.4778	3.9162	19.31	3.0417	3.4616
16	2.67	5.6458	4.1665	20.05	3.5776	3.5176
17	3.20	10.9622	4.2133	22.22	3.1298	3.5776
18	3.89	5.5322	4.2832	23.47	2.5991	3.6595
19	4.19	4.1665	4.4778	25.44	2.5553	3.6674
20	4.56	2.3727	4.8034	28.11	4.7346	4.0348
21	5.23	3.0813	4.8467	28.89	4.0934	4.0934
22	5.28	7.6526	5.2430	30.08	2.3895	4.5506
23	6.19	5.9408	5.2757	33.31	4.0348	4.7346
24	6.48	4.2832	5.5322	35.43	5.8554	4.9249
25	6.93	4.8467	5.6458	36.81	3.2030	4.9271
26	7.73	5.6532	5.6532	57.80	3.1169	5.7976
27	9.06	3.5770	5.9408	58.06	3.4231	5.8554
28	9.10	2.8955	6.6014	70.41	5.7976	6.0315
29	9.37	3.9156	7.6526	76.59	4.5506	6.5451
30	9.47	4.2133	10.9622			
31	9.79	2.8626	15.1031			

Mean	2.90		4.6479	26.28	3.77
Medium	2.67		4.1665	19.31	3.4616
Z-Score Range		0.95 to 15.10			2.02 to 6.55

APPENDIX E

CALCULATIONS

TABLE E-1:   BANKRUPT FIRMS 1987-1990

TABLE E-2:   NONBANKRUPT FIRMS 1987-1990

TABLE E-3:   BANKRUPT FIRMS 1991-1996

TABLE E-4:   NONBANKRUPT FIRMS 1991-1996

TABLE E-1

BANKRUPT FIRMS 1987-1990

Bankrupt firms Perior 1987-1990	1	2	3	4	5	6
Stock Symbol	SDA	D.KFS	D.HUS	D.SLR	CDYN	D.BES
SIC Code	3721	3931	3571	3999	3845	2842
Date of Bankruptcy	2/28/90	9/9/91	9/24/90	1/31/90	6/24/91	12/31/91
Year of Data	12/31/89	12/31/90	12/31/89	6/30/89	9/30/90	12/31/90
DISC Disk Date	Dec-91	Feb-92	Feb-92	Nov-90	Feb-92	Dec-93
current assets	721	1,203	1,153	1,297	878	1,699
total assets	1,103	1,253	1,517	1,531	1,877	1,995
current liability	1,166	19,588	1,117	1,983	1,992	627
total liabilities	1,180	19,588	1,117	1,992	1,992	1,227
retained earnings	-5,053	-42,332	-4,184	-2,953	-2,948	-463
equity	-76	-18,335	400	-460	-114	769
sales	3,794	2,832	2,205	5,732	987	4,072
EBIT&Extraordinary	-772	-7,421	40	-1,992	-551	-199
X_1	-0.4034	-14.6728	0.0237	-0.4481	-0.5935	0.5373
X_2	-4.5811	-33.7845	-2.7581	-1.9288	-1.5706	-0.2321
X_3	-0.6999	-5.9226	0.0264	-1.3011	-0.2936	-0.0997
X_4	-0.0644	-0.9360	0.3581	-0.2309	-0.0572	0.6267
X_5	3.4397	2.2602	1.4535	3.7440	0.5258	2.0411
Z-Score	-2.9383	-55.6748	-0.6361	-2.3580	-2.1672	2.1790
current assets	1,329	11,664	539	2,229	665	2,153
total assets	1,896	13,455	861	2,565	1,490	2,486
current liability	1,122	22,145	1,517	969	1,132	838
total liabilities	1,154	22,303	1,637	982	1,188	1,462
retained earnings	-4,260	-32,464	-4,173	-910	-2,207	-208
equity	716	-8,847	-775	1,582	302	1,024
sales	3,812	19,282	1,894	5,498	196	3,900
EBIT&Extraordinary	-1,149	-10,467	-439	-1,176	-1,257	-186
X_1	0.1092	-0.7790	-1.1359	0.4912	-0.3134	0.5290
X_2	-2.2468	-2.4128	-4.8467	-0.3548	-1.4812	-0.0837
X_3	-0.6060	-0.7779	-0.5099	-0.4585	-0.8436	-0.0748
X_4	0.6205	-0.3967	-0.4734	1.6110	0.2542	0.7004
X_5	2.0105	1.4331	2.1998	2.1435	0.1315	1.5688
Z-Score	-1.4406	-3.7556	-4.5072	1.4430	-3.8624	1.9358
current assets	2,598	19458	485	1,492	1,591	2,140
total assets	3,200	20866	821	1,888	1,747	2,538
current liability	1,248	9071	880	1,469	509	611
total liabilities	1,262	17906	982	1,542	509	1,262
retained earnings	-3,084	-19185	-3,680	343	-909	44
equity	1,938	2960	-161	346	1,238	1,276
sales	4,482	25021	1,015	5,327	0	3,753
EBIT&Extraordinary	-1,509	1629	-652	264	-750	16
X_1	0.4219	0.4978	-0.4811	0.0122	0.6193	0.6024
X_2	-0.9638	-0.9194	-4.4823	0.1817	-0.5203	0.0173
X_3	-0.4716	0.0781	-0.7942	0.1398	-0.4293	0.0063
X_4	1.5357	0.1653	-0.1640	0.2244	2.4322	1.0111
X_5	1.4006	1.1991	1.2363	2.8215	0.0000	1.4787
Z-Score	0.0638	1.0869	-5.4440	3.5072	-0.3090	2.3666
Sales fourth year	3333	11541	2611	2308		6694
Sales fifty year		6536				6060
5 Yr Growth Rate	#DIV/0!	-18.87%	#DIV/0!	#DIV/0!	#DIV/0!	-9.46%

	7	8	9	10	11	12
Stock Symbol	D.BFI	IMPN	UGPH	D.ABP	D.VHS	D.BEA
SIC Code	2396	3845	2791	3669	3575	3663
Date of Bankruptcy	12/8/89	8/7/91	6/10/91	4/27/90	6/30/89	2/12/91
Year of Data	9/30/88	6/30/90	12/31/90	9/30/89	9/30/88	12/31/89
DISC Disk Date	Dec-91	Feb-92	Dec-93	Feb-92	Nov-90	Sep-94
current assets	1,710	414	1,063	424	2,478	2,278
total assets	2,021	2,105	2,317	2,794	2,942	3,102
current liability	1,939	970	825	1,504	5,767	2,681
total liabilities	1,959	970	1,554	2,840	14,075	2,685
retained earnings	-1,575	-4,289	198	-8,078	-57,666	-1,811
equity	62	1,135	763	-45	-11,131	417
sales	4,365	196	3,107	382	8,438	4,146
EBIT&Extraordinary	-32	-421	-146	-1,841	-5,314	-278
X_1	-0.1133	-0.2641	0.1027	-0.3865	-1.1179	-0.1299
X_2	-0.7793	-2.0375	0.0855	-2.8912	-19.6010	-0.5838
X_3	-0.0158	-0.2000	-0.0630	-0.6589	-1.8063	-0.0896
X_4	0.0316	1.1701	0.4910	-0.0158	-0.7908	0.1553
X_5	2.1598	0.0931	1.3410	0.1367	2.8681	1.3366
Z-Score	1.3783	-1.9522	1.4947	-4.6434	-20.4854	0.5330
current assets	2,258	424	1,240	170	5,915	3,703
total assets	2,705	2,337	2,588	3,340	6,473	4,813
current liability	1,459	1,232	787	2,384	6,307	3,776
total liabilities	1,593	1,232	1,595	2,797	14,452	3,785
retained earnings	-523	-3,869	428	-6,112	-51,490	-1,200
equity	1,112	1,105	993	544	-7,978	1,028
sales	3,460	125	2,702	357	15,376	5,606
EBIT&Extraordinary	42	-712	87	-3,022	-12,816	-1,236
X_1	0.2954	-0.3457	0.1750	-0.6629	-0.0606	-0.0152
X_2	-0.1933	-1.6555	0.1654	-1.8299	-7.9546	-0.2493
X_3	0.0155	-0.3047	0.0336	-0.9048	-1.9799	-0.2568
X_4	0.6981	0.8969	0.6226	0.1945	-0.5520	0.2716
X_5	1.2791	0.0535	1.0440	0.1069	2.3754	1.1648
Z-Score	1.6660	-2.1666	1.6735	-4.6481	-10.7938	0.2566
current assets	1,690	424	811	949	9,832	4,764
total assets	2,117	2,337	2,218	4,600	12,957	5,647
current liability	1,260	1,232	619	562	24,715	3,080
total liabilities	1,395	1,232	1,245	1,096	25,192	3,104
retained earnings	-201	-3,869	439	-2,960	-44,278	323
equity	722	1,105	973	3,504	-12,234	2,543
sales	1,755	138	2,167	884	21,581	5,989
EBIT&Extraordinary	-274	-215	-196	-792	-11,348	-952
X_1	0.2031	-0.3457	0.0866	0.0841	-1.1486	0.2982
X_2	-0.0949	-1.6555	0.1979	-0.6435	-3.4173	0.0572
X_3	-0.1294	-0.0920	-0.0884	-0.1722	-0.8758	-0.1686
X_4	0.5176	0.8969	0.7815	3.1971	-0.4856	0.8193
X_5	0.8290	0.0591	0.9770	0.1922	1.6656	1.0606
Z-Score	0.7078	-1.5003	1.2584	0.5149	-4.9809	1.1410
Sales fourth year	1936	188	2870	560	24626	9068
Sales fifty year	2254	180	1976		31673	8794
5 Yr Growth Rate	17.97%	2.15%	11.98%	#DIV/0!	-28.16%	-17.14%

	13	14	15	16	17	18
Stock Symbol	D.VHI	D.LRU	D.CXK	D.GYO	D.GAP	D.NXI
SIC Code	2395	3679	3845	3699	3363	2599
Date of Bankruptcy	10/9/90	6/6/91	11/16/90	3/21/91	4/23/91	3/10/92
Year of Data	12/31/89	12/31/89	6/30/89	12/31/89	6/30/90	12/31/90
DISC Disk Date	Feb-92	Feb-92	Dec-91	Feb-92	Feb-92	Dec-93
current assets	2,975	2,577	1,921	2,946	3,989	4,330
total assets	3,342	3,661	4,007	4,446	5,700	5,802
current liability	4,593	2,669	1,591	2,093	4,353	5,849
total liabilities	4,635	2,897	2,341	2,694	6,086	7,096
retained earnings	-1,269	-2,810	-12,856	-2,840	-2,155	-5,438
equity	-1,292	764	1,666	1,752	-385	-1,294
sales	6,429	3,800	1,583	5,364	10,519	11,168
EBIT&Extraordinary	-459	-676	-2,593	-1,462	-167	-4,890
X_1	-0.4841	-0.0251	0.0824	0.1919	-0.0639	-0.2618
X_2	-0.3797	-0.7675	-3.2084	-0.6388	-0.3781	-0.9373
X_3	-0.1373	-0.1846	-0.6471	-0.3288	-0.0293	-0.8428
X_4	-0.2787	0.2637	0.7117	0.6503	-0.0633	-0.1824
X_5	1.9237	1.0380	0.3951	1.2065	1.8454	1.9249
Z-Score	0.7073	-0.0952	-3.9759	0.0520	1.3581	-1.7558
current assets	3,656	2,751	2,721	4,338	4,218	5,066
total assets	4,129	3,744	5,095	4,782	5,931	7,899
current liability	4,264	2,335	1,151	821	3,266	3,138
total liabilities	4,366	2,374	4,451	1,221	5,078	5,346
retained earnings	-213	-1,938	-9,703	-1,032	-915	-298
equity	-236	1,371	644	3,561	854	2,498
sales	7,775	3,603	4,088	2,613	9,449	8,265
EBIT&Extraordinary	-2,523	290	-1,603	-760	-254	389
X_1	-0.1473	0.1111	0.3081	0.7355	0.1605	0.2441
X_2	-0.0516	-0.5176	-1.9044	-0.2158	-0.1543	-0.0377
X_3	-0.6110	0.0775	-0.3146	-0.1589	-0.0428	0.0492
X_4	-0.0541	0.5775	0.1447	2.9165	0.1682	0.4673
X_5	1.8830	0.9623	0.8024	0.5464	1.5932	1.0463
Z-Score	-0.1912	1.0849	-1.5081	1.6210	1.5120	1.5366
current assets	4,085	2,691	5,072	4,322	2,223	3,420
total assets	10,600	3,840	6,944	5,537	3,535	5,608
current liability	4,999	753	1,436	1,225	1,373	2,486
total liabilities	5,002	2,516	5,039	1,237	2,040	4,918
retained earnings	3,576	-1,994	-7,643	-292	-273	-278
equity	5,598	1,325	1,905	4,300	1,495	630
sales	9,195	3,650	4,827	2,743	10,465	8,105
EBIT&Extraordinary	115	-335	-1,820	857	513	48
X_1	-0.0862	0.5047	0.5236	0.5593	0.2405	0.1665
X_2	0.3374	-0.5193	-1.1007	-0.0527	-0.0772	-0.0496
X_3	0.0108	-0.0872	-0.2621	0.1548	0.1451	0.0086
X_4	1.1192	0.5266	0.3781	3.4762	0.7328	0.1281
X_5	0.8675	0.9505	0.6951	0.4954	2.9604	1.4453
Z-Score	1.5934	0.8208	-0.5186	2.7917	3.8202	1.6002
Sales fourth year	8154	4363	5248	4594	7445	9047
Sales fifty year	8193	4067	1618	2705		8265
5 Yr Growth Rate	-5.88%	-1.68%	-0.55%	18.67%	#DIV/0!	7.82%

	19	20	21	22	23	24
Stock Symbol	D.DWF	D.DXV	D.VIR	D.KGO	D.IWP	D.CKK
SIC Code	3585	3661	3563	3699	3674	2033
Date of Bankruptcy	5/16/90	12/11/90	4/2/90	2/5/91	7/31/91	12/31/90
Year of Data	9/30/89	7/31/89	12/31/89	12/31/90	2/28/90	12/31/89
DISC Disk Date	Feb-92	Dec-91	Nov-90	Feb-92	Dec-91	Feb-92
current assets	2,653	5,114	5,596	1,119	4,880	4,768
total assets	5,846	7,090	7,312	7,846	7,880	7,981
current liability	3,610	3,859	13,207	2,901	12,690	3,633
total liabilities	5,796	4,147	13,290	2,901	12,690	5,951
retained earnings	-498	-4,870	-14,111	-19,141	-13,324	-5,250
equity	50	2,944	-5,977	4,945	-4,809	2,030
sales	1,979	5,875	5,941	3,316	13,809	5,807
EBIT&Extraordinary	-329	-1,587	-2,701	-352	-3,133	-1,307
X_1	-0.1637	0.1770	-1.0409	-0.2271	-0.9911	0.1422
X_2	-0.0852	-0.6869	-1.9298	-2.4396	-1.6909	-0.6578
X_3	-0.0563	-0.2238	-0.3694	-0.0449	-0.3976	-0.1638
X_4	0.0086	0.7099	-0.4497	1.7046	-0.3790	0.3411
X_5	0.3385	0.8286	0.8125	0.4226	1.7524	0.7276
Z-Score	-0.0229	-0.0252	-2.9066	-1.2309	-1.7884	-0.0946
current assets	1,912	4,945	4,910	843	3,957	1,323
total assets	2,219	7,471	6,604	7,725	7,684	1,639
current liability	127	2,160	9,478	2,810	4,542	557
total liabilities	277	2,583	9,619	2,810	8,296	575
retained earnings	-3,192	-2,925	-11,114	-18,724	-9,041	-3,932
equity	1,941	4,888	-3,015	4,915	-611	1,064
sales	140	5,769	5,558	1,941	8,978	5,910
EBIT&Extraordinary	-1,694	-2,901	-3,297	-707	-1,699	-592
X_1	0.8044	0.3728	-0.6917	-0.2546	-0.0761	0.4674
X_2	-1.4385	-0.3915	-1.6829	-2.4238	-1.1766	-2.3990
X_3	-0.7634	-0.3883	-0.4992	-0.0915	-0.2211	-0.3612
X_4	7.0072	1.8924	-0.3134	1.7491	-0.0736	1.8504
X_5	0.0631	0.7722	0.8416	0.2513	1.1684	3.6059
Z-Score	-0.0075	0.2947	-2.7642	-1.5345	-0.6030	1.5567
current assets	3,881	8,543	8,339	1,331	2,219	2,267
total assets	4,159	10,872	9,493	8,551	4,959	2,339
current liability	382	2,779	4,788	2,901	2,854	659
total liabilities	532	2,876	9,200	2,901	6,141	674
retained earnings	-1,480	181	-7,805	-17,989	-6,570	-3,330
equity	3,627	7,995	293	5,650	-1,181	1,665
sales	244	8,275	13,470	1,745	4,688	4,464
EBIT&Extraordinary	-432	30	-2,101	-219	-1,775	-2,016
X_1	0.8413	0.5302	0.3741	-0.1836	-0.1281	0.6875
X_2	-0.3559	0.0166	-0.8222	-2.1037	-1.3249	-1.4237
X_3	-0.1039	0.0028	-0.2213	-0.0256	-0.3579	-0.8619
X_4	6.8177	2.7799	0.0318	1.9476	-0.1923	2.4703
X_5	0.0587	0.7611	1.4189	0.2041	0.9454	1.9085
Z-Score	2.9011	2.3300	0.3136	-0.9714	-1.4634	-0.4487
Sales fourth year	70	4240	8488	396	2640	4861
Sales fifty year		2619	7132	2650	1364	
5 Yr Growth Rate	#DIV/0!	22.38%	-4.47%	5.77%	78.38%	#DIV/0!

	25	26	27	28	29	30
Stock Symbol	MAXN	BIOR	D.EUR	D.PRC	D.MCY	D.EDF
SIC Code	3537	2833	3537	3089	3577	3559
Date of Bankruptcy	3/9/90	9/14/89	2/27/91	8/2/91	11/12/91	8/26/88
Year of Data	5/31/89	12/31/88	12/31/90	12/31/90	12/31/90	12/31/87
DISC Disk Date	Feb-92	Nov-90	Dec-91	Dec-93	Dec-93	Nov-90
current assets	8,688	6,257	8,370	3,612	9,930	12,440
total assets	10,955	11,326	11,763	11,878	12,200	14,585
current liability	8,900	23,608	8,388	11,748	7,917	16,940
total liabilities	9,100	23,608	11,570	11,841	7,957	17,807
retained earnings	380	-37,549	-2,870	-7,385	-2,479	-8,350
equity	1,855	-12,280	193	37	4,243	-3,220
sales	27,610	1,520	20,068	14,934	26,214	28,027
EBIT&Extraordinary	-1,244	-3,337	-14	-7,059	-1,390	-7,045
X_1	-0.0194	-1.5320	-0.0015	-0.6850	0.1650	-0.3085
X_2	0.0347	-3.3153	-0.2440	-0.6217	-0.2032	-0.5725
X_3	-0.1136	-0.2946	-0.0012	-0.5943	-0.1139	-0.4830
X_4	0.2038	-0.5202	0.0167	0.0031	0.5332	-0.1808
X_5	2.5203	0.1342	1.7060	1.2573	2.1487	1.9216
Z-Score	2.2636	-4.9064	1.4982	-1.6081	1.9606	-0.3651
current assets	11,046	8,818	8,167	4,242	12,128	16,641
total assets	14,692	16,465	11,770	17,660	14,005	19,618
current liability	10,277	1,354	7,159	2,153	7,734	15,114
total liabilities	10,958	23,583	10,486	9,796	7,907	15,221
retained earnings	2,259	-32,108	-1,739	443	-624	-730
equity	3,734	-7,117	1,284	7,864	6,098	4,397
sales	31,811	574	20,256	15,262	27,383	18,058
EBIT&Extraordinary	178	-8,021	-15	-1,954	-498	-8,346
X_1	0.0523	0.4533	0.0856	0.1183	0.3137	0.0778
X_2	0.1538	-1.9501	-0.1477	0.0251	-0.0446	-0.0372
X_3	0.0121	-0.4872	-0.0013	-0.1106	-0.0356	-0.4254
X_4	0.3408	-0.3018	0.1224	0.8028	0.7712	0.2889
X_5	2.1652	0.0349	1.7210	0.8642	1.9552	0.9205
Z-Score	2.5094	-2.9322	1.7013	0.9619	2.3520	-0.2575
current assets	10,092	16,526	10,084	3,957	14,805	27,428
total assets	14,026	26,414	14,178	17,177	16,602	32,379
current liability	8,866	1,411	9,972	2,943	9,012	22,855
total liabilities	9,857	23,411	13,159	7,228	9,441	23,149
retained earnings	2,694	-21,876	-368	2,590	438	4,447
equity	4,169	3,004	1,020	9,949	7,160	9,230
sales	28,484	667	21,463	19,373	34,195	40,512
EBIT&Extraordinary	198	-5,219	1,089	2,470	1,087	2,221
X_1	0.0874	0.5722	0.0079	0.0590	0.3489	0.1412
X_2	0.1921	-0.8282	-0.0260	0.1508	0.0264	0.1373
X_3	0.0141	-0.1976	0.0768	0.1438	0.0655	0.0686
X_4	0.4229	0.1283	0.0775	1.3765	0.7584	0.3987
X_5	2.0308	0.0253	1.5138	1.1278	2.0597	1.2512
Z-Score	2.4736	-0.8260	1.7657	2.3205	2.8501	1.8469
Sales fourth year	31584	2476	20138	13574	30439	28775
Sales fifty year		496	15896	11394	11455	27248
5 Yr Growth Rate	#DIV/0!	32.31%	6.00%	7.00%	22.99%	0.71%

	31	32	33	34	35	36
Stock Symbol	D.SIH	OMCOQ	D.BHK	D.NBZ	D.JPF	D.BGX
SIC Code	2869	3544	3491	3651	3149	2325
Date of Bankruptcy	3/13/89	4/17/90	2/22/91	12/26/91	2/6/90	4/22/91
Year of Data	12/31/88	12/31/89	9/30/89	12/31/90	4/30/89	12/31/90
DISC Disk Date	Nov-90	Nov-90	Dec-91	Dec-93	Nov-90	Dec-91
current assets	6,707	10,741	9,624	5,680	19,880	20,950
total assets	15,780	17,201	20,474	22,280	24,377	25,362
current liability	22,501	13,048	3,320	3,097	19,701	25,485
total liabilities	22,524	16,049	12,090	17,808	19,701	26,015
retained earnings	-12,805	1,291	-15,477	4,245	704	-14,211
equity	-6,743	1,152	8,384	4,472	4,676	-652
sales	31,340	35,986	8,880	9,051	36,701	63,076
EBIT&Extraordinary	662	-2,109	-1,659	1,723	-830	-6,695
X_1	-1.0009	-0.1341	0.3079	0.1159	0.0073	-0.1788
X_2	-0.8115	0.0751	-0.7559	0.1905	0.0289	-0.5603
X_3	0.0420	-0.1226	-0.0810	0.0773	-0.0340	-0.2640
X_4	-0.2994	0.0718	0.6935	0.2511	0.2373	-0.0251
X_5	1.9861	2.0921	0.4337	0.4062	1.5056	2.4870
Z-Score	0.5817	1.7045	0.0528	0.9957	1.5262	1.0485
current assets	4,758	16,127	7,811	5,683	22,662	27,534
total assets	9,203	24,954	17,226	21,053	27,795	32,575
current liability	19,468	12,896	4,136	2,196	11,673	16,129
total liabilities	19,513	19,859	9,248	16,390	19,854	38,389
retained earnings	-11,198	4,928	-12,583	4,437	3,968	-4,754
equity	-5,136	5,095	7,978	4,663	7,940	-5,813
sales	19,457	43,328	9,875	6,297	41,144	74,555
EBIT&Extraordinary	-589	-461	65	760	-25	-3,101
X_1	-1.5984	0.1295	0.2133	0.1656	0.3954	0.3501
X_2	-1.2168	0.1975	-0.7305	0.2108	0.1428	-0.1459
X_3	-0.0640	-0.0185	0.0038	0.0361	-0.0009	-0.0952
X_4	-0.2632	0.2566	0.8627	0.2845	0.3999	-0.1514
X_5	2.1142	1.7363	0.5733	0.2991	1.4803	2.2887
Z-Score	-0.3761	2.0433	0.4804	0.8274	2.0469	2.0522
current assets	2,649	15,015	4,662	3,836	22,068	27,156
total assets	12,808	23,595	12,641	17,033	27,025	33,487
current liability	17,707	8,214	4,235	2,607	8,202	11,466
total liabilities	17,805	16,208	5,618	11,852	16,804	33,068
retained earnings	-11,112	6,952	-12,221	4,954	6,248	1,492
equity	-5,050	7,387	7,023	5,181	10,220	419
sales	13,125	32,293	4,441	5,102	39,291	100,945
EBIT&Extraordinary	-1,970	1,917	-2,371	1,702	1,095	-11,461
X_1	-1.1757	0.2882	0.0338	0.0722	0.5131	0.4685
X_2	-0.8676	0.2946	-0.9668	0.2908	0.2312	0.0446
X_3	-0.1538	0.0812	-0.1876	0.0999	0.0405	-0.3423
X_4	-0.2836	0.4558	1.2501	0.4371	0.6082	0.0127
X_5	1.0248	1.3686	0.3513	0.2995	1.4539	3.0145
Z-Score	-1.1521	2.2660	-0.5017	1.0911	2.3960	2.3240
Sales fourth year	29562	23828	9594	5032	41657	192112
Sales fifty year		21714	14386	4977	34925	173832
5 Yr Growth Rate	#DIV/0!	13.46%	-11.36%	16.13%	1.25%	-22.39%

	37	38	39	40	41	42
Stock Symbol	D.ESA	D.PDL	D.OIK	D.VOE	CLRQC	D.RCK
SIC Code	3571	3433	3089	3312	3861	2329
Date of Bankruptcy	5/2/90	8/1/89	4/4/91	2/7/92	9/6/91	5/5/89
Year of Data	12/31/89	12/31/88	12/31/90	11/30/90	12/31/90	12/31/87
DISC Disk Date	Dec-91	Nov-90	Dec-91	Dec-93	Dec-91	Feb-92
current assets	12,999	11,715	14,403	16,142	22,008	21,856
total assets	25,593	26,508	26,901	29,043	29,907	30,113
current liability	29,350	8,070	6,205	12,543	15,301	47,107
total liabilities	33,933	48,501	27,656	23,735	16,484	50,270
retained earnings	-15,327	-59,403	-4,524	-10,365	-13,668	-25,381
equity	-8,339	-21,992	-1,250	5,308	13,422	-20,156
sales	24,832	47,761	69,462	78,347	42,512	40,433
EBIT&Extraordinary	-4,624	-8,127	929	-1,470	-8,104	83
X_1	-0.6389	0.1375	0.3047	0.1239	0.2243	-0.8385
X_2	-0.5989	-2.2409	-0.1682	-0.3569	-0.4570	-0.8429
X_3	-0.1807	-0.3066	0.0345	-0.0506	-0.2710	0.0028
X_4	-0.2457	-0.4534	-0.0452	0.2236	0.8142	-0.4010
X_5	0.9703	1.8018	2.5821	2.6976	1.4215	1.3427
Z-Score	-0.6616	-1.1443	2.7413	2.4155	0.6924	-0.1349
current assets	40,228	18,237	15,461	15,471	17,600	21,129
total assets	54,904	39,280	29,659	29,232	36,890	44,193
current liability	34,170	38,181	8,887	9,519	8,023	13,937
total liabilities	43,172	46,635	30,664	21,158	8,488	40,576
retained earnings	4,257	-44,335	-4,278	-7,599	-4,438	-1,607
equity	11,732	-7,354	-1,004	8,074	28,402	3,617
sales	32,265	48,523	73,492	76,836	12,515	49,120
EBIT&Extraordinary	2,207	-5,082	323	-5,671	8,731	-7,860
X_1	0.1103	-0.5077	0.2217	0.2036	0.2596	0.1627
X_2	0.0775	-1.1287	-0.1442	-0.2600	-0.1203	-0.0364
X_3	0.0402	-0.1294	0.0109	-0.1940	0.2367	-0.1779
X_4	0.2718	-0.1577	-0.0327	0.3816	3.3461	0.0891
X_5	0.5877	1.2353	2.4779	2.6285	0.3393	1.1115
Z-Score	0.9703	-0.5554	2.5298	2.1066	2.5635	0.6800
current assets	45,200	36,548	17,536	17,320	1,084	31,447
total assets	69,272	75,595	33,621	35,276	29,032	44,250
current liability	30,501	21,428	24,063	10,393	4,832	12,351
total liabilities	44,454	65,527	32,932	18,659	4,832	34,923
retained earnings	17,897	-24,807	-2,585	929	-12,212	4,904
equity	24,818	10,068	689	16,617	24,200	9,327
sales	26,354	62,294	68,789	97,271	33	50,890
EBIT&Extraordinary	-29	-2,787	-2,505	1,600	-3,655	-1,355
X_1	0.2122	0.2000	-0.1941	0.1964	-0.1291	0.4315
X_2	0.2584	-0.3282	-0.0769	0.0263	-0.4206	0.1108
X_3	-0.0004	-0.0369	-0.0745	0.0454	-0.1259	-0.0306
X_4	0.5583	0.1536	0.0209	0.8906	5.0083	0.2671
X_5	0.3804	0.8240	2.0460	2.7574	0.0011	1.1501
Z-Score	0.9838	0.6378	1.6149	3.4300	1.2646	1.5681
Sales fourth year	18892	64855	62662	81642		62585
Sales fifty year	15086	34632	58415	75581		61647
5 Yr Growth Rate	13.27%	8.37%	4.43%	0.90%	#DIV/0!	-10.01%

	43	44	45	46	47	48
Stock Symbol	D.CTX	TNDS	NEI	D.SLL	D.HSS	COKN
SIC Code	3579	3086	2452	2752	2542	2653
Date of Bankruptcy	2/8/91	8/17/89	12/10/90	8/8/89	10/5/89	5/24/91
Year of Data	6/30/90	9/30/88	12/31/89	5/31/89	6/30/89	12/31/89
DISC Disk Date	Dec-91	Nov-90	Dec-91	Nov-90	Nov-90	Dec-91
current assets	17,018	15,992	23,625	18,053	20,787	17,428
total assets	30,371	30,856	31,064	33,698	44,216	45,233
current liability	8,917	23,770	15,182	14,000	43,757	33,503
total liabilities	43,425	31,399	26,264	25,522	48,890	41,436
retained earnings	-50,365	-23,018	-44,991	-2,038	-8,769	-22,897
equity	-13,053	-546	4,800	8,176	-4,673	3,797
sales	25,671	67,122	44,910	77,736	79,770	75,670
EBIT&Extraordinary	-21,990	-19,635	-8,518	-9,583	-22,754	2,793
X_1	0.2667	-0.2521	0.2718	0.1203	-0.5195	-0.3554
X_2	-1.6583	-0.7460	-1.4483	-0.0605	-0.1983	-0.5062
X_3	-0.7240	-0.6363	-0.2742	-0.2844	-0.5146	0.0617
X_4	-0.3006	-0.0174	0.1828	0.3204	-0.0956	0.0916
X_5	0.8452	2.1753	1.4457	2.3068	1.8041	1.6729
Z-Score	-2.7457	-0.6260	-0.3642	1.5882	-0.3790	1.2163
current assets	36,014	22,295	39,963	23,873	44,488	17,957
total assets	58,010	60,313	57,944	42,230	79,496	39,131
current liability	11,744	24,134	17,369	11,284	26,161	20,344
total liabilities	46,419	38,418	36,582	23,864	59,132	34,253
retained earnings	-25,628	-584	-28,475	8,391	16,995	-23,010
equity	11,591	21,873	21,362	18,366	20,364	4,878
sales	63,567	67,926	59,341	70,753	146,459	74,939
EBIT&Extraordinary	-23,930	780	-271	-5,990	-7,348	4,983
X_1	0.4184	-0.0305	0.3899	0.2981	0.2305	-0.0610
X_2	-0.4418	-0.0094	-0.4914	0.1987	0.2138	-0.5880
X_3	-0.4125	0.0129	-0.0047	-0.1418	-0.0924	0.1273
X_4	0.2497	0.5693	0.5839	0.7696	0.3444	0.1424
X_5	1.0958	1.1262	1.0241	1.6754	1.8423	1.9151
Z-Score	-0.1574	1.3735	1.1161	1.9366	2.0425	1.8249
current assets	65,030	13,222	26,928	25,154	54,305	17,604
total assets	92,626	27,746	61,312	36,368	80,127	39,479
current liability	21,957	8,068	18,132	10,331	28,225	18,912
total liabilities	55,491	20,861	37,571	13,687	51,946	36,085
retained earnings	249	1,770	-26,092	12,980	25,528	-25,140
equity	36,935	6,836	23,741	22,681	28,181	3,394
sales	93,314	33,602	56,117	74,933	129,467	61,577
EBIT&Extraordinary	-18,691	2,083	-3,648	5,817	-9,932	876
X_1	0.4650	0.1858	0.1435	0.4076	0.3255	-0.0331
X_2	0.0027	0.0638	-0.4256	0.3569	0.3186	-0.6368
X_3	-0.2018	0.0751	-0.0595	0.1599	-0.1240	0.0222
X_4	0.6656	0.3277	0.6319	1.6571	0.5425	0.0941
X_5	1.0074	1.2111	0.9153	2.0604	1.6158	1.5597
Z-Score	0.9937	1.7667	0.7364	3.8438	1.9585	1.1019
Sales fourth year	101293	22798	54989	66549	140318	42299
Sales fifty year	116027	16402	48839	54129	144154	42902
5 Yr Growth Rate	-31.42%	42.23%	-2.07%	9.47%	-13.75%	15.24%

	49	50	51	52	53	54
Stock Symbol	TOWL	D.MDA	CHY	D.FAS	GFB	TNIB
SIC Code	3914	3577	3663	3577	2522	3743
Date of Bankruptcy	8/25/89	4/2/90	9/17/90	9/30/91	4/18/90	7/1/91
Year of Data	6/30/89	12/31/89	6/30/90	10/31/90	12/31/88	12/31/90
DISC Disk Date	Nov-90	Nov-90	Dec-93	Dec-91	Nov-90	Dec-91
current assets	48,389	52,990	39,139	36,168	37,934	18,855
total assets	50,435	55,990	61,796	62,273	63,553	71,228
current liability	56,422	31,026	43,399	16,067	18,910	43,328
total liabilities	58,195	274,410	44,593	25,442	39,086	46,440
retained earnings	-13,404	-294,280	-7,234	-29,118	4,341	11,387
equity	-7,759	-218,419	17,203	36,831	24,467	24,788
sales	75,864	494,767	32,266	46,886	139,439	31,083
EBIT&Extraordinary	398	-161,664	-10,283	-10,672	-2,015	-5,886
X_1	-0.1593	0.3923	-0.0689	0.3228	0.2993	-0.3436
X_2	-0.2658	-5.2559	-0.1171	-0.4676	0.0683	0.1599
X_3	0.0079	-2.8874	-0.1664	-0.1714	-0.0317	-0.0826
X_4	-0.1333	-0.7960	0.3858	1.4476	0.6260	0.5338
X_5	1.5042	8.8367	0.5221	0.7529	2.1941	0.4364
Z-Score	1.1304	-4.6569	0.0175	0.6623	2.6266	0.2920
current assets	54,079	277,801	48,207	40,035	47,226	25,807
total assets	58,727	364,745	72,188	66,994	72,675	61,399
current liability	19,587	397,819	39,532	22,879	23,440	7,076
total liabilities	60,315	401,014	41,725	37,609	44,445	33,158
retained earnings	-7,138	-110,443	6,504	-19,916	8,105	14,493
equity	-1,587	-36,268	30,463	29,385	28,230	28,241
sales	35,780	531,071	44,157	58,484	134,971	41,074
EBIT&Extraordinary	-4,290	-98,272	-920	-12,812	-1,219	-549
X_1	0.5873	-0.3290	0.1202	0.2561	0.3273	0.3051
X_2	-0.1215	-0.3028	0.0901	-0.2973	0.1115	0.2360
X_3	-0.0730	-0.2694	-0.0127	-0.1912	-0.0168	-0.0089
X_4	-0.0263	-0.0904	0.7301	0.7813	0.6352	0.8517
X_5	0.6093	1.4560	0.6117	0.8730	1.8572	0.6690
Z-Score	0.6882	0.0856	1.0400	0.5370	2.3973	1.4162
current assets	244	192,248	38,130	50,669	45,893	27,438
total assets	4,285	273,606	70,390	85,689	73,725	60,539
current liability	3,319	74,175	11,541	29,353	19,391	9,754
total liabilities	3,650	172,395	37,541	42,541	41,895	34,944
retained earnings	526	31,778	10,347	-5,002	11,721	12,589
equity	635	101,211	31,560	43,148	31,830	25,595
sales	985	362,467	46,014	70,785	130,820	41,558
EBIT&Extraordinary	406	39,345	2,319	-31,943	3,923	1,284
X_1	-0.7176	0.4315	0.3777	0.2488	0.3595	0.2921
X_2	0.1228	0.1161	0.1470	-0.0584	0.1590	0.2079
X_3	0.0947	0.1438	0.0329	-0.3728	0.0532	0.0212
X_4	0.1740	0.5871	0.8407	1.0143	0.7598	0.7325
X_5	0.2299	1.3248	0.6537	0.8261	1.7744	0.6865
Z-Score	0.1863	2.4233	1.5032	0.2211	2.6477	1.4442
Sales fourth year	894	178464	42199	84269	134513	31659
Sales fifty year	989	113951		88579	142180	26014
5 Yr Growth Rate	195.94%	44.35%	#DIV/0!	-14.70%	-0.49%	4.55%

	Mean	Mean times weight
Stock Symbol		
SIC Code		
Date of Bankruptcy		
Year of Data		
DISC Disk Date		
current assets		
total assets		
current liability		
total liabilities		
retained earnings		
equity		
sales		
EBIT&Extraordinary		
X_1	-0.4464	-0.3201
X_2	-1.9700	-1.6686
X_3	-0.4261	-1.3238
X_4	0.1277	0.0536
X_5	1.6394	1.6361
		-1.6227
Z-Score	-1.6227	

current assets		
total assets		
current liability		
total liabilities		
retained earnings		
equity		
sales		
EBIT&Extraordinary		
X_1	0.0748	0.0537
X_2	-0.7795	-0.6603
X_3	-0.2311	-0.7179
X_4	0.6228	0.2616
X_5	1.2655	1.2629
		0.2000
Z-Score	0.2000	

current assets		
total assets		
current liability		
total liabilities		
retained earnings		
equity		
sales		
EBIT&Extraordinary		
X_1	0.1759	0.1261
X_2	-0.3907	-0.3309
X_3	-0.0975	-0.3029
X_4	0.9577	0.4022
X_5	1.1514	1.1491
		1.0437
Z-Score	1.0437	

Sales fourth year
Sales fifty year

5 Yr Growth Rate

TABLE E-2

NONBANKRUPT FIRMS 1987-1990

Nonbankrupt firms	1	2	3	4	5	6
Period 1987-1990						
Stock Symbol	D.ERX	D.HWW	D.CVG	FIFTH	CDIT	OPTS
SIC Code	2759	3821	3999	3625	3571	3827
Date of Bankruptcy						
Year of Data	12/31/90	7/31/90	12/31/89	12/31/89	12/31/89	12/31/90
Disclosure Disk Date	Feb-92	Feb-92	Nov-90	Dec-96	Nov-90	Feb-92
current assets	1,026	1,796	1,712	1,955	2,752	2,695
total assets	1,026	2,052	2,153	2,581	3,031	3,083
current liability	98	684	1,189	830	428	334
total liabilities	98	788	1,192	830	428	334
retained earnings	670	15	160	983	577	2,380
equity	928	1,264	961	1,751	2,603	2,749
sales	1,813	2,570	2,843	3,608	2,843	2,780
EBIT&Extraordinary	840	58	285	449	-231	604
X_1	0.9045	0.5419	0.2429	0.4359	0.7667	0.7658
X_2	0.6530	0.0073	0.0743	0.3809	0.1904	0.7720
X_3	0.8187	0.0283	0.1324	0.1740	-0.0762	0.1959
X_4	9.4694	1.6041	0.8062	2.1096	6.0818	8.2305
X_5	1.7671	1.2524	1.3205	1.3979	0.9380	0.9017
Z-Score	9.4860	2.4062	2.3048	3.4568	3.9646	6.1684
current assets	382	901	443	1,546	3,142	2,346
total assets	480	1,089	585	2,174	3,155	2,639
current liability	390	311	151	471	448	247
total liabilities	390	417	151	692	448	247
retained earnings	-167	3	-28	714	808	2,018
equity	90	672	434	1,482	2,707	2,392
sales	3,594	1,910	1,188	3,398	2,846	2,700
EBIT&Extraordinary	-725	-222	-42	473	627	350
X_1	-0.0167	0.5418	0.4991	0.4945	0.8539	0.7954
X_2	-0.3479	0.0028	-0.0479	0.3284	0.2561	0.7647
X_3	-1.5104	-0.2039	-0.0718	0.2176	0.1987	0.1326
X_4	0.2308	1.6115	2.8742	2.1416	6.0424	9.6842
X_5	7.4875	1.7539	2.0308	1.5630	0.9021	1.0231
Z-Score	2.5699	2.1846	3.3281	3.7681	4.8847	6.7185
current assets	1,061	815	169	1,507	2,417	2,091
total assets	1,422	968	439	2,054	2,435	2,360
current liability	526	308	239	567	412	198
total liabilities	608	421	354	861	412	198
retained earnings	556	254	21	425	404	1,796
equity	814	547	84	1,193	2,023	2,163
sales	4,885	1,635	1,050	2,782	3,553	2,387
EBIT&Extraordinary	-788	58	30	329	316	324
X_1	0.3762	0.5238	-0.1595	0.4576	0.8234	0.8021
X_2	0.3910	0.2624	0.0478	0.2069	0.1659	0.7610
X_3	-0.5541	0.0599	0.0683	0.1602	0.1298	0.1373
X_4	1.3388	1.2993	0.2373	1.3856	4.9102	10.9242
X_5	3.4353	1.6890	2.3918	1.3544	1.4591	1.0114
Z-Score	2.8699	3.0153	2.6252	2.9347	4.6526	7.2439
Sales fourth year	2870	2077	757		4366	2160
Sales fifth year	1976	1928	155		5881	1717
5 Yr Growth Rate	-2.13%	7.45%	106.95%		-16.62%	12.80%

	7	8	9	10	11	12
Stock Symbol	AND	IMTEC	STCP	BURP	SEAS	CYBE
SIC Code	3669	3579	2844	3523	3812	3699
Date of Bankruptcy						
Year of Data	12/31/89	6/30/89	12/31/90	6/30/89	10/31/89	12/31/90
Disclosure Disk Date	Nov-90	Dec-96	Feb-92	Nov-90	Nov-90	Feb-92
current assets	3,029	2,963	2,633	3,320	3,289	3,659
total assets	3,571	3,573	3,627	3,813	3,850	3,964
current liability	236	1,648	751	397	183	581
total liabilities	243	1,970	1,692	959	216	581
retained earnings	3,015	391	937	107	1,422	937
equity	3,328	1,603	1,935	2,854	3,633	3,383
sales	3,705	5,441	5,502	4,293	2,886	4,608
EBIT&Extraordinary	291	696	991	716	317	388
X_1	0.7821	0.3680	0.5189	0.7666	0.8068	0.7765
X_2	0.8443	0.1094	0.2583	0.0281	0.3694	0.2364
X_3	0.0815	0.1948	0.2732	0.1878	0.0823	0.0979
X_4	13.6955	0.8137	1.1436	2.9760	16.8194	5.8227
X_5	1.0375	1.5228	1.5170	1.1259	0.7496	1.1625
Z-Score	8.3167	2.8233	3.4340	3.5304	8.9594	4.6667
current assets	3,181	1,768	1,936	2,892	3,311	3,270
total assets	3,610	2,370	2,951	3,460	3,626	3,554
current liability	162	970	586	406	184	500
total liabilities	162	1,173	1,605	1,038	221	500
retained earnings	3,135	30	348	-348	1,195	654
equity	3,448	1,196	1,346	2,422	3,405	3,054
sales	4,105	3,580	4,661	3,903	3,656	3,971
EBIT&Extraordinary	494	18	683	552	387	692
X_1	0.8363	0.3367	0.4575	0.7185	0.8624	0.7794
X_2	0.8684	0.0127	0.1179	-0.1006	0.3296	0.1840
X_3	0.1368	0.0076	0.2314	0.1595	0.1067	0.1947
X_4	21.2840	1.0196	0.8386	2.3333	15.4072	6.1080
X_5	1.1371	1.5105	1.5795	1.1280	1.0083	1.1173
Z-Score	11.8344	2.2115	3.0755	3.0314	8.7064	5.0001
current assets	3,305	1,875	1,465	4,459	3,305	2,881
total assets	3,757	2,570	2,511	5,079	3,570	3,072
current liability	328	1,069	432	609	318	490
total liabilities	328	1,351	1,539	1,037	400	490
retained earnings	59	69	-26	-663	928	182
equity	3,429	1,219	971	4,042	3,169	2,582
sales	3,583	3,390	3,437	3,778	2890	2,724
EBIT&Extraordinary	524	30	463	1,014	408	423
X_1	0.7924	0.3136	0.4114	0.7580	0.8367	0.7783
X_2	0.0157	0.0268	-0.0104	-0.1305	0.1120	0.0592
X_3	0.1395	0.0117	0.1844	0.1996	0.1143	0.1377
X_4	10.4543	0.9023	0.6309	3.8978	2.9182	5.2694
X_5	0.9537	1.3191	1.3688	0.7438	0.8877	0.8867
Z-Score	6.3574	1.9793	2.4901	3.4327	3.1615	4.1341
Sales fourth year	3906		2501	7656	3070	2724
Sales fifth year	3248		1812	10301	2416	1380
5 Yr Growth Rate	3.35%		32.01%	-19.65%	4.54%	35.18%

	13	14	15	16	17	18
Stock Symbol	DGIX	DYNA	MFCO	WELL	HBW	HOWA
SIC Code	3751	3914	3663	2511	2335	2335
Date of Bankruptcy						
Year of Data	12/31/89	12/31/90	9/30/90	4/30/90	5/31/88	5/31/89
Disclosure Disk Date	Nov-90	Dec-96	Feb-92	Dec-96	Dec-95	Dec-96
current assets	3,523	3,359	3,423	4,204	5,050	5,738
total assets	4,800	4,802	5,769	5,956	6,051	6,695
current liability	2,594	2,484	1,220	1,598	1,026	1,331
total liabilities	3,262	3,209	1,985	3,009	1,501	1,753
retained earnings	787	815	1,789	575	2,255	2,647
equity	1,538	1,593	3,784	2,947	4,550	4,942
sales	7,262	3,973	7,443	6,038	7,585	9,332
EBIT&Extraordinary	169	-33	854	670	230	608
X_1	0.1935	0.1822	0.3819	0.4375	0.6650	0.6583
X_2	0.1640	0.1697	0.3101	0.0965	0.3727	0.3954
X_3	0.0352	-0.0069	0.1480	0.1125	0.0380	0.0908
X_4	0.4715	0.4964	1.9063	0.9794	3.0313	2.8192
X_5	1.5129	0.8274	1.2902	1.0138	1.2535	1.3939
Z-Score	2.0950	1.2873	3.0846	2.1681	3.4347	3.6641
current assets	3,813	3,523	2,349	3,175	4,819	5,050
total assets	4,862	4,800	4,432	4,305	5,870	6,051
current liability	2,914	2,594	763	1,274	1,427	1,026
total liabilities	3,589	3,262	1,474	2,112	1,454	1,501
retained earnings	915	787	1,424	63	2,122	2,255
equity	1,273	1,538	2,958	2,193	4,417	4,550
sales	6,970	7,262	5,793	5,627	8,145	7,585
EBIT&Extraordinary	403	88	762	622	-66	230
X_1	0.1849	0.1935	0.3579	0.4416	0.5779	0.6650
X_2	0.1882	0.1640	0.3213	0.0146	0.3615	0.3727
X_3	0.0829	0.0183	0.1719	0.1445	-0.0112	0.0380
X_4	0.3547	0.4715	2.0068	1.0384	3.0378	3.0313
X_5	1.4336	1.5129	1.3071	1.3071	1.3876	1.2535
Z-Score	2.1292	2.0425	3.2102	2.5185	3.3463	3.4347
current assets	5,840	3813	2,356	2,532	5,055	4,819
total assets	6,364	4862	3,948	3,663	6,142	5,870
current liability	5,034	2914	561	946	1,432	1,427
total liabilities	5,066	3589	1,291	1,912	1,477	1,454
retained earnings	897	915	1,136	-380	2,271	2,122
equity	1,298	1273	2,658	1,751	4,666	4,417
sales	6,498	6970	5,272	4,722	8,701	8,145
EBIT&Extraordinary	429	541	709	488	-464	-66
X_1	0.1266	0.1849	0.4547	0.4330	0.5899	0.5779
X_2	0.1409	0.1882	0.2877	-0.1037	0.3697	0.3615
X_3	0.0674	0.1113	0.1796	0.1332	-0.0755	-0.0112
X_4	0.2562	0.3547	2.0589	0.9158	3.1591	3.0378
X_5	1.0211	1.4336	1.3354	1.2891	1.4166	1.3876
Z-Score	1.5463	2.2174	3.3251	2.3077	3.2420	3.3463
Sales fourth year	2583	6498	4648	4160		
Sales fifth year	2203		5301			
5 Yr Growth Rate	34.74%		8.85%			

	19	20	21	22	23	24
Stock Symbol	WTRS	ASYS	LDII	D.CKC	STLO	KITS
SIC Code	3672	3679	3610	3561	3324	2834
Date of Bankruptcy						
Year of Data	1/31/90	9/30/89	6/30/90	6/30/90	9/30/90	9/30/88
Disclosure Disk Date	Nov-90	Nov-90	Nov-90	Feb-92	Nov-90	Nov-90
current assets	5,985	6,185	3,707	4,343	4,364	5,240
total assets	7,329	7,476	7,915	8,012	8,715	8,969
current liability	1,712	2,556	2,446	2,416	1,404	557
total liabilities	1,805	2,710	3,255	2,805	1,950	973
retained earnings	4,172	645	462	2,343	3,628	3,593
equity	5,524	4,766	4,660	5,207	5,122	7,996
sales	12,321	22,230	5,421	13,360	13,467	5,648
EBIT&Extraordinary	168	1,584	474	2,109	911	231
X_1	0.5830	0.4854	0.1593	0.2405	0.3396	0.5221
X_2	0.5692	0.0863	0.0584	0.2924	0.4163	0.4006
X_3	0.0229	0.2119	0.0599	0.2632	0.1045	0.0258
X_4	3.0604	1.7587	1.4316	1.8563	2.6267	8.2179
X_5	1.6811	2.9735	0.6849	1.6675	1.5453	0.6297
Z-Score	3.9345	4.7856	1.6346	3.6818	3.5663	4.8737
current assets	6,219	4,543	2,247	4,632	4,269	6,217
total assets	7,692	5,602	5,238	7,216	8,772	9,205
current liability	1,829	1,809	1,602	2,662	1,744	871
total liabilities	2,137	2,138	2,400	3,047	2,375	1,404
retained earnings	4,203	-338	332	1,305	3,409	3,397
equity	5,555	3,464	3	4,169	4,903	7,801
sales	12,300	10,794	4,204	11,455	14,263	5,195
EBIT&Extraordinary	-26	497	210	1,832	1,469	604
X_1	0.5707	0.4880	0.1231	0.2730	0.2878	0.5808
X_2	0.5464	-0.0603	0.0634	0.1808	0.3886	0.3690
X_3	-0.0034	0.0887	0.0401	0.2539	0.1675	0.0656
X_4	2.5994	1.6202	0.0012	1.3682	2.0644	5.5563
X_5	1.5991	1.9268	0.8026	1.5874	1.6260	0.5644
Z-Score	3.5491	3.1779	1.0680	3.2967	3.5456	3.8297
current assets	5,713	3,058	1,697	3,738	3,640	7,252
total assets	7,306	3,319	3,653	6,154	7,981	9,006
current liability	1,919	426	1,314	2,378	1,982	1,027
total liabilities	4,035	426	1,406	2,762	2,545	1,673
retained earnings	5,387	-783	295	528	2,658	2,930
equity	7,306	2,893	2,247	3,392	4,152	7,333
sales	12,210	3,570	2,530	10,146	12,335	6,261
EBIT&Extraordinary	650	298	233	1,484	932	2,580
X_1	0.5193	0.7930	0.1048	0.2210	0.2077	0.6912
X_2	0.7373	-0.2359	0.0808	0.0858	0.3330	0.3253
X_3	0.0890	0.0898	0.0638	0.2411	0.1168	0.2865
X_4	1.8107	6.7911	1.5982	1.2281	1.6314	4.3831
X_5	1.6712	1.0756	0.6926	1.6487	1.5455	0.6952
Z-Score	3.7016	4.5735	1.7042	3.1415	3.0215	4.1960
Sales fourth year	11909	3673	1824	9347	11532	4926
Sales fifth year	10805	4583	1586	10065	9694	
5 Yr Growth Rate	3.34%	48.40%	35.97%	7.34%	8.57%	

	25	26	27	28	29	30
Stock Symbol	PVNA	QUIP	DKEY	VTC	DESI	D.MAB
SIC Code	2013	3559	3571	3548	3566	3089
Date of Bankruptcy						
Year of Data	12/31/89	12/31/90	12/31/90	12/31/90	8/31/87	12/31/90
Disclosure Disk Date	Nov-90	Feb-92	Feb-92	Feb-92	Dec-96	Feb-92
current assets	5,879	8,011	11,035	9,979	11,233	13,722
total assets	9,475	11,471	11,768	12,392	13,975	15,252
current liability	2,423	1,487	1,210	3,281	2,063	3,292
total liabilities	2,505	3,487	1,257	5,865	4,405	3,658
retained earnings	3,258	3,373	4,278	2,407	993	8,202
equity	6,970	7,984	10,511	3,527	9,570	11,594
sales	34,254	12,589	8,659	18,168	21,792	34,758
EBIT&Extraordinary	1,973	-66	3,241	922	489	3,712
X_1	0.3647	0.5687	0.8349	0.5405	0.6562	0.6838
X_2	0.3439	0.2940	0.3635	0.1942	0.0711	0.5378
X_3	0.2082	-0.0058	0.2754	0.0744	0.0350	0.2434
X_4	2.7824	2.2896	8.3620	0.6014	2.1725	3.1695
X_5	3.6152	1.0975	0.7358	1.4661	1.5594	2.2789
Z-Score	5.9763	2.6959	6.0086	2.4990	3.1081	5.3075
current assets	5,923	9,365	10,088	10,771	10,810	10,221
total assets	9,598	12,117	10,834	13,373	14,453	11,560
current liability	2,112	2,001	1,112	3,675	1,595	1,553
total liabilities	3,433	4,101	1,152	7,216	4,945	2,039
retained earnings	2,462	3,404	2,106	2,040	1,347	6,601
equity	6,165	8,015	9,682	6,157	9,508	9,521
sales	31,276	12,778	9,833	20,575	19,320	31,455
EBIT&Extraordinary	1,475	-939	4,226	1,337	-504	3,396
X_1	0.3971	0.6077	0.8285	0.5306	0.6376	0.7498
X_2	0.2565	0.2809	0.1944	0.1525	0.0932	0.5710
X_3	0.1537	-0.0775	0.3901	0.1000	-0.0349	0.2938
X_4	1.7958	1.9544	8.4045	0.8532	1.9228	4.6694
X_5	3.2586	1.0546	0.9076	1.5385	1.3367	2.7210
Z-Score	4.9858	2.3062	6.4063	2.7141	2.5694	6.6108
current assets	5,041	9,467	6,608	9,626	10,222	9,256
total assets	8,687	12,245	7,211	12,444	13,667	10,762
current liability	1,620	1,354	745	3,330	1,437	2,246
total liabilities	2,997	3,554	745	7,107	3,570	2,828
retained earnings	1,924	4,080	-1,110	1,213	2,399	5,013
equity	5,690	8,691	6,465	5,337	10,097	7,933
sales	31,168	15,290	8,644	16,544	19,668	25,497
EBIT&Extraordinary	1,773	2,115	3,403	703	740	2,479
X_1	0.3938	0.6626	0.8131	0.5059	0.6428	0.6514
X_2	0.2215	0.3332	-0.1539	0.0975	0.1755	0.4658
X_3	0.2041	0.1727	0.4719	0.0565	0.0541	0.2303
X_4	1.8986	2.4454	8.6779	0.7509	2.8283	2.8052
X_5	3.5879	1.2487	1.1987	1.3295	1.4391	2.3692
Z-Score	5.4822	3.5672	6.7599	2.2631	3.4019	5.1199
Sales fourth year	24774	12155	3767	10527		19266
Sales fifth year	23889	9207	1706	7162		16490
5 Yr Growth Rate	9.43%	8.14%	50.10%	26.20%		20.49%

	31	32	33	34	35	36
Stock Symbol	AROS	ADMG	D.BBW	MCCL	TSNG	VUL
SIC Code	3564	2835	2337	3469	3674	3069
Date of Bankruptcy						
Year of Data	12/31/89	9/30/88	10/31/90	9/30/89	12/31/90	12/31/90
Disclosure Disk Date	Nov-90	Nov-90	Feb-90	Nov-90	Feb-92	Feb-92
current assets	12,075	11175	15,167	14,806	20,244	15,500
total assets	16,387	16937	18,090	20,450	22,484	22,870
current liability	1,855	1204	6,879	6,667	4,352	2,153
total liabilities	1,855	1527	9,886	11,381	4,472	4,671
retained earnings	10,691	5054	2,146	7,319	15,829	19,806
equity	14,532	15410	8,204	9,069	18,012	18,199
sales	2,747	6908	50,354	31,314	38,353	20,983
EBIT&Extraordinary	905	1525	3,103	484	9,585	1,813
X_1	0.6237	0.5748	0.4582	0.3980	0.7068	0.5836
X_2	0.6524	0.2586	0.1186	0.3579	0.7040	0.8660
X_3	0.0552	0.1057	0.1715	0.0237	0.4263	0.0793
X_4	7.8340	11.6538	0.8299	0.7969	4.0277	3.8962
X_5	0.1676	0.4035	2.7835	1.5312	1.7058	0.9175
Z-Score	4.6289	6.2567	4.0884	2.5249	5.8216	3.9503
current assets	11,388	9,856	10,249	13,655	12,663	16,723
total assets	15,890	15,463	12,785	19,042	14,589	22,740
current liability	1,614	968	3,138	5,384	2,472	3,558
total liabilities	1,741	1,222	6,532	10,047	2,613	4,790
retained earnings	10,288	3,998	367	7,493	9,719	19,544
equity	14,149	14,241	6,254	8,995	11,975	17,949
sales	2,462	6,239	41,006	33,408	31,136	23,844
EBIT&Extraordinary	251	1,634	2,905	3,263	8,019	3,117
X_1	0.6151	0.5748	0.5562	0.4344	0.6985	0.5789
X_2	0.6475	0.2586	0.0287	0.3935	0.6662	0.8595
X_3	0.0158	0.1057	0.2272	0.1714	0.5497	0.1371
X_4	8.1269	11.6538	0.9574	0.8953	4.5829	3.7472
X_5	0.1549	0.4035	3.2074	1.7544	2.1342	1.0485
Z-Score	4.6064	6.2567	4.7321	3.3041	6.8277	4.1892
current assets	15,784	8,581	8,844	10,439	9,547	15,930
total assets	20,616	14,489	11,463	14,937	10,708	22,546
current liability	5,269	821	3,885	6,035	4,472	3,578
total liabilities	5,411	989	6,965	7,699	4,971	4,853
retained earnings	11,157	2,997	-1,383	6,015	4,569	18,625
equity	15,205	13,500	4,499	7,238	5,737	17,693
sales	12,141	4,111	31,706	26,584	21,481	24,098
EBIT&Extraordinary	1,917	1,654	1,736	2,631	5,006	2,070
X_1	0.5100	0.5356	0.4326	0.2948	0.4739	0.5479
X_2	0.5412	0.2068	-0.1206	0.4027	0.4267	0.8261
X_3	0.0930	0.1142	0.1514	0.1761	0.4675	0.0918
X_4	2.8100	13.6502	0.6459	0.9401	1.1541	3.6458
X_5	0.5889	0.2837	2.7659	1.7797	2.0061	1.0688
Z-Score	2.8809	6.9301	3.7102	3.2708	4.6405	3.9757
Sales fourth year	4630	2774	14533	23153	11066	28657
Sales fifth year	6103	2534	20174	17234	4256	21974
5 Yr Growth Rate	-18.09%	25.26%	25.69%	16.10%	73.26%	-1.15%

	37	38	39	40	41	42
Stock Symbol	CABL	HOW	WLKR	FICI	GPAR	D.AUB
SIC Code	3357	3465	3143	3577	3577	3845
Date of Bankruptcy						
Year of Data	10/31/90	7/31/89	10/28/89	9/30/89	10/31/90	7/31/90
Disclosure Disk Date	Feb-92	Nov-90	Nov-90	Nov-90	Feb-92	Feb-92
current assets	15,135	20,279	23,866	20,755	27,933	16,349
total assets	23,007	25,400	25,418	25,883	29,768	31,983
current liability	4,958	4,280	16,237	5,744	2,259	3,850
total liabilities	9,579	5,240	19,222	7,470	2,259	6,514
retained earnings	1,680	28,067	1,692	9,932	14,438	8,166
equity	13,428	20,160	6,154	18,413	27,509	25,469
sales	25,078	65,075	42,998	23,239	14,148	26,445
EBIT&Extraordinary	3,085	5,325	2,155	3,156	583	2,948
X_1	0.4423	0.6299	0.3001	0.5800	0.8625	0.3908
X_2	0.0730	1.1050	0.0666	0.3837	0.4850	0.2553
X_3	0.1341	0.2096	0.0848	0.1219	0.0196	0.0922
X_4	1.4018	3.8473	0.3202	2.4649	12.1775	3.9099
X_5	1.0900	2.5620	1.6916	0.8978	0.4753	0.8268
Z-Score	2.4722	6.2117	2.3577	3.0510	6.6789	3.2502
current assets	12,644	18,864	21,694	21,928	29,678	14,670
total assets	15,844	21,198	23,455	24,486	31,394	27,519
current liability	2,514	5,523	15,842	5214	3,047	2,571
total liabilities	4,388	6,849	17,699	7,678	3,047	4,463
retained earnings	706	25,525	1,256	8,512	15,388	6,274
equity	11,456	17,349	5,714	16,808	28,347	23,056
sales	22,167	52,952	40,040	21,015	24,209	18,550
EBIT&Extraordinary	1,914	6,172	1,056	3,730	4,427	310
X_1	0.6394	0.6294	0.2495	0.6826	0.8483	0.4397
X_2	0.0446	1.2041	0.0535	0.3476	0.4902	0.2280
X_3	0.1208	0.2912	0.0450	0.1523	0.1410	0.0113
X_4	2.6108	2.5331	0.3228	2.1891	9.3032	5.1660
X_5	1.3991	2.4980	1.7071	0.8582	0.7711	0.6741
Z-Score	3.3643	5.9326	2.2034	3.0331	6.1385	3.3858
current assets	6,556	17,323	21,296	19,429	27,824	16,863
total assets	8,953	20,638	23,240	21,308	29,188	26,109
current liability	1,775	4,810	16,322	3,206	3,900	1,988
total liabilities	4,848	6,380	18,677	6,479	3,912	3,700
retained earnings	249	22,495	41	6,138	12,361	5,884
equity	4,105	14,257	4,460	14,829	25,276	22,049
sales	16,664	50,950	33,852	18,109	24,679	16,008
EBIT&Extraordinary	1,078	7,289	1,287	3,955	6,016	2,243
X_1	0.5340	0.6063	0.2140	0.7614	0.8197	0.5697
X_2	0.0278	1.0900	0.0018	0.2881	0.4235	0.2254
X_3	0.1204	0.3532	0.0554	0.1856	0.2061	0.0859
X_4	0.8467	2.2346	0.2388	2.2888	6.4611	5.9592
X_5	1.8613	2.4687	1.4566	0.8499	0.8455	0.6131
Z-Score	2.9937	5.8576	1.8810	3.1760	5.1443	3.9811
Sales fourth year	5503	42257	31776	14832	22839	1670
Sales fifth year	1557	38474	29954	11416	20675	60
5 Yr Growth Rate	100.33%	14.04%	9.46%	19.45%	-9.05%	358.19%

	43	44	45	46	47	48
Stock Symbol	GIB	CIMC	ANDO	PATK	D.DTZ	BPMI
SIC Code	2782	3089	2369	2434	2514	2621
Date of Bankruptcy						
Year of Data	12/31/89	4/30/90	11/30/88	12/31/89	6/30/89	12/31/89
Disclosure Disk Date	Nov-90	Nov-90	Dec-96	Nov-90	Nov-90	Nov-90
current assets	23,016	16556	32,069	21,038	31,851	24,052
total assets	37,487	38289	41,810	43,273	49,282	50,614
current liability	5,577	7672	15,253	7,814	13,824	8,145
total liabilities	22,059	14480	26,353	25,288	36,683	22,971
retained earnings	14,180	15951	5,947	7,156	7,421	26,094
equity	15,428	23810	15,398	17,984	12,599	27,643
sales	53,876	57400	71,376	146,921	84,327	74,763
EBIT&Extraordinary	5,262	4080	2,259	2,780	469	8,626
X_1	0.4652	0.1965	0.4022	0.3056	0.3658	0.3143
X_2	0.3783	0.3824	0.1422	0.1654	0.1506	0.5155
X_3	0.1404	0.1571	0.0540	0.0642	0.0095	0.1704
X_4	0.6994	1.8707	0.5843	0.7112	0.3435	1.2034
X_5	1.4372	1.3993	1.7072	3.3952	1.7111	1.4771
Z-Score	2.8181	3.1352	2.5259	4.2459	2.2713	3.1711
current assets	14,441	15,605	30,920	23,585	35,023	24,620
total assets	27,601	37,232	38,317	44,461	51,581	48,471
current liability	7,235	7,752	15,696	8,245	16,480	10,008
total liabilities	14,534	15,427	22,968	26,804	36,462	25,081
retained earnings	12,292	13,947	5,735	6,699	9,943	21,880
equity	13,067	21,806	15,349	17,657	15,119	23,390
sales	46,235	55,017	63,692	148,126	65,007	72,157
EBIT&Extraordinary	4,012	6,044	2,476	5,051	5,390	7,701
X_1	0.2611	0.2109	0.3973	0.3450	0.3595	0.3015
X_2	0.4453	0.3746	0.1497	0.1507	0.1928	0.4514
X_3	0.1454	0.1623	0.0646	0.1136	0.1045	0.1589
X_4	0.8991	1.4135	0.6683	0.6587	0.4147	0.9326
X_5	1.6751	1.4777	1.6622	3.3316	1.2603	1.4887
Z-Score	3.0654	3.0413	2.5520	4.3296	2.1776	2.9695
current assets	11,514	11,327	24,116	21,899	15,299	16,947
total assets	23,050	28,078	29,424	40,353	19,874	40,726
current liability	4,005	5,810	11,405	8,333	5,897	5,945
total liabilities	9,430	9,781	14,784	24,963	6,660	20,928
retained earnings	10,979	10,737	4,960	5,965	8,076	18,198
equity	13,621	18,297	14,640	15,389	13,214	19,798
sales	39,366	39,290	51,257	127,057	44,423	59,814
EBIT&Extraordinary	3,427	4,412	4,604	3,793	5,571	3,248
X_1	0.3258	0.1965	0.4320	0.3362	0.4731	0.2701
X_2	0.4763	0.3824	0.1686	0.1478	0.4064	0.4468
X_3	0.1497	0.1571	0.1565	0.0940	0.2803	0.0798
X_4	1.4444	1.8707	0.9903	0.6165	1.9841	0.9460
X_5	1.7079	1.3993	1.7420	3.1486	2.2352	1.4687
Z-Score	3.4101	3.1352	3.0931	4.0596	4.6184	2.6830
Sales fourth year	31146	33532		120773	39957	51366
Sales fifth year	28220	26187		122105	31405	49072
5 Yr Growth Rate	17.55%	10.67%		4.73%	28.01%	11.10%

	49	50	51	52	53	54
Stock Symbol	SIGN	D.EPT	BSH	SBS	PSI	MLD
SIC Code	3993	3549	2511	3549	3661	3792
Date of Bankruptcy						
Year of Data	12/31/89	9/30/89	12/31/88	12/31/90	12/31/90	12/31/90
Disclosure Disk Date	Nov-90	Nov-90	Nov-90	Feb-92	Feb-92	Feb-92
current assets	32,060	43,448	38,325	53,532	52,920	41,760
total assets	53,263	57,133	58,683	65,835	66,523	67,303
current liability	19,590	6,786	24,709	32,196	11,917	15,188
total liabilities	32,615	24,337	35,951	36,463	29,947	38,089
retained earnings	18,646	32,146	17,535	21,840	30,986	16,626
equity	20,648	32,796	22,732	29,162	36,576	29,214
sales	89,464	57,226	93,848	124,553	71,842	168,910
EBIT&Extraordinary	8,208	5,072	8,041	2,789	9,421	6,542
X_1	0.2341	0.6417	0.2320	0.3241	0.6164	0.3948
X_2	0.3501	0.5627	0.2988	0.3317	0.4658	0.2470
X_3	0.1541	0.0888	0.1370	0.0424	0.1416	0.0972
X_4	0.6331	1.3476	0.6323	0.7998	1.2214	0.7670
X_5	1.6797	1.0016	1.5992	1.8919	1.0800	2.5097
Z-Score	2.8854	2.7781	2.7068	2.8690	2.8672	3.6211
current assets	31,189	52,571	34,340	45,656	49,207	38,504
total assets	51,666	63,823	53,390	58,068	59,665	64,840
current liability	13,748	9,025	23,480	26,496	10,352	12,001
total liabilities	34,745	31,880	34,983	30,777	28,373	37,548
retained earnings	14,924	31,271	13,493	20,184	24,154	14,654
equity	16,921	31,943	18,407	27,154	31,292	27,292
sales	76,552	43,182	93,475	120,766	62,309	195,976
EBIT&Extraordinary	7,115	10,677	11,788	3,150	7,910	10,464
X_1	0.3376	0.6823	0.2034	0.3300	0.6512	0.4087
X_2	0.2889	0.4900	0.2527	0.3476	0.4048	0.2260
X_3	0.1377	0.1673	0.2208	0.0542	0.1326	0.1614
X_4	0.4870	1.0020	0.5262	0.8823	1.1029	0.7269
X_5	1.4817	0.6766	1.7508	2.0797	1.0443	3.0225
Z-Score	2.5978	2.5200	3.0142	3.1457	2.7272	4.3076
current assets	31,027	52,040	27,229	18,271	46,862	42,862
total assets	54,186	56,560	46,916	56,912	54,909	69,665
current liability	16,062	9,080	21,380	28,754	11,261	21,058
total liabilities	39,472	29,450	34,229	31,226	29,289	46,225
retained earnings	12,747	26,203	7,942	18,271	18,368	10,478
equity	14,714	27,109	12,688	25,564	25,620	23,440
sales	66,503	44,375	65,403	92,400	57,955	192,923
EBIT&Extraordinary	5,420	13,269	6,598	5,204	6,774	14,136
X_1	0.2762	0.7595	0.1247	-0.1842	0.6484	0.3130
X_2	0.2352	0.4633	0.1693	0.3210	0.3345	0.1504
X_3	0.1000	0.2346	0.1406	0.0914	0.1234	0.2029
X_4	0.3728	0.9205	0.3707	0.8187	0.8747	0.5071
X_5	1.2273	0.7846	1.3940	1.6236	1.0555	2.7693
Z-Score	2.0895	2.8355	2.2167	2.3881	2.5523	3.9590
Sales fourth year	57976	37085		86674	50357	144812
Sales fifth year	39306	31965		77927	40709	84842
5 Yr Growth Rate	22.83%	15.67%		12.44%	15.26%	18.78%

	Mean	Mean times weight
Stock Symbol		
SIC Code		
Date of Bankruptcy		
Year of Data		
Disclosure Disk Date		
current assets		
total assets		
current liability		
total liabilities		
retained earnings		
equity		
sales		
EBIT&Extraordinary		
X_1	0.5040	0.3614
X_2	0.3403	0.2882
X_3	0.1279	0.3975
X_4	3.3626	1.4123
X_5	1.4419	1.4390
		3.8984
Z-Score	3.8984	

current assets		
total assets		
current liability		
total liabilities		
retained earnings		
equity		
sales		
EBIT&Extraordinary		
X_1	0.5017	0.3597
X_2	0.2930	0.2482
X_3	0.0940	0.2919
X_4	3.2246	1.3543
X_5	1.6098	1.6066
		3.8607
Z-Score	3.8607	

current assets		
total assets		
current liability		
total liabilities		
retained earnings		
equity		
sales		
EBIT&Extraordinary		
X_1	0.4733	0.3394
X_2	0.2530	0.2143
X_3	0.1330	0.4131
X_4	2.6554	1.1153
X_5	1.5006	1.4976
		3.5796
Z-Score	3.5796	

Sales fourth year
Sales fifth year

5 Yr Growth Rate

TABLE E-3

BANKRUPT FIRMS 1991-1996

Bankrupt firm	1	2	3	4	5	6
Period 1991-1996						
Stock Symbol	GAPI	FPHI	RYDN	D.AFV	PRTC	D.RSU
SIC Code	3812	2834	3661	3679	3825	3567
Date of Bankruptcy	9/21/93	5/18/95	.4/28/94	1/6/93	8/27/93	8/3/95
Year of Data	12/31/92	9/30/94	1/31/94	6/30/91	6/30/92	9/30/94
Disclousure Disk Date	Sep-94	Dec-96	Dec-95	Dec-93	Dec-93	Dec-95
current assets	178	326	1,140	852	553	1,126
total assets	209	535	1,355	1,355	1,369	1,413
current liability	311	1,032	3,425	979	546	1,464
total liabilities	377	1,032	3,613	1,018	563	1,464
retained earnings	-3,176	-14,824	-9,486	-15,310	-3,485	-3,032
equity	-168	-497	-2,258	337	807	-51
sales	882	787	4,967	3,991	2,195	2,219
EBIT&Extraordinary	-140	-2,072	-4,803	-1,506	-360	-612
X1	-0.6364	-1.3196	-1.6863	-0.0937	0.0051	-0.2392
X2	-15.1962	-27.7084	-7.0007	-11.2989	-2.5457	-2.1458
X3	-0.6699	-3.8729	-3.5446	-1.1114	-0.2630	-0.4331
X4	-0.4456	-0.4816	-0.6250	0.3310	1.4334	-0.0348
X5	4.2201	1.4710	3.6657	2.9454	1.6034	1.5704
Z-Score Year 1	-11.3842	-35.1825	-14.7561	-10.0121	-0.7674	-1.7821
current assets	354	850	2,794	1,965	683	1,603
total assets	391	1,278	3,127	2,701	1,505	2,041
current liability	306	875	1,955	804	1,137	1,435
total liabilities	405	887	2,203	844	1,206	1,435
retained earnings	-3,022	-12,748	-4,049	-13,789	-3,078	-2,376
equity	-12	391	924	1,857	299	605
sales	1,328	785	7,016	4,622	1,248	3,916
EBIT&Extraordinary	102	-3,946	865	-1,861	-1,646	202
X1	0.1228	-0.0196	0.2683	0.4298	-0.3017	0.0823
X2	-7.7289	-9.9750	-1.2949	-5.1051	-2.0452	-1.1641
X3	0.2609	-3.0876	0.2766	-0.6890	-1.0937	0.0990
X4	-0.0296	0.4408	0.4194	2.2002	0.2479	0.4216
X5	3.3964	0.6142	2.2437	1.7112	0.8292	1.9187
Z-Score Year 2	-2.2707	-17.2580	2.3705	-3.5247	-4.4149	1.4724
current assets	165	3,529	2,185	3,511	1,842	1,832
total assets	311	4,721	2,531	4,667	2,695	2,199
current liability	281	507	2,142	946	634	1,695
total liabilities	494	551	2,431	946	634	1,695
retained earnings	-3,191	-8,792	-4,761	-11,915	-1,286	-2,477
equity	-183	4,170	100	3,721	2,060	504
sales	767	401	3,620	8,064	2,040	3,938
EBIT&Extraordinary	-301	-3,016	-3,873	909	-728	-829
X1	-0.3730	0.6401	0.0170	0.5496	0.4482	0.0623
X2	-10.2605	-1.8623	-1.8811	-2.5530	-0.4772	-1.1264
X3	-0.9678	-0.6388	-1.5302	0.1948	-0.2701	-0.3770
X4	-0.3704	7.5681	0.0411	3.9334	3.2492	0.2973
X5	2.4662	0.0849	1.4303	1.7279	0.7570	1.7908
Z-Score Year 3	-9.6594	0.1600	-4.8908	2.2133	1.1980	-0.1686
Sales fourth year	1144	148	5965	7481	1978	6411
Sales fifth year	1198	5	4138	8515	1109	7388
5 Yr Growth Rate	-7.37%	254.20%	4.67%	-17.26%	18.61%	-25.97%

	7	8	9	10	11	12
Stock Symbol	CEXY	PEPI	CSMT	D.BEF	NATTQ	D.ACQ
SIC Code	3578	3679	3567	3845	3443	3535
Date of Bankruptcy	3/31/95	10/30/92	10/6/95	3/31/92	4/19/96	12/9/94
Year of Data	12/31/93	10/31/91	12/31/94	11/30/91	12/31/95	6/30/94
Disclousure Disk Date	Dec-95	Dec-93	Dec-95	Dec-93	Dec-96	Dec-95
current assets	842	1,168	635	1,966	1,209	1,664
total assets	1,419	1,431	1,435	2,034	2,070	2,157
current liability	1,106	1,210	1,410	1,598	5,725	1,588
total liabilities	1,276	1,379	2,152	1,897	5,737	1,588
retained earnings	-15,570	-38,485	-10,618	-6,077	-6,715	-9,664
equity	143	51	-717	137	-3,667	569
sales	1,013	3,421	4,310	2,065	3,684	695
EBIT&Extraordinary	-1,182	-454	-96	-386	-1,726	-3,126
X1	-0.1860	-0.0294	-0.5401	0.1809	-2.1816	0.0352
X2	-10.9725	-26.8938	-7.3993	-2.9877	-3.2440	-4.4803
X3	-0.8330	-0.3173	-0.0669	-0.1898	-0.8338	-1.4492
X4	0.1121	0.0370	-0.3332	0.0722	-0.6392	0.3583
X5	0.7139	2.3906	3.0035	1.0152	1.7797	0.3222
Z-Score Year 1	-11.2557	-21.3844	-4.0048	-1.9470	-5.3948	-7.8003
current assets	747	1,150	3,237	1,878	1,893	1,781
total assets	1,537	1,517	4,204	2,001	3,116	2,635
current liability	786	695	5,279	1,428	4,558	1,083
total liabilities	3,450	945	6,109	1,546	4,581	1,083
retained earnings	-14,272	-37,964	-11,801	-5,577	-4,513	-9,416
equity	-1,912	572	-1,905	455	-1,466	1,552
sales	735	3,743	4,371	1,885	7,188	1,669
EBIT&Extraordinary	-1,745	75	-580	-772	198	-1,094
X1	-0.0254	0.2999	-0.4857	0.2249	-0.8553	0.2649
X2	-9.2856	-25.0257	-2.8071	-2.7871	-1.4483	-3.5734
X3	-1.1353	0.0494	-0.1380	-0.3858	0.0635	-0.4152
X4	-0.5542	0.6053	-0.3118	0.2943	-0.3200	1.4331
X5	0.4782	2.4674	1.0397	0.9420	2.3068	0.6334
Z-Score Year 2	-11.1661	-18.1115	-2.2479	-2.3344	0.5253	-2.8927
current assets	981	1,217	3,925	2,063	1,379	1,438
total assets	2,007	1,996	5,027	2,288	2,697	1,935
current liability	1,748	1,429	5,081	1,094	1,931	88
total liabilities	1,903	1,429	5,997	1,334	3,966	88
retained earnings	-12,124	-37,969	-10,846	-4,714	-4,317	-5,307
equity	104	567	-969	954	-1,269	1,848
sales	755	4,258	7,609	2,836	4,645	653
EBIT&Extraordinary	-1,855	74	-1,536	210	-488	-582
X1	-0.3822	-0.1062	-0.2300	0.4235	-0.2047	0.6977
X2	-6.0409	-19.0225	-2.1575	-2.0603	-1.6007	-2.7426
X3	-0.9243	0.0371	-0.3056	0.0918	-0.1809	-0.3008
X4	0.0547	0.3968	-0.1616	0.7151	-0.3200	21.0000
X5	0.3762	2.1333	1.5136	1.2395	1.7223	0.3375
Z-Score Year 3	-7.8639	-13.7774	-1.4989	0.3811	-0.4802	6.3995
Sales fourth year	476	4772	19220	2734	8064	1814
Sales fifth year	783	5653	27497	1422	7750	4521
5 Yr Gowth Rate	6.65%	-11.80%	-37.08%	9.78%	-16.97%	-37.38%

	13	14	15	16	17	18
Stock Symbol	FINX	D.SYK	PRCE	MWVL	D.DUO	CELP
SIC Code	3999	3578	3441	3679	3695	2835
Date of Bankruptcy	9/15/93	12/30/91	3/6/96	5/17/94	3/1/92	11/23/94
Year of Data	5/31/92	9/30/91	3/31/95	4/30/93	9/30/91	12/31/93
Disclousure Disk Date	Sep-94	Dec-93	Dec-96	Dec-93	Dec-93	Dec-95
current assets	1,769	1,236	1,850	2,711	485	1,525
total assets	2,316	2,788	3,141	3,144	3,213	3,273
current liability	754	2,524	6,291	4,308	2,309	1,288
total liabilities	754	4,933	6,291	4,308	6,995	1,813
retained earnings	-50,436	-49,707	-10,694	-8,594	-13,015	-10,260
equity	1,562	-2,145	-3,150	-1,164	-3,782	1,459
sales	258	4,956	7,270	7,043	188	2,710
EBIT&Extraordinary	-3,320	-4,359	-7,271	-192	-2,272	-1,354
X1	0.4383	-0.4620	-1.4139	-0.5080	-0.5677	0.0724
X2	-21.7772	-17.8289	-3.4046	-2.7335	-4.0507	-3.1347
X3	-1.4335	-1.5635	-2.3149	-0.0611	-0.7071	-0.4137
X4	2.0716	-0.4348	-0.5007	-0.2702	-0.5407	0.8047
X5	0.1114	1.7776	2.3145	2.2401	0.0585	0.8280
Z-Score Year 1	-21.6037	-18.6986	-8.9902	-0.7470	-6.2037	-2.7242
current assets	958	3,244	3,799	2,721	628	1,650
total assets	1,821	11,365	5,135	3,397	3,799	3,544
current liability	1,327	8,699	3,114	5,605	386	385
total liabilities	1,331	10,015	3,253	5,605	5,113	689
retained earnings	-47,102	-46,212	-3,131	-8,178	-10,546	-8,864
equity	489	1,350	1,882	-2,208	-1,313	2,855
sales	936	14,114	3,924	5,708	702	1,247
EBIT&Extraordinary	-3,383	5,427	-767	263	-3,488	-931
X1	-0.2026	-0.4800	0.1334	-0.8490	0.0637	0.3569
X2	-25.8660	-4.0662	-0.6097	-2.4074	-2.7760	-2.5011
X3	-1.8578	0.4775	-0.1494	0.0774	-0.9181	-0.2627
X4	0.3674	0.1348	0.5785	-0.3939	-0.2568	4.1437
X5	0.5140	1.2419	0.7642	1.6803	0.1848	0.3519
Z-Score Year 2	-27.1586	-1.0085	0.1207	-0.8958	-5.0817	-0.5872
current assets	2,953	7079	266	2,413	1,118	2,759
total assets	3,909	23021	1,354	3,397	5,672	4,840
current liability	1,166	20904	2,190	5,776	2,097	835
total liabilities	2,173	24146	2,190	5,776	4,245	1,408
retained earnings	-43,638	-40549	-2,151	-8,192	-6,762	-8,250
equity	1,737	-1125	-836	-2,564	1,428	3,433
sales	208	11295	356	3,414	2,496	1,132
EBIT&Extraordinary	-7,576	-12835	-1,991	-3,713	-3,213	-478
X1	0.4572	-0.6005	-1.4210	-0.9900	-0.1726	0.3975
X2	-11.1635	-1.7614	-1.5886	-2.4115	-1.1922	-1.7045
X3	-1.9381	-0.5575	-1.4705	-1.0930	-0.5665	-0.0988
X4	0.7994	-0.0466	-0.3817	-0.4439	0.3364	2.4382
X5	0.0532	0.4906	0.2629	1.0050	0.4401	0.2339
Z-Score Year 3	-14.7605	-3.1847	-6.8310	-5.3319	-2.3131	-0.2081
Sales fourth year	134	24702		2697	1795	1497
Sales fifth year	113	18940		4463	870	2166
5 Yr Gowth Rate	22.92%	-28.48%		12.08%	-31.82%	5.76%

	19	20	21	22	23	24
Stock Symbol	CODE	D.RTJ	SONAC	D.ABF	ENVH	D.CNP
SIC Code	3699	3559	3443	3842	3581	3564
Date of Bankruptcy	1/19/95	12/31/93	7/17/96	5/29/92	7/18/94	1/5/93
Year of Data	12/31/93	9/30/92	4/30/95	12/31/91	10/31/93	12/31/92
Disclousure Disk Date	Dec-96	Sep-94	Dec-96	Dec-93	Sep-94	Dec-93
current assets	2,850	2,352	2,568	3,558	370	6,420
total assets	3,475	4,130	4,718	5,410	7,045	8,573
current liability	2,442	1,998	3,551	8,587	3,260	8,515
total liabilities	2,442	3,931	3,556	8,768	3,728	8,515
retained earnings	-24,936	-12,795	-7,898	-6,693	-8,454	-722
equity	1,033	199	1,162	-3,358	3,317	58
sales	6,611	4,878	7,257	14,300	21	3,337
EBIT&Extraordinary	-434	-451	-4,722	-5,897	-4,253	-575
X1	0.1174	0.0857	-0.2084	-0.9296	-0.4102	-0.2444
X2	-7.1758	-3.0981	-1.6740	-1.2372	-1.2000	-0.0842
X3	-0.1249	-0.1092	-1.0008	-1.0900	-0.6037	-0.0671
X4	0.4230	0.0506	0.3268	-0.3830	0.8898	0.0068
X5	1.9024	1.1811	1.5382	2.6433	0.0030	0.3892
Z-Score Year 1	-4.3055	-1.7019	-3.0046	-2.6239	-2.8095	-0.0636
current assets	3,170	3436	1,902	6,299	747	9,964
total assets	3,799	4083	2,612	8,382	7,914	10,654
current liability	2,332	3692	1,104	6,096	2,869	10,165
total liabilities	2,332	5012	1,125	6,349	3,356	10,165
retained earnings	-24,502	-13696	-3,176	-310	-4,677	-5,528
equity	1,467	-929	1,487	2,033	4,559	489
sales	7,117	2563	2,683	12,962	28	31,350
EBIT&Extraordinary	-1,760	-253	-2,605	405	-1,985	-8,751
X1	0.2206	-0.0627	0.3055	0.0242	-0.2681	-0.0189
X2	-6.4496	-3.3544	-1.2159	-0.0370	-0.5910	-0.5189
X3	-0.4633	-0.0620	-0.9973	0.0483	-0.2508	-0.8214
X4	0.6291	-0.1854	1.3218	0.3202	1.3585	0.0481
X5	1.8734	0.6277	1.0272	1.5464	0.0035	2.9426
Z-Score Year 2	-4.6102	-2.5300	-2.3292	1.8140	-0.8980	-0.0482
current assets	5,725	3,659	1,731	3,933	45	14,979
total assets	6,364	6,088	2,120	5,757	4,493	16,853
current liability	3,137	2,401	908	3,966	1,499	4,163
total liabilities	3,137	4,963	941	4,377	1,978	8,063
retained earnings	-22,742	-11,652	-632	-381	-2,481	2,766
equity	3,227	1,125	1,180	1,380	2,515	8,790
sales	9,698	2,150	3,778	10,069	2,181	40,040
EBIT&Extraordinary	-1,028	-227	226	-652	-345	725
X1	0.4067	0.2066	0.3882	-0.0057	-0.3236	0.6418
X2	-3.5735	-1.9139	-0.2981	-0.0662	-0.5522	0.1641
X3	-0.1615	-0.0373	0.1066	-0.1133	-0.0768	0.0430
X4	1.0287	0.2267	1.2540	0.3153	1.2715	1.0902
X5	1.5239	0.3532	1.7821	1.7490	0.4854	2.3758
Z-Score Year 3	-1.2842	-1.1411	2.6622	1.4659	0.0802	3.5618
Sales fourth year	10590	2937	3408	10212		32408
Sales fifth year	8475	2671	3652	7657		17453
5 Yr Gowth Rate	-6.02%	16.25%	18.73%	16.90%		-33.87%

	25	26	27	28	29	30
Stock Symbol	D.BIO	D.ANY	ASI	CICIQ	D.CEK	MTGYQ
SIC Code	3842	3571	3542	3577	2515	3559
Date of Bankruptcy	4/29/93	12/20/91	5/9/91	7/18/94	1/11/96	7/22/94
Year of Data	7/31/92	6/30/91	3/31/91	12/31/93	9/30/94	8/31/93
Disclousure Disk Date	Sep-94	Dec-93	Dec-91	Sep-94	Dec-96	Dec-95
current assets	5,396	6,641	8,590	7,055	7,408	9,576
total assets	9,382	9,700	9,725	10,158	10,389	10,699
current liability	5,960	22,097	15,575	5,148	4,642	2,878
total liabilities	6,277	22,274	15,914	5,469	8,586	8,115
retained earnings	-10,693	-43,103	-6,707	-31,348	-1,607	-7,151
equity	3,105	-12,574	-6,188	4,689	1,803	2,584
sales	6,754	24,143	16,015	2,595	31,547	15,800
EBIT&Extraordinary	-11,236	-22,523	-2,883	-8,227	-972	-1,506
X1	-0.0601	-1.5934	-0.7183	0.1877	0.2662	0.6260
X2	-1.1397	-4.4436	-0.6897	-3.0860	-0.1547	-0.6684
X3	-1.1976	-2.3220	-0.2965	-0.8099	-0.0936	-0.1408
X4	0.4947	-0.5645	-0.3888	0.8574	0.2100	0.3184
X5	0.7199	2.4890	1.6468	0.2555	3.0366	1.4768
Z-Score Year 1	-3.8032	-9.8736 ˙	-0.5400	-4.3806	2.8879	1.0530
current assets	13,962	22,241	9,624	4,902	11,540	13,461
total assets	15,229	35,784	13,271	7,239	15,006	14,957
current liability	1,783	22,462	4,993	3,594	6,623	5,885
total liabilities	2,113	24,979	15,063	3,724	11,790	10,981
retained earnings	221	-19,651	-2,310	-23,049	-45	-5,217
equity	13,117	10,805	-1,791	3,515	3,216	3,976
sales	12,225	56,630	17,490	4,070	40,269	21,119
EBIT&Extraordinary	890	-36,669	-292	-5,022	-1,134	-3,181
X1	0.7997	-0.0062	0.3490	0.1807	0.3277	0.5065
X2	0.0145	-0.5492	-0.1741	-3.1840	-0.0030	-0.3488
X3	0.0584	-1.0247	-0.0220	-0.6937	-0.0756	-0.2127
X4	6.2078	0.4326	-0.1189	0.9439	0.2728	0.3621
X5	0.8027	1.5826	1.3179	0.5622	2.6835	1.4120
Z-Score Year 2	4.1757	-1.8923	1.2997	-3.7652	2.7903	0.9682
current assets	2,934	44,754	12,136	4,804	14,873	18,095
total assets	3,605	53,094	15,516	6,691	19,110	19,378
current liability	1,264	9,174	4,966	2,179	6,976	7,174
total liabilities	1,559	10,366	17,993	2,337	14,026	12,108
retained earnings	-347	13,341	-2,995	-17,935	2,396	-1,546
equity	2,046	42,728	-2,476	4,354	5,084	7,270
sales	7,872	84,973	20,004	1,085	56,015	30,996
EBIT&Extraordinary	716	7,432	780	-4,019	-2,690	4,173
X1	0.4632	0.6701	0.4621	0.3923	0.4132	0.5636
X2	-0.0963	0.2513	-0.1930	-2.6805	0.1254	-0.0798
X3	0.1986	0.1400	0.0503	-0.6007	-0.1408	0.2153
X4	1.3124	4.1219	-0.1376	1.8631	0.3625	0.6004
X5	2.1836	1.6004	1.2892	0.1622	2.9312	1.5995
Z-Score Year 3	3.5982	4.4567	1.5529	-2.9110	3.0427	2.8541
Sales fourth year	4760	60284	22166	904	56499	20911
Sales fifth year	3565	41536	21716	413	59410	19973
5 Yr Gowth Rate	17.32%	-12.68%	-7.33%	58.32%	-14.64%	-5.69%

	31	32	33	34	35	36
Stock Symbol	D.GLS	D.AEB	D.SDN	SMBXQ	D.SDF	D.WXF
SIC Code	2339	3446	3825	3571	3339	3845
Date of Bankruptcy	4/30/95	10/8/91	5/20/94	1/27/93	9/17/93	5/29/96
Year of Data	12/31/93	3/31/91	3/31/94	6/30/92	12/31/92	6/30/95
Disclousure Disk Date	Dec-95	Feb-92	Dec-95	Dec-93	Dec-95	Dec-96
current assets	10,791	7,761	10598	12,277	5,902	8,802
total assets	11,280	11,803	13,685	14,460	14,564	15,659
current liability	5,876	2,785	20,506	8,366	10,067	8,693
total liabilities	5,876	5,439	20,506	11,936	16,524	10,948
retained earnings	1,168	-12,656	-12,009	-85,547	-28,000	-49,414
equity	5,404	6,364	-6,821	2,524	-1,960	4,711
sales	30,513	18,106	21,840	26,461	32,109	8,142
EBIT&Extraordinary	2,192	-164	-7,546	-4,006	77	-50,742
X1	0.4357	0.4216	-0.7240	0.2705	-0.2860	0.0070
X2	0.1035	-1.0723	-0.8775	-5.9161	-1.9225	-3.1556
X3	0.1943	-0.0139	-0.5514	-0.2770	0.0053	-3.2404
X4	0.9197	1.1701	-0.3326	0.2115	-0.1186	0.4303
X5	2.7051	1.5340	1.5959	1.8299	2.2047	0.5200
Z-Score Year 1	4.0898	1.3733	-1.5226	-3.7627	0.3334	-12.0362
current assets	5,689	8,749	14,722	20,167	4,854	14478
total assets	5,864	12,670	18,128	25,758	14,478	33783
current liability	1,415	2,562	15,796	12,161	9,414	3152
total liabilities	1,415	5,731	17,286	18,726	14,570	5737
retained earnings	213	-12,081	-3,780	-80,875	-26,406	1792
equity	4,448	6,939	842	7,032	-92	28046
sales	15,996	20,582	26,579	43,883	29,951	19976
EBIT&Extraordinary	1,559	829	-6,917	-8,891	-124	2642
X1	0.7289	0.4883	-0.0592	0.3108	-0.3150	0.3353
X2	0.0363	-0.9535	-0.2085	-3.1398	-1.8239	0.0530
X3	0.2659	0.0654	-0.3816	-0.3452	-0.0086	0.0782
X4	3.1435	1.2108	0.0487	0.3755	-0.0063	4.8886
X5	2.7278	1.6245	1.4662	1.7037	2.0687	0.5913
Z-Score Year 2	5.4220	1.8755	0.0791	-1.6510	0.2647	3.1716
current assets	2,687	7,975	23,366	26,927	9,388	12,407
total assets	2,755	12,097	25,260	39,514	17,997	26,433
current liability	1,937	2,003	13,309	15,565	9,388	4,606
total liabilities	1,937	5,504	16,703	22,529	16,083	7,958
retained earnings	222	-12,427	4,257	-71,192	-24,020	821
equity	818	6,593	8,557	16,985	17,997	18,475
sales	10,404	17,416	42,133	53,538	30,578	16,000
EBIT&Extraordinary	1,200	-713	-1,132	-4,701	4,489	1,544
X1	0.2722	0.4937	0.3981	0.2875	0.0000	0.2951
X2	0.0806	-1.0273	0.1685	-1.8017	-1.3347	0.0311
X3	0.4356	-0.0589	-0.0448	-0.1190	0.2494	0.0584
X4	0.4223	1.1979	0.5123	0.7539	1.1190	2.3216
X5	3.7764	1.4397	1.6680	1.3549	1.6991	0.6053
Z-Score Year 3	5.5630	1.2406	2.1688	-0.0207	1.8102	1.9985
Sales fourth year	8140	16899	28989	67237	37899	6422
Sales fifth year	361	15327	32718	81339	36777	4890
5 Yr Gowth Rate	203.21%	4.25%	-9.61%	-24.48%	-3.34%	13.59%

	37	38	39	40	41	42
Stock Symbol	EAC	BIOS	MUN	D.IIE	D.TQL	D.SSL
SIC Code	3429	2879	2329	3844	3646	3674
Date of Bankruptcy	2/20/91	9/27/96	7/3/91	7/27/94	2/26/96	11/12/93
Year of Data	1/31/91	12/31/95	1/5/91	3/31/93	12/31/94	7/31/93
Disclousure Disk Date	Feb-92	Dec-96	Dec-93	Dec-95	Dec-96	Dec-95
current assets	8,805	9,350	12,882	7,218	14,232	15,171
total assets	16,079	16,357	16,720	17,309	19,507	22,614
current liability	19,618	15,039	54,570	10,652	9,319	38,045
total liabilities	20,955	18,681	56,434	16,064	14,452	38,635
retained earnings	-15,514	-128,592	-62,203	-14,577	-3,524	-53,401
equity	-4,875	-2,324	-39,714	1,245	5,056	-16,021
sales	31,107	22,999	38,988	18,695	28,120	57,605
EBIT&Extraordinary	-2,998	-17,125	-9,355	2,122	-3,474	439
X1	-0.6725	-0.3478	-2.4933	-0.1984	0.2519	-1.0115
X2	-0.9649	-7.8616	-3.7203	-0.8422	-0.1807	-2.3614
X3	-0.1865	-1.0470	-0.5595	0.1226	-0.1781	0.0194
X4	-0.2326	-0.1244	-0.7037	0.0775	0.3498	-0.4147
X5	1.9346	1.4061	2.3318	1.0801	1.4415	2.5473
Z-Score Year 1	-0.0457	-8.8100	-4.6456	0.6358	1.0598	-0.2970
current assets	15,031	14,463	54,219	7,167	6,682	21,970
total assets	31,689	23,043	77,764	16,219	9,513	30,940
current liability	29,041	4,832	41,001	15,346	1,124	44,737
total liabilities	30,563	9,953	77,816	16,786	3,770	45,826
retained earnings	-9,486	-110,052	-23,750	-16,316	526	-51,264
equity	1,126	13,090	-52	-567	5,743	-14,886
sales	37,415	17,140	42,820	16,641	12,535	59,746
EBIT&Extraordinary	-8,059	-20,787	-4,372	1,378	674	-21,460
X1	-0.4421	0.4180	0.1700	-0.5043	0.5843	-0.7358
X2	-0.2993	-4.7759	-0.3054	-1.0060	0.0553	-1.6569
X3	-0.2543	-0.9021	-0.0562	0.0850	0.0709	-0.6936
X4	0.0368	1.3152	-0.0007	-0.0338	1.5233	-0.3248
X5	1.1807	0.7438	0.5506	1.0260	1.3177	1.9310
Z-Score Year 2	-0.1669	-5.2536	0.2378	0.0601	2.6407	-2.2953
current assets	35,782	17,745	60,919	9,052	1,911	33,466
total assets	48,867	22,258	88,691	16,100	4,366	47,006
current liability	25,248	2,565	36,207	8,768	1,658	44,076
total liabilities	35,630	2,565	73,968	15,849	3,436	44,076
retained earnings	2,751	-38,327	-8,776	-15,456	268	-26,708
equity	13,237	19,693	14,723	241	930	2,930
sales	31,531	12,901	45,669	17,115	6,314	93,310
EBIT&Extraordinary	1,068	-21,331	-5,524	2,934	518	-2,365
X1	0.2156	0.6820	0.2786	0.0176	0.0579	-0.2257
X2	0.0563	-1.7219	-0.0990	-0.9600	0.0614	-0.5682
X3	0.0219	-0.9584	-0.0623	0.1822	0.1186	-0.0503
X4	0.3715	7.6776	0.1990	0.0152	0.2707	0.0665
X5	0.6452	0.5796	0.5149	1.0630	1.4462	1.9851
Z-Score Year 3	1.0701	-0.1441	0.5199	0.8330	2.0191	1.2096
Sales fourth year	30013	4554	128654	16378	5960	97014
Sales fifth year	27911	2614	147851	13742	2663	101062
5 Yr Gowth Rate	2.75%	72.23%	-28.34%	8.00%	80.26%	-13.11%

	43	44	45	46	47	48
Stock Symbol	D.CTI	OPTOQ	QPDC	SPCLQ	D.SXD	D.AQZ
SIC Code	2431	3827	3542	3661	3443	3452
Date of Bankruptcy	5/6/93	10/14/94	9/1/95	1/26/95	1/21/94	9/17/93
Year of Data	6/30/91	6/30/94	9/30/94	3/31/94	12/31/92	9/30/92
Disclousure Disk Date	Dec-93	Dec-95	Dec-95	Dec-95	Sep-94	Dec-93
current assets	13,528	15,815	16,210	23016	10,856	22,288
total assets	24,060	25,991	30,445	30,875	31,608	36,894
current liability	14,629	22,155	10,940	16,262	8,312	2,217
total liabilities	18,146	22,441	12,116	18,088	16,973	51,121
retained earnings	-3,097	-2,339	-6,448	-50,167	3,170	-15,836
equity	5,914	3,551	18,329	12,787	14,479	-14,227
sales	44,815	18,923	36,532	6,384	19,617	16,657
EBIT&Extraordinary	438	8,827	-8,434	-18,018	2,415	-6,525
X1	-0.0458	-0.2439	0.1731	0.2188	0.0805	0.5440
X2	-0.1287	-0.0900	-0.2118	-1.6248	0.1003	-0.4292
X3	0.0182	0.3396	-0.2770	-0.5836	0.0764	-0.1769
X4	0.3259	0.1582	1.5128	0.7069	0.8531	-0.2783
X5	1.8626	0.7281	1.1999	0.2068	0.6206	0.4515
Z-Score Year 1	1.9105	1.5971	0.9169	-2.5293	1.3577	-0.1893
current assets	15,438	17,782	11,401	21,340	8,848	20,983
total assets	27,263	26,645	17,145	26,246	16,252	36,090
current liability	9,196	4,934	3,571	14,719	7,757	38,902
total liabilities	19,722	15,167	3,949	14,906	10,727	40,398
retained earnings	-1,675	5,589	1,408	-24,697	1,990	-5,917
equity	7,540	11,478	13,196	11,340	5,525	-4,308
sales	52,225	37,199	12,176	1,229	11,750	16,044
EBIT&Extraordinary	2,005	2,330	1,106	-7,128	8,750	-13,069
X1	0.2290	0.4822	0.4567	0.2523	0.0671	-0.4965
X2	-0.0614	0.2098	0.0821	-0.9410	0.1224	-0.1640
X3	0.0735	0.0874	0.0645	-0.2716	0.5384	-0.3621
X4	0.3823	0.7568	3.3416	0.7608	0.5151	-0.1066
X5	1.9156	1.3961	0.7102	0.0468	0.7230	0.4446
Z-Score Year 2	2.4130	2.5062	2.7097	-1.0937	2.7625	-1.2211
current assets	14,591	16,972	2,381	31,003	3,400	18,538
total assets	29,540	23,641	4,776	37,499	7,494	60,071
current liability	13,163	3,853	2,261	26,027	3,314	83,316
total liabilities	21,787	13,200	3,780	26,568	6,293	115,867
retained earnings	-1,486	4,551	732	-14,809	723	-57,405
equity	7,753	10,440	996	10,931	1,010	-55,796
sales	49,087	32,622	3,919	82,432	9,730	14,665
EBIT&Extraordinary	1,152	1,656	-1,047	-1,752	1,145	-37,791
X1	0.0483	0.5549	0.0251	0.1327	0.0115	-1.0784
X2	-0.0503	0.1925	0.1533	-0.3949	0.0965	-0.9556
X3	0.0390	0.0700	-0.2192	-0.0467	0.1528	-0.6291
X4	0.3559	0.7909	0.2635	0.4114	0.1605	-0.4816
X5	1.6617	1.3799	0.8206	2.1982	1.2984	0.2441
Z-Score Year 3	1.9211	2.4879	0.3963	1.9821	1.9278	-3.4958
Sales fourth year	45800	32198	4006	109382	2902	3050
Sales fifth year	39364	39174	4384	84196		1493
5 Yr Gowth Rate	3.30%	-16.63%	69.90%	-47.53%		82.76%

	49	50	51	52	53	54
Stock Symbol	SODI	D.AAN	D.DDT	HAPY	LRC	D.AVU
SIC Code	3674	3571	3645	3944	3961	3085
Date of Bankruptcy	1/31/92	5/31/92	10/30/93	9/25/96	4/9/93	6/23/93
Year of Data	2/28/91	12/31/91	12/31/92	3/31/95	12/31/92	9/30/92
Disclousure Disk Date	Sep-94	Dec-93	Sep-94	Dec-96	Dec-93	Sep-94
current assets	22,463	31,524	35,151	37,855	11,801	19,680
total assets	38,159	40,739	41,040	41,373	42,818	43,612
current liability	9,452	16,053	10,736	4,621	7,067	113,019
total liabilities	37,014	56,343	10,825	4,621	70,697	116,713
retained earnings	-24,905	-86,642	2,855	6,344	-89,809	-92,658
equity	1,145	-4,629	30,215	36,752	-27,879	-73,101
sales	22,263	43,824	84,928	60,022	75,484	67,857
EBIT&Extraordinary	-5,241	-6,092	-1,063	12,170	-30,043	-12,694
X1	0.3410	0.3798	0.5949	0.8033	0.1106	-2.1402
X2	-0.6527	-2.1268	0.0696	0.1533	-2.0975	-2.1246
X3	-0.1373	-0.1495	-0.0259	0.2942	-0.7016	-0.2911
X4	0.0309	-0.0822	2.7912	7.9533	-0.3943	-0.6263
X5	0.5834	1.0757	2.0694	1.4508	1.7629	1.5559
Z-Score Year 1	-0.1398	-0.9546	3.6426	6.4080	-2.2835	-2.9487
current assets	31,604	49,485	44,214	3,549	24,206	35,596
total assets	52,488	62,180	50,252	4,518	66,877	65,560
current liability	11,045	25,062	18,504	971	20,604	104,884
total liabilities	41,223	67,190	18,685	971	60,133	114,373
retained earnings	-14,785	-77,192	4,207	3,225	-55,190	-68,370
equity	11,265	-5,010	31,567	3,547	6,744	-48,813
sales	36,857	72,812	94,717	40,109	106,834	109,408
EBIT&Extraordinary	1,872	-29,812	975	7,508	-2,272	-11,588
X1	0.3917	0.3928	0.5116	0.5706	0.0539	-1.0569
X2	-0.2817	-1.2414	0.0837	0.7138	-0.8252	-1.0429
X3	0.0357	-0.4794	0.0194	1.6618	-0.0340	-0.1768
X4	0.2733	-0.0746	1.6894	3.6529	0.1122	-0.4268
X5	0.7022	1.1710	1.8848	8.8776	1.5975	1.6688
Z-Score Year 2	0.9686	-1.1222	3.0887	16.5710	0.8755	-0.7040
current assets	33,470	80,878	32,326	2,976	34,062	46,777
total assets	57,000	93,476	36,596	3,235	78,942	79,110
current liability	37,414	22,936	4,934	1,864	24,331	69,507
total liabilities	44,311	62,395	5,199	1,864	65,095	105,120
retained earnings	-13,361	-42,761	4,044	1,270	-48,091	-45,567
equity	12,689	31,081	31,397	1,371	13,847	-26,010
sales	36,308	68,379	76,908	16,357	114,604	126,514
EBIT&Extraordinary	-7,024	5,707	2,904	1,675	6,706	-5,760
X1	-0.0692	0.6199	0.7485	0.3437	0.1233	-0.2873
X2	-0.2344	-0.4575	0.1105	0.3926	-0.6092	-0.5760
X3	-0.1232	0.0611	0.0794	0.5178	0.0849	-0.0728
X4	0.2864	0.4981	6.0390	0.7355	0.2127	-0.2474
X5	0.6370	0.7315	2.1015	5.0563	1.4517	1.5992
Z-Score Year 3	0.1250	1.1859	5.5106	7.5428	1.3745	0.5720
Sales fourth year	38278	64829	61649	5470	105354	125623
Sales fifth year	49512	73509	32042	5047	91534	132328
5 Yr Gowth Rate	-18.11%	-12.13%	27.59%	85.70%	-4.71%	-15.38%

	55	56	57	58	59	60
Stock Symbol	D.CTW	CCXI	KRSC	CMPX	VICT	FAIR
SIC Code	3089	3496	3571	3661	3961	2512
Date of Bankruptcy	11/5/92	4/28/94	12/30/94	8/8/96	7/2/96	1/3/96
Year of Data	12/31/91	6/31/93	12/25/93	12/31/95	6/30/95	12/31/95
Disclousure Disk Date	Dec-93	Sep-94	Dec-95	Dec-96	Dec-96	Dec-96
current assets	14,584	21,649	38,290	32,254	25268	37,262
total assets	43,671	46,376	47,377	47,711	47,951	53,421
current liability	12,301	34,662	43,466	13,863	5,368	228,077
total liabilities	36,095	49,243	43,466	60,191	39,919	484,356
retained earnings	-135	-44,347	-145,696	-61,641	-25,024	-486,027
equity	7,576	-2,867	3,911	-12,480	8,032	-430,935
sales	49,549	60,435	18,094	92,211	49,863	176,834
EBIT&Extraordinary	-8,640	299	-66,810	231	2,059	-11,827
X1	0.0523	-0.2806	-0.1093	0.3855	0.4150	-3.5719
X2	-0.0031	-0.9562	-3.0752	-1.2920	-0.5219	-9.0981
X3	-0.1978	0.0064	-1.4102	0.0048	0.0429	-0.2214
X4	0.2099	-0.0582	0.0900	-0.2073	0.2012	-0.8897
X5	1.1346	1.3032	0.3819	1.9327	1.0399	3.3102
Z-Score Year 1	0.6406	0.2850	-6.6455	1.0389	1.1113	-8.0251
current assets	17,458	21,582	33,407	30,769	27,341	78,767
total assets	49,539	48,164	40,325	50,476	50,673	95,564
current liability	9,807	20,743	8,795	13,587	3,444	35,246
total liabilities	35,199	48,371	8,795	64,467	41,328	456,142
retained earnings	6,629	-42,046	-78,557	-56,926	-23,711	-415,259
equity	14,340	-207	31,530	-13,991	9,345	-360,578
sales	53,608	56,668	10,066	119,998	42,569	244,869
EBIT&Extraordinary	2,783	2,376	-21,176	-9,976	-453	14,992
X1	0.1544	0.0174	0.6103	0.3404	0.4716	0.4554
X2	0.1338	-0.8730	-1.9481	-1.1278	-0.4679	-4.3453
X3	0.0562	0.0493	-0.5251	-0.1976	-0.0089	0.1569
X4	0.4074	-0.0043	3.5850	-0.2170	0.2261	-0.7905
X5	1.0821	1.1766	0.2496	2.3773	0.8401	2.5624
Z-Score Year 2	1.6497	0.5988	-1.0892	0.9562	0.8474	-0.6413
current assets	15,606	29,046	10,292	49,221	26,490	84,211
total assets	45,437	53,810	13,129	80,923	50,756	113,555
current liability	10,155	22,441	5,828	15,917	21,380	40,874
total liabilities	31,050	53,052	19,749	80,434	39,357	433,334
retained earnings	6,675	-41,405	-56,938	-41,602	-21,657	-375,827
equity	14,386	758	-6,620	489	11,399	-319,779
sales	58,630	57,041	904	184,137	42,179	261,451
EBIT&Extraordinary	-393	-1,575	-22,126	-5,824	-1,591	-2,144
X1	0.1200	0.1227	0.3400	0.4116	0.1007	0.3816
X2	0.1469	-0.7695	-4.3368	-0.5141	-0.4267	-3.3096
X3	-0.0086	-0.0293	-1.6853	-0.0720	-0.0313	-0.0189
X4	0.4633	0.0143	-0.3352	0.0061	0.2896	-0.7380
X5	1.2904	1.0600	0.0689	2.2755	0.8310	2.3024
Z-Score Year 3	1.6659	0.4093	-8.7377	1.9095	0.5644	-0.6004
Sales fourth year	61111	57528		139086	39789	267043
Sales fifth year	53785	39698		88754	40992	341400
5 Yr Gowth Rate	-2.03%	11.08%		0.96%	5.02%	-15.16%

	61	62	63	64	65	66
Stock Symbol	D.GEX	D.FKE	RAY	ASBG	D.CVD	AMER
SIC Code	3555	2087	3292	3731	3792	3842
Date of Bankruptcy	11/1/93	4/19/93	9/14/93	11/30/93	11/8/95	7/17/96
Year of Data	9/30/92	6/30/92	12/31/92	9/30/92	12/31/94	12/31/95
Disclousure Disk Date	Sep-94	Dec-93	Dec-95	Sep-94	Dec-96	Dec-96
current assets	25,573	38,095	34,233	22,369	52,752	44,176
total assets	55,985	56,547	73,287	77,147	77,562	78,416
current liability	46,856	30,738	28,971	40,940	33,634	31,805
total liabilities	57,159	33,658	83,189	81,695	53,175	51,382
retained earnings	-40,895	-5,942	-82,379	-40,823	-9,286	-7,023
equity	-1,174	22,889	-9,902	-4,548	24,387	27,034
sales	38,841	57,874	125,540	91,488	250,505	87,351
EBIT&Extraordinary	-10,220	-1,402	11,065	-6,060	-1,520	-3,001
X1	-0.3802	0.1301	0.0718	-0.2407	0.2465	0.1578
X2	-0.7305	-0.1051	-1.1241	-0.5292	-0.1197	-0.0896
X3	-0.1825	-0.0248	0.1510	-0.0786	-0.0196	-0.0383
X4	-0.0205	0.6800	-0.1190	-0.0557	0.4586	0.5261
X5	0.6938	1.0235	1.7130	1.1859	3.2297	1.1139
Z-Score Year 1	-0.7747	1.2343	1.2281	0.2953	3.4303	1.2510
current assets	38,558	21,124	29,820	12,924	51,188	38,951
total assets	85,455	34,053	65,236	72,436	77,241	68,783
current liability	61,500	13,434	28,797	30,794	23,106	25,294
total liabilities	71,451	30,562	78,858	64,903	50,039	39,141
retained earnings	-23,385	-2,635	-85,792	-29,033	-3,098	-2,329
equity	14,004	3,491	-13,622	7,533	27,202	29,642
sales	45,013	46,923	103,310	73,749	182,897	90,005
EBIT&Extraordinary	-16,560	5,024	7,371	-1,652	3,330	-5,419
X1	-0.2685	0.2258	0.0157	-0.2467	0.3636	0.1986
X2	-0.2737	-0.0774	-1.3151	-0.4008	-0.0401	-0.0339
X3	-0.1938	0.1475	0.1130	-0.0228	0.0431	-0.0788
X4	0.1960	0.1142	-0.1727	0.1161	0.5436	0.7573
X5	0.5267	1.3779	1.5836	1.0181	2.3679	1.3085
Z-Score Year 2	-0.4184	1.9779	0.7563	0.4776	2.9521	1.4929
current assets	65,868	19,613	34,229	13,919	42,164	43,190
total assets	112,414	27,752	72,471	78,209	44,889	71,404
current liability	29,186	13,219	40,538	25,644	46,222	20,442
total liabilities	80,783	26,753	82,650	65,975	46,232	50,974
retained earnings	-4,038	-5,266	-86,916	-23,748	-1,419	2,429
equity	31,631	999	-10,179	12,234	-1,343	20,430
sales	71,182	19,120	120,291	74,373	238,715	76,554
EBIT&Extraordinary	-825	1,290	18,716	-5,849	1,121	4,343
X1	0.3263	0.2304	-0.0871	-0.1499	-0.0904	0.3186
X2	-0.0359	-0.1898	-1.1993	-0.3036	-0.0316	0.0340
X3	-0.0073	0.0465	0.2583	-0.0748	0.0250	0.0608
X4	0.3916	0.0373	-0.1232	0.1854	-0.0290	0.4008
X5	0.6332	0.6890	1.6599	0.9510	5.3179	1.0721
Z-Score Year 3	0.9771	0.8522	1.3290	0.4299	5.2811	1.6845
Sales fourth year	80322	12317	105211	65782	177719	49277
Sales fifth year	79967	8342	120754	70520	105780	44459
5 Yr Gowth Rate	-16.52%	62.29%	0.98%	6.72%	24.05%	18.39%

	67	68	69	70	Mean	Mean times weight
Stock Symbol	CBCX	CHKE	RYR	D.NBG		
SIC Code	2836	2339	2013	3083		
Date of Bankruptcy	7/31/94	11/7/94	2/3/93	8/27/93		
Year of Data	12/31/92	5/28/94	10/31/92	12/31/92		
Disclousure Disk Date	Dec-95	Dec-95	Sep-94	Dec-93		
current assets	34,558	40,632	32,775	49,808		
total assets	83,651	93,700	95,308	99,223		
current liability	15,477	14,115	74,737	189,019		
total liabilities	21,213	105,330	77,199	221,737		
retained earnings	-51,479	-24,830	-27,276	-350,061		
equity	60,695	-11,630	18,109	-122,514		
sales	36,138	114,087	248,329	162,725		
EBIT&Extraordinary	-12,891	-17,222	-1,307	-10,220		
X1	0.2281	0.2830	-0.4403	-1.4030	-0.2857	-0.2049
X2	-0.6154	-0.2650	-0.2862	-3.5280	-3.7104	-3.1427
X3	-0.1541	-0.1838	-0.0137	-0.1030	-0.5383	-1.6726
X4	2.8612	-0.1104	0.2346	-0.5525	0.2941	0.1235
X5	0.4320	1.2176	2.6055	1.6400	1.5424	1.5393
						-3.3573
Z-Score Year 1	0.7964	0.5762	2.0982	-2.9096	-3.3573	
current assets	48,001	52,295	38,616	71,841		
total assets	79,716	124,622	105,082	127,752		
current liability	7,074	16,785	13,908	134,254		
total liabilities	13,450	110,582	78,452	220,344		
retained earnings	-37,960	840	-17,853	-320,139		
equity	66,266	13,200	26,630	-92,592		
sales	28,981	157,299	254,935	205,381		
EBIT&Extraordinary	1,133	-41,692	3,832	-11,042		
X1	0.5134	0.2849	0.2351	-0.4885	0.1015	0.0727
X2	-0.4762	0.0067	-0.1699	-2.5059	-2.2595	-1.9138
X3	0.0142	-0.3345	0.0365	-0.0864	-0.2157	-0.6700
X4	4.9268	0.1194	0.3394	-0.4202	0.7685	0.3228
X5	0.3636	1.2622	2.4261	1.6077	1.4271	1.4243
						-0.7640
Z-Score Year 2	2.4410	0.4804	2.7018	-1.3134	-0.7640	
current assets	17,994	77,436	42,312	36,737		
total assets	44,268	214,198	109,216	72,974		
current liability	5,411	158,671	17,309	26,474		
total liabilities	11,864	198,097	77,675	105,059		
retained earnings	-38,308	-19,348	-12,160	-256,139		
equity	32,404	15,547	31,541	-32,085		
sales	21,854	194,944	254,689	236,446		
EBIT&Extraordinary	-9,694	15,669	6,919	-12,334		
X1	0.2842	-0.3793	0.2289	0.1406	0.1391	0.0997
X2	-0.8654	-0.0903	-0.1113	-3.5100	-1.5069	-1.2763
X3	-0.2190	0.0732	0.0634	-0.1690	-0.1911	-0.5937
X4	2.7313	0.0785	0.4061	-0.3054	1.1406	0.4790
X5	0.4937	0.9101	2.3320	3.2401	1.3884	1.3856
						0.0944
Z-Score Year 3	0.4303	0.8201	2.7645	-0.2919	0.0944	
Sales fourth year	23243	236901	231828	126524		
Sales fifth year	18811	208550	214595	129655		
5 Yr Gowth Rate	17.73%	-14.00%	3.72%	5.84%		

TABLE E-4

NONBANKRUPT FIRMS 1991-1996

nonbankrupt firms Period 1991-1996	1	2	3	4	5	6
Stock Symbol	D.SAV	ZVXI	ELST	D.WHE	ESVC	IMSG
SIC Code	3821	3679	3661	3949	3577	3577
Date of Bankruptcy Year of Data	6/30/92	12/31/91	12/31/93	7/31/92	11/30/94	4/30/95
Disclosure Disk Date	Dec-93	Dec-93	Dec-95	Dec-93	Sep-96	Dec-95
current assets	863	1,222	386	1,244	2,030	2,150
total assets	934	1,329	1,540	1,996	2,082	2,297
current liability	201	288	136	272	567	720
total liabilities	201	293	136	496	567	729
retained earnings	-91	647	497	467	855	604
equity	733	1,037	1,404	1,501	1,515	1,568
sales	2,178	2,572	1,444	2,486	3,446	5,027
EBIT&Extraordinary	168	626	438	44	754	587
X1	0.7088	0.7028	0.1623	0.4870	0.7027	0.6226
X2	-0.0974	0.4868	0.3227	0.2340	0.4107	0.2630
X3	0.1799	0.4710	0.2844	0.0220	0.3622	0.2556
X4	3.6468	3.5392	10.3235	3.0262	2.6720	2.1509
X5	2.3319	1.9353	0.9377	1.2455	1.6551	2.1885
Z-Score	4.8434	5.7976	6.5451	3.1298	4.7509	4.5506
current assets	700	570	325	1,357	1,065	1,639
total assets	751	628	1,155	2,152	1,110	1,764
current liability	173	219	44	484	99	545
total liabilities	173	231	44	791	99	565
retained earnings	-245	247	204	455	351	242
equity	578	397	1,111	1,361	1,010	1,198
sales	2,180	1,355	1,232	1,968	1,655	4,022
EBIT&Extraordinary	63	289	324	87	253	266
X1	0.7017	0.5589	0.2433	0.4057	0.8703	0.6202
X2	-0.3262	0.3933	0.1766	0.2114	0.3162	0.1372
X3	0.0839	0.4602	0.2805	0.0404	0.2279	0.1508
X4	3.3410	1.7186	25.2500	1.7206	10.2020	2.1204
X5	2.9028	2.1576	1.0667	0.9145	1.4910	2.2800
Z-Score	4.7877	5.0388	12.8651	2.2309	7.3728	4.1954
current assets	750	251	223	1,240	427	1,278
total assets	815	302	915	2,023	440	1,380
current liability	288	75	67	621	198	361
total liabilities	293	94	67	738	198	391
retained earnings	-301	59	-59	415	181	33
equity	522	207	847	1,286	242	989
sales	2,143	654	1,124	3,178	1,619	3,037
EBIT&Extraordinary	-38	9	315	676	279	210
X1	0.5669	0.5828	0.1705	0.3060	0.5205	0.6645
X2	-0.3693	0.1954	-0.0645	0.2051	0.4114	0.0239
X3	-0.0466	0.0298	0.3443	0.3342	0.6341	0.1522
X4	1.7816	2.2021	12.6418	1.7425	1.2222	2.5294
X5	2.6294	2.1656	1.2284	1.5709	3.6795	2.2007
Z-Score	3.3212	3.7620	7.6728	3.7310	6.8772	4.2282
Sales fourth year	2358	654	912	1312	134	1461
Sales fifty year	2174	305	977	1114		517
5 Yr Growth Rate	0.05%	70.41%	10.26%	22.22%		76.59%

	7	8	9	10	11	12
Stock Symbol	NRDC	CRLI	SYMT	D.ANS	OPTC	MTRO
SIC Code	2844	3663	3812	3812	3663	3661
Date of Bankruptcy						
Year of Data	9/30/94	12/31/91	3/31/92	9/30/91	12/31/93	6/30/94
DISC Disk Date	Dec-95	Dec-93	Dec-93	Feb-92	Dec-95	Sep-96
current assets	2,255	1,783	1,844	2,351	2,369	2,295
total assets	2,565	2,611	2,623	2,941	3,115	3,306
current liability	1,603	153	813	1,506	960	437
total liabilities	1,802	311	1,209	1,795	1,133	437
retained earnings	252	995	618	720	93	780
equity	763	2,300	1,413	1,147	1,982	2,869
sales	8,109	2,225	5,521	5,702	7,083	4,064
EBIT&Extraordinary	469	270	300	466	224	157
X1	0.2542	0.6243	0.3931	0.2873	0.4523	0.5620
X2	0.0982	0.3811	0.2356	0.2448	0.0299	0.2359
X3	0.1828	0.1034	0.1144	0.1584	0.0719	0.0475
X4	0.4234	7.3955	1.1687	0.6390	1.7493	6.5652
X5	3.1614	0.8522	2.1048	1.9388	2.2738	1.2293
Z-Score	4.1665	5.0482	3.4282	3.1090	3.5770	4.7346
current assets	1,700	1,790	2,141	2,126	2,207	2,990
total assets	2,093	2,392	2,929	2,635	2,872	4,056
current liability	1,632	147	1,321	1,288	861	1,244
total liabilities	2,025	284	1,734	1,663	1,100	1,269
retained earnings	-256	802	400	583	-3	697
equity	68	2,108	1,195	972	1,772	2,787
sales	7,592	2,441	4,026	4,130	2,872	4,590
EBIT&Extraordinary	157	421	205	288	6,001	682
X1	0.0325	0.6869	0.2800	0.3180	0.4687	0.4305
X2	-0.1223	0.3353	0.1366	0.2213	-0.0010	0.1718
X3	0.0750	0.1760	0.0700	0.1093	2.0895	0.1681
X4	0.0336	7.4225	0.6892	0.5845	1.6109	2.1962
X5	3.6273	1.0205	1.3745	1.5674	1.0000	1.1317
Z-Score	3.7869	5.4592	2.1951	2.5647	8.5018	3.0284
current assets	1,685	1,586	1,949	1,812	1,969	2,572
total assets	2,049	2,104	2,783	2,273	2,250	3,678
current liability	1,507	143	1,342	1,323	896	692
total liabilities	2,098	284	1,703	1,399	896	1,255
retained earnings	-278	515	284	484	-403	334
equity	-50	1,820	1,079	873	1,354	2,423
sales	6,975	2,384	5,771	4,176	4,868	4,440
EBIT&Extraordinary	-326	340	147	147	163	21
X1	0.0869	0.6858	0.2181	0.2151	0.4769	0.5111
X2	-0.1357	0.2448	0.1020	0.2129	-0.1791	0.0908
X3	-0.1591	0.1616	0.0528	0.0647	0.0724	0.0057
X4	-0.0238	6.4085	0.6336	0.6240	1.5112	1.9307
X5	3.4041	1.1331	2.0737	1.8372	2.1636	1.2072
Z-Score	2.8403	5.0235	2.7426	2.6312	3.2092	2.4768
Sales fourth year	4961	2127	4772	3387	4305	1418
Sales fifty year	6880		5653	3687	5006	1509
5 Yr Growth Rate	4.19%		-0.59%	11.52%	9.06%	28.11%

	13	14	15	16	17	18
Stock Symbol	TOPM	MSIE	IMTC	IMTC	CECF	D.GCB
SIC Code	3523	3674	3579	3579	3564	3494
Date of Bankruptcy						
Year of Data	5/31/91	9/30/91	6/30/92	6/30/93	12/31/94	9/30/94
DISC Disk Date	Feb-92	Feb-92	Dec-93	Dec-95	Dec-95	Dec-95
current assets	2,634	3,503	2,182	2,479	2,155	3,526
total assets	3,377	3,584	4,117	4,407	4,680	4,691
current liability	892	341	839	1,383	1,443	735
total liabilities	1,222	341	988	1,405	2,909	2,470
retained earnings	1,116	3,170	1,333	1,205	849	1,805
equity	2,155	3,243	3,129	3,003	1,772	2,221
sales	5,049	1,919	6,330	7,121	10,247	5,024
EBIT&Extraordinary	173	35	192	-89	752	278
X1	0.5158	0.8823	0.3262	0.2487	0.1521	0.5950
X2	0.3305	0.8845	0.3238	0.2734	0.1814	0.3848
X3	0.0512	0.0098	0.0466	-0.0202	0.1607	0.0593
X4	1.7635	9.5103	3.1670	2.1374	0.6091	0.8992
X5	1.4951	0.5354	1.5375	1.6158	2.1895	1.0710
Z-Score	3.0417	5.9408	3.5176	2.8575	3.2030	2.3831
current assets	2,645	3,492	2511	2,182	3,141	2,793
total assets	3,321	3,560	4249	4,117	5,838	3,933
current liability	990	317	759	839	2,773	507
total liabilities	1,404	317	1246	988	4,384	1,831
retained earnings	880	3,140	1232	1,333	531	1,687
equity	1,916	3,243	3002	3,129	1,454	2,102
sales	5,326	1,219	7451	6,330	8,634	5,374
EBIT&Extraordinary	850	-67	702	192	21	494
X1	0.4983	0.8919	0.4123	0.3262	0.0630	0.5812
X2	0.2650	0.8820	0.2900	0.3238	0.0910	0.4289
X3	0.2559	-0.0188	0.1652	0.0466	0.0036	0.1256
X4	1.3647	10.2303	2.4093	3.1670	0.3317	1.1480
X5	1.6037	0.3424	1.7536	1.5375	1.4789	1.3664
Z-Score	3.5507	5.9665	3.8165	3.5176	1.7487	3.0161
current assets	1912	4,038	2,976	2,511	1,239	2,690
total assets	2502	4,128	4,572	4,249	3,838	3,716
current liability	664	775	1,690	759	604	595
total liabilities	1093	775	1,951	1,246	2,294	1,835
Retained Earnings	427	3,215	862	1,232	621	1,466
equity	1409	3,353	2,621	3,002	1,544	1,880
sales	4895	1,666	7,144	7,451	6,870	5,341
EBIT&Extraordinary	843	-20	807	702	502	540
X1	0.4988	0.7905	0.2813	0.4123	0.1655	0.5638
X2	0.1707	0.7788	0.1885	0.2900	0.1618	0.3945
X3	0.3369	-0.0048	0.1765	0.1652	0.1308	0.1453
X4	1.2891	4.3265	1.3434	2.4093	0.6731	1.0245
X5	1.9564	0.4036	1.5626	1.7536	1.7900	1.4373
Z-Score	4.0430	3.4313	3.0334	3.8165	2.7312	3.0546
Sales fourth year	3287	1418	5441	7144	4700	5522
Sales fifty year	2492	1509	3580		2925	5974
5 Yr Growth Rate	19.31%	6.19%	15.31%		36.81%	-4.24%

	19	20	21	22	23	24
Stock Symbol	BNSOF	GODD	CDAL	FAME	D.SJR	WTBK
SIC Code	3821	3494	3448	2891	3559	3519
Date of Bankruptcy						
Year of Data	3/31/91	9/30/95	9/24/94	9/30/93	9/30/92	10/30/93
DISC Disk Date	Feb-92	Sep-96	Dec-95	Dec-95	Dec-93	Dec-95
current assets	3,727	4,039	3,471	3,929	3,803	6,457
total assets	4,905	5,151	5,277	5,549	8,076	8,772
current liability	2,745	894	2,081	170	2,490	937
total liabilities	2,780	2,500	3,364	170	4,080	1,114
Retained Earnings	611	2,235	852	2,236	149	1,766
equity	2,125	2,651	1,913	5,379	3,996	7,658
sales	7,535	6,771	10,896	3,127	3,274	13,411
EBIT&Extraordinary	452	860	451	758	15	588
X1	0.2002	0.6106	0.2634	0.6774	0.1626	0.6293
X2	0.1246	0.4339	0.1615	0.4030	0.0184	0.2013
X3	0.0922	0.1670	0.0855	0.1366	0.0019	0.0670
X4	0.7644	1.0604	0.5687	31.6412	0.9794	6.8743
X5	1.5362	1.3145	2.0648	0.5635	0.4054	1.5288
Z-Score	2.3895	3.0813	2.8907	15.1031	0.9539	5.2430
current assets	4,558	3,526	3,569	3,759	3,438	7,238
total assets	6,158	4,691	4,227	5,407	7,772	9,281
current liability	4,154	735	2,293	164	1,700	1,691
total liabilities	4,202	2,470	2,526	164	3,444	1,959
Retained Earnings	442	1,805	637	2,075	461	1,430
equity	1,957	2,221	1,701	5,243	4,328	7,322
sales	6,526	5,024	11,428	5,262	3,406	15,106
EBIT&Extraordinary	-172	278	-7	1,426	375	590
X1	0.0656	0.5950	0.3019	0.6649	0.2236	0.5977
X2	0.0718	0.3848	0.1507	0.3838	0.0593	0.1541
X3	-0.0279	0.0593	-0.0017	0.2637	0.0483	0.0636
X4	0.4657	0.8992	0.6734	31.9695	1.2567	3.7376
X5	1.0598	1.0710	2.7036	0.9732	0.4382	1.6276
Z-Score	1.2743	2.3831	3.3199	16.0196	1.3257	3.9507
current assets	3,867	2,793	4,315	3,635	3,223	6,767
total assets	5,271	3,933	5,222	5,235	7,705	9,037
current liability	2,940	507	2,914	444	1,830	1,781
total liabilities	3,035	1,831	3,336	444	3,251	2,112
Retained Earnings	722	1,687	1,761	1,587	551	1,033
equity	2,236	2,102	1,886	4,791	4,454	6,925
sales	1,391	5,374	12,912	4,946	4,963	13,031
EBIT&Extraordinary	-40	494	147	1,494	521	-355
X1	0.1759	0.5812	0.2683	0.6096	0.1808	0.5517
X2	0.1370	0.4289	0.3372	0.3032	0.0715	0.1143
X3	-0.0076	0.1256	0.0282	0.2854	0.0676	-0.0393
X4	0.7367	1.1480	0.5653	10.7905	1.3700	3.2789
X5	0.2639	1.3664	2.4726	0.9448	0.6441	1.4420
Z-Score	0.7913	3.0161	3.2706	7.0554	1.6185	3.1866
Sales fourth year	5498	5341	12242	5076	4694	16379
Sales fifty year	2632	5522		3523	3992	14336
5 Yr Growth Rate	30.08%	5.23%		-2.94%	-4.84%	-1.65%

	25	26	27	28	29	30
Stock Symbol	MITY	D.NFN	D.MNP	ESEX	MSYS	DKEY
SIC Code	2522	3829	3569	3589	3559	3571
Date of Bankruptcy						
Year of Data	3/31/95	6/30/92	8/31/93	12/31/90	3/31/91	12/31/93
DISC Disk Date	Sep-96	Dec-93	Sep-94	Feb-92	Feb-92	Dec-95
current assets	7,786	7,677	4,837	6,664	2,779	9,709
total assets	9,090	9,158	9,394	9,830	9,953	11,363
current liability	923	4,860	1,961	5,009	2,128	1,082
total liabilities	923	560	2,889	5,642	5,350	1,174
Retained Earnings	1,524	2,884	552	1,096	2,315	5,806
equity	8,167	3,498	6,505	4,188	4,603	10,188
sales	13,029	22,122	9,765	24,175	4,886	6,074
EBIT&Extraordinary	2,508	1,503	916	-143	1,649	-353
X1	0.7550	0.3076	0.3062	0.1684	0.0654	0.7592
X2	0.1677	0.3149	0.0588	0.1115	0.2326	0.5110
X3	0.2759	0.1641	0.0975	-0.0145	0.1657	-0.0311
X4	8.8483	6.2464	2.2516	0.7423	0.8604	8.6780
X5	1.4333	2.4156	1.0395	2.4593	0.4909	0.5345
Z-Score	6.6874	6.0315	2.5553	2.9361	1.6099	5.0589
current assets	3,164	7,849	3,833	10,296	2,292	9,870
total assets	4,127	9,384	5,306	13,978	7,470	11,030
current liability	2,017	5,540	1,755	8,551	1,198	662
total liabilities	2,017	6,661	2,297	9,264	3,745	722
Retained Earnings	1,637	2,108	-161	1,622	1,398	5,997
equity	2,110	2,722	3,009	4,714	3,725	10,308
sales	9,922	15,064	7,611	29,135	3,402	5,604
EBIT&Extraordinary	1,840	816	742	987	991	369
X1	0.2779	0.2461	0.3916	0.1248	0.1465	0.8348
X2	0.3967	0.2246	-0.0303	0.1160	0.1871	0.5437
X3	0.4458	0.0870	0.1398	0.0706	0.1327	0.0335
X4	1.0461	0.4086	1.3100	0.5089	0.9947	14.2770
X5	2.4042	1.6053	1.4344	2.0843	0.4554	0.5081
Z-Score	4.7592	2.4106	2.6713	2.7011	1.5480	7.6664
current assets	1,615	6,062	2,068	8,547	1,431	11,386
total assets	2,524	7,507	3,134	11,190	4,122	12,197
current liability	672	4,007	624	6,850	1,116	845
total liabilities	672	5,037	723	7,667	2,122	897
Retained Earnings	1,372	1,856	-759	1,497	784	5,745
equity	1,852	2,470	2,411	3,523	2,000	11,299
sales	8,182	14,042	3,614	26,014	2,127	7,731
EBIT&Extraordinary	936	762	194	567	578	2,288
X1	0.3736	0.2737	0.4608	0.1517	0.0764	0.8642
X2	0.5436	0.2472	-0.2422	0.1338	0.1902	0.4710
X3	0.3708	0.1015	0.0619	0.0507	0.1402	0.1876
X4	2.7560	0.4904	3.3347	0.4595	0.9425	12.5964
X5	3.2417	1.8705	1.1532	2.3248	0.5160	0.6338
Z-Score	6.2732	2.7938	2.8690	2.8926	1.5624	7.5245
Sales fourth year	5762	14042	3257	25713	22166	8239
Sales fifty year		12598	3944	25175	21716	9290
5 Yr Growth Rate		15.11%	25.44%	-1.01%	-31.13%	-10.08%

Stock Symbol	31	32	33	34	35	36
	ARTW	ASON	KNIT	MOCO	MRM	THMP
SIC Code	3523	3462	2339	3829	3679	3442
Date of Bankruptcy						
Year of Data	5/30/92	1/31/91	2/28/94	12/31/93	12/31/95	6/30/91
DISC Disk Date	Dec-93	Feb-92	Dec-95	Dec-95	Sep-95	Feb-92
current assets	9,352	8,342	9,402	7,570	11,689	11,053
total assets	11,758	12,854	13,702	14,077	15,189	15,356
current liability	5,353	3,289	5,070	1,243	1,665	1,739
total liabilities	5,495	5,767	6,414	1,261	1,820	4,470
Retained Earnings	6,692	2,392	3,119	10,935	10,966	10,504
equity	6,264	7,088	7,288	12,816	13,369	10,886
sales	19,440	14,069	15,318	10,405	14,397	28,576
EBIT&Extraordinary	256	1,039	41	2,786	2,591	2,884
X1	0.3401	0.3931	0.3162	0.4495	0.6600	0.6065
X2	0.5691	0.1861	0.2276	0.7768	0.7220	0.6840
X3	0.0218	0.0808	0.0030	0.1979	0.1706	0.1878
X4	1.1399	1.2291	1.1363	10.1634	7.3456	2.4353
X5	1.6533	1.0945	1.1179	0.7391	0.9479	1.8609
Z-Score	2.9224	2.2992	2.0217	6.6014	5.6458	4.4778
current assets	10,983	7,262	8,048	15,151	10,683	8,371
total assets	13,346	11,953	12,513	16,273	14,705	12,605
current liability	7,031	2,524	3,542	1,636	1,551	1,531
total liabilities	7,101	5,300	4,984	1,659	1,693	3,431
Retained Earnings	6,894	1,956	3,337	12,451	9,990	8,794
equity	6,244	6,653	7,530	14,614	13,012	9,174
sales	21,917	11,159	16,367	12,679	13,593	27,838
EBIT&Extraordinary	2,067	555	1,132	4,020	2,268	1,389
X1	0.2961	0.3964	0.3601	0.8305	0.6210	0.5426
X2	0.5166	0.1636	0.2667	0.7651	0.6794	0.6977
X3	0.1549	0.0464	0.0905	0.2470	0.1542	0.1102
X4	0.8793	1.2553	1.5108	8.8089	7.6858	2.6739
X5	1.6422	0.9336	1.3080	0.7791	0.9244	2.2085
Z-Score	3.1393	2.0260	2.7051	6.4884	5.6504	4.6495
current assets	8,637	6,741	8,173	13,711	7,502	7,525
total assets	10,839	11,138	12,339	14,817	14,716	9,552
current liability	5,548	2,456	3,459	1,881	1,632	1,157
total liabilities	5,639	4,561	4,946	1,884	1,777	1,157
Retained Earnings	6,012	1,881	3,011	10,526	9,249	8,014
equity	5,200	6,578	7,393	12,933	12,939	8,394
sales	19,245	9,809	9,462	13,556	14,252	29,534
EBIT&Extraordinary	1,692	185	803	4,301	3,081	-10
X1	0.2850	0.3847	0.3820	0.7984	0.3989	0.6667
X2	0.5547	0.1689	0.2440	0.7104	0.6285	0.8390
X3	0.1561	0.0166	0.0651	0.2903	0.2094	-0.0010
X4	0.9221	1.4422	1.4947	6.8646	7.2814	7.2550
X5	1.7755	0.8807	0.7668	0.9149	0.9685	3.0919
Z-Score	3.3184	1.9551	2.0759	5.8723	5.4935	7.3182
Sales fourth year	22342	11111	6213	11522	12445	29613
Sales fifty year	19710	9193	7842	9798	12956	26188
5 Yr Growth Rate	-0.34%	11.22%	18.22%	1.51%	2.67%	2.21%

	37	38	39	40	41	42
Stock Symbol	SPAN	DAIG	MXC	GBL	KOSS	CVCO
SIC Code	2329	3845	3315	2835	3651	2452
Date of Bankruptcy						
Year of Data	9/28/91	9/30/93	12/31/92	3/31/95	6/30/94	9/30/91
DISC Disk Date	Feb-92	Dec-95	Sep-96	Dec-95	Dec-95	Feb-92
current assets	8,450	12,750	9,639	12,324	16,511	7,335
total assets	16,371	17,117	17,868	18,384	19,220	20,889
current liability	3,417	2,160	3,403	1,648	2,013	5,116
total liabilities	5,838	3,061	5,443	1,930	5,072	13,248
Retained Earnings	6,917	10,577	10,573	3,619	11,437	7,218
equity	10,533	14,056	12,425	16,454	14,149	7,641
sales	29,249	25,678	19,732	18,261	35,561	42,428
EBIT&Extraordinary	2,847	8,058	-1,339	2,231	4,848	2,962
X1	0.3074	0.6187	0.3490	0.5807	0.7543	0.1062
X2	0.4225	0.6179	0.5917	0.1969	0.5951	0.3455
X3	0.1739	0.4708	-0.0749	0.1214	0.2522	0.1418
X4	1.8042	4.5920	2.2827	8.5254	2.7896	0.5768
X5	1.7866	1.5001	1.1043	0.9933	1.8502	2.0311
Z-Score	3.6595	5.8554	2.5795	5.5322	4.8467	3.0787
current assets	7,081	8,822	11,712	12,807	14,696	13,812
total assets	15,187	11,645	19,191	3,523	17,542	20,379
current liability	2,796	2,570	3,335	1,547	2,903	8,143
total liabilities	6,200	4,059	5,739	2,410	7,016	9,296
Retained Earnings	5,431	5,367	11,587	2,609	8,636	1,599
equity	8,987	7,587	13,452	15,620	10,526	11,083
sales	25,174	19,187	19,527	17,213	32,137	50,448
EBIT&Extraordinary	2,344	4,924	892	1,684	4,829	2,566
X1	0.2821	0.5369	0.4365	3.1961	0.6723	0.2782
X2	0.3576	0.4609	0.6038	0.7406	0.4923	0.0785
X3	0.1543	0.4228	0.0465	0.4780	0.2753	0.1259
X4	1.4495	1.8692	2.3440	6.4813	1.5003	1.1922
X5	1.6576	1.6477	1.0175	4.8859	1.8320	2.4755
Z-Score	3.2478	4.5185	2.9687	12.0023	4.2128	3.6284
current assets	6,843	4,224	10,347	11,456	10,455	11,901
total assets	14,610	6,969	20,988	16,925	13,252	18,945
current liability	2,850	1,258	6,281	1,684	2,142	7,666
total liabilities	6,221	3,342	8,703	2,417	5,838	8,861
Retained Earnings	4,381	1,792	10,652	1,491	5,846	2,496
equity	8,389	3,627	12,285	14,507	7,414	10,084
sales	21,595	11,227	24,307	16,390	26,021	46,319
EBIT&Extraordinary	2,205	1,024	-595	-856	1,655	3,219
X1	0.2733	0.4256	0.1937	0.5774	0.6273	0.2235
X2	0.2999	0.2571	0.5075	0.0881	0.4411	0.1317
X3	0.1509	0.1469	-0.0283	-0.0506	0.1249	0.1699
X4	1.3485	1.0853	1.4116	6.0021	1.2700	1.1380
X5	1.4781	1.6110	1.1581	0.9684	1.9636	2.4449
Z-Score	2.9604	3.0431	2.2294	3.8188	3.7045	3.7178
Sales fourth year	18784	10017	26171	16942	24326	38485
Sales fifty year	15272	7632	23996	15674	27200	22629
5 Yr Growth Rate	17.64%	35.43%	-4.77%	3.89%	6.93%	17.02%

	43	44	45	46	47	48
Stock Symbol	DETC	CXIM	HST	CSPI	D.EEX	APR
SIC Code	3669	3841	3471	3571	3661	3443
Date of Bankruptcy						
Year of Data	3/31/93	6/30/94	12/31/92	8/26/94	12/31/93	12/31/92
DISC Disk Date	Sep-94	Dec-95	Dec-93	Dec-96	Dec-95	Dec-93
current assets	15,764	17,572	16,268	24,976	21,657	19,803
total assets	22,543	25,171	29,895	29,936	32,639	36,725
current liability	3,559	4,313	4,412	1,891	1,944	4,974
total liabilities	6,484	8,148	4,980	3,695	2,782	8,013
Retained Earnings	9,934	5,889	21,884	16,839	31,089	17,651
equity	16,059	17,023	24,916	26,241	29,856	28,712
sales	29,431	30,115	71,398	19,460	55,729	50,631
EBIT&Extraordinary	2,590	501	2,540	2,544	2,116	4,004
X1	0.5414	0.5268	0.3966	0.7711	0.6040	0.4038
X2	0.4407	0.2340	0.7320	0.5625	0.9525	0.4806
X3	0.1149	0.0199	0.0850	0.0850	0.0648	0.1090
X4	2.4767	2.0892	5.0032	7.1018	10.7318	3.5832
X5	1.3055	1.1964	2.3883	0.6501	1.7074	1.3787
Z-Score	3.4616	2.7092	5.6532	4.9249	7.6526	3.9162
current assets	13,852	16,165	16,005	23,666	30,467	19,381
total assets	20,942	24,419	32,284	27,853	31,911	36,280
current liability	3,117	3,439	4,336	1,793	1,804	4,102
total liabilities	6,461	7,460	7,784	3,539	2,791	8,212
Retained Earnings	8,497	5,825	20,614	15,120	30,353	16,791
equity	14,481	16,959	24,500	24,314	29,120	28,068
sales	27,254	29,196	70,082	18,015	101,870	50,621
EBIT&Extraordinary	2,694	396	3,772	2,933	2,840	5,921
X1	0.5126	0.5212	0.3614	0.7853	0.8982	0.4211
X2	0.4057	0.2385	0.6385	0.5428	0.9512	0.4628
X3	0.1286	0.0162	0.1168	0.1053	0.0890	0.1632
X4	2.2413	2.2733	3.1475	6.8703	10.4335	3.4179
X5	1.3014	1.1956	2.1708	0.6468	3.1923	1.3953
Z-Score	3.3510	2.7741	4.6514	4.8811	9.2942	4.0291
current assets	13,755	16,955	14,889	21,084	28,960	18,939
total assets	20,630	20,470	29,841	24,973	30,416	36,801
current liability	2,778	3,906	4,501	1,253	1,604	4,423
total liabilities	7,679	3,706	7,359	2,777	2,495	9,106
Retained Earnings	8,540	5,710	18,593	13,163	29,153	14,563
equity	12,952	16,763	22,482	22,196	27,921	27,695
sales	28,135	26,230	35,087	16,035	68,014	47,719
EBIT&Extraordinary	3,260	-280	3,053	2,249	1,597	5,368
X1	0.5321	0.6375	0.3481	0.7941	0.8994	0.3944
X2	0.4140	0.2789	0.6231	0.5271	0.9585	0.3957
X3	0.1580	-0.0137	0.1023	0.0901	0.0525	0.1459
X4	1.6867	4.5232	3.0550	7.9928	11.1908	3.0414
X5	1.3638	1.2814	1.1758	0.6421	2.2361	1.2967
Z-Score	3.2926	3.8294	3.5518	5.2934	8.5516	3.6427
Sales fourth year	21863		65006	13089	74010	51585
Sales fifty year	19140		53007	11298	45366	49245
5 Yr Growth Rate	11.36%		7.73%	14.56%	5.28%	0.70%

	49	50	51	52	53	54
Stock Symbol	VIDE	CME	CSII	PNTK	FTSP	SNTC
SIC Code	3671	3577	3661	3951	3949	3089
Date of Bankruptcy						
Year of Data	2/28/91	6/30/91	12/31/92	9/30/94	2/28/95	6/30/91
DISC Disk Date	Feb-92	Feb-92	Dec-93	Dec-95	Dec-95	Feb-92
current assets	26,555	37,171	32,077	36,831	39,730	34,848
total assets	38,469	40,747	41,211	42,200	45,864	46,233
current liability	7,094	22,090	6,167	15,380	21,621	4,418
total liabilities	24,247	23,143	6,460	15,720	25,014	6,667
Retained Earnings	10,471	2,059	17,781	20,894	12,565	20,672
equity	14,050	16,806	34,751	26,479	20,850	39,566
sales	54,113	130,062	54,764	62,136	85,529	24,704
EBIT&Extraordinary	4,440	-12,028	6,967	8,378	10,285	5,013
X1	0.5059	0.3701	0.6287	0.5083	0.3948	0.6582
X2	0.2722	0.0505	0.4315	0.4951	0.2740	0.4471
X3	0.1154	-0.2952	0.1691	0.1985	0.2242	0.1084
X4	0.5795	0.7262	5.3794	1.6844	0.8335	5.9346
X5	1.4067	3.1919	1.3289	1.4724	1.8648	0.5343
Z-Score	2.5991	2.8816	4.9271	3.5776	3.4231	4.2133
current assets	27,908	36,348	25,876	36,836	25,035	32,622
total assets	39,287	41,084	34,571	42,130	29,406	43,262
current liability	13,524	13,885	4,412	18,345	13,667	4,050
total liabilities	26,017	15,019	4,613	18,627	15,467	6,883
Retained Earnings	8,919	10,560	13,369	17,374	6,466	17,548
equity	13,111	26,065	29,958	23,502	13,940	36,379
sales	54,543	187,724	37,928	51,321	35,535	23,985
EBIT&Extraordinary	3,533	1,253	5,407	6,988	1,462	6,096
X1	0.3661	0.5468	0.6209	0.4389	0.3866	0.6604
X2	0.2270	0.2570	0.3867	0.4124	0.2199	0.4056
X3	0.0899	0.0305	0.1564	0.1659	0.0497	0.1409
X4	0.5039	1.7355	6.4943	1.2617	0.9013	5.2853
X5	1.3883	4.5693	1.0971	1.2182	1.2084	0.5544
Z-Score	2.3314	5.9935	5.0811	2.9250	2.2024	4.0280
current assets	20,881	46,014	21,164	27,902	16,579	30,297
total assets	33,403	50,078	30,362	32,267	20,324	40,376
current liability	7,758	23,360	4,110	12,146	5,403	4,384
total liabilities	21,013	24,414	4,247	12,146	7,044	7,886
Retained Earnings	8,238	10,155	10,555	14,008	5,831	13,659
equity	12,251	25,664	26,115	20,121	13,279	32,490
sales	40,576	200,385	33,505	39,130	38,244	23,240
EBIT&Extraordinary	5,550	9,055	4,077	4,918	4,957	4,521
X1	0.3929	0.4524	0.5617	0.4883	0.5499	0.6418
X2	0.2466	0.2028	0.3476	0.4341	0.2869	0.3383
X3	0.1662	0.1808	0.1343	0.1524	0.2439	0.1120
X4	0.5830	1.0512	6.1490	1.6566	1.8852	4.1200
X5	1.2147	4.0015	1.1035	1.2127	1.8817	0.5756
Z-Score	2.4640	5.4929	4.7983	3.0974	4.0648	3.3994
Sales fourth year	25714	151491	29282	33847	27169	18751
Sales fifty year	23287		32307	29913	13702	17203
5 Yr Growth Rate	23.47%		14.10%	20.05%	58.06%	9.47%

	55	56	57	58	59	60
Stock Symbol	VRSA	LAN	ILCT	FSCR	AORGB	DJRI
SIC Code	3069	3556	3648	3452	3931	2068
Date of Bankruptcy						
Year of Data	3/31/92	12/31/94	9/30/95	6/30/93	12/31/92	7/31/92
DISC Disk Date	Sep-94	Dec-95	Sep-96	Sep-94	Dec-95	Dec-93
current assets	30,779	32,341	22,856	19,674	44,370	18,372
total assets	46,884	46,896	47,185	49,205	53,581	55,380
current liability	3,793	14,963	11,791	9,751	1,187	6,657
total liabilities	5,987	19,977	18,383	23,333	2,405	7,926
Retained Earnings	22,612	17,082	22,669	22,946	40,068	7,614
equity	40,897	26,919	28,802	25,872	51,176	47,545
sales	48,935	70,900	58,429	73,050	26,238	55,033
EBIT&Extraordinary	8,206	5,307	5,978	3,412	5,606	4,555
X1	0.5756	0.3706	0.2345	0.2017	0.8059	0.2115
X2	0.4823	0.3643	0.4804	0.4663	0.7478	0.1375
X3	0.1750	0.1132	0.1267	0.0693	0.1046	0.0822
X4	6.8310	1.3475	1.5668	1.1088	21.2790	5.9986
X5	1.0437	1.5119	1.2383	1.4846	0.4897	0.9937
Z-Score	5.2757	3.0006	2.8626	2.7024	10.9622	4.0348
current assets	26,763	25,472	21,381	19,055	41,517	12,715
total assets	42,707	38,902	41,997	46,952	51,116	43,645
current liability	4,214	14,509	11,952	8,808	1,080	6,417
total liabilities	6,206	18,577	18,374	22,491	2,531	6,602
Retained Earnings	18,915	14,132	18,131	21,607	37,376	5,429
equity	36,501	20,325	23,624	24,461	48,584	37,043
sales	51,898	56,661	52,022	67,618	25,276	69,635
EBIT&Extraordinary	9,975	3,585	1,343	3,494	5,784	12,219
X1	0.5280	0.2818	0.2245	0.2182	0.7911	0.1443
X2	0.4429	0.3633	0.4317	0.4602	0.7312	0.1244
X3	0.2336	0.0922	0.0320	0.0744	0.1132	0.2800
X4	5.8816	1.0941	1.2857	1.0876	19.1956	5.6109
X5	1.2152	1.4565	1.2387	1.4402	0.4945	1.5955
Z-Score	5.1624	2.7092	2.4022	2.6715	10.0937	5.0275
current assets	23,890	25,065	21,159	17,407	39,255	9,767
total assets	39,101	37,762	39,742	42,761	49,667	40,935
current liability	5,469	14,921	9,373	6,387	1,581	6,118
total liabilities	7,468	19,840	15,177	19,349	3,109	6,463
Retained Earnings	14,087	11,958	17,941	20,323	34,379	2,857
equity	31,633	17,923	24,565	23,412	46,558	34,471
sales	53,122	44,729	51,997	57,147	25,721	46,648
EBIT&Extraordinary	9,895	2,393	7,111	149	7,322	4,151
X1	0.4711	0.2686	0.2966	0.2577	0.7585	0.0891
X2	0.3603	0.3167	0.4514	0.4753	0.6922	0.0698
X3	0.2531	0.0634	0.1789	0.0035	0.1474	0.1014
X4	4.2358	0.9034	1.6186	1.2100	14.9752	5.3336
X5	1.3586	1.1845	1.3084	1.3364	0.5179	1.1396
Z-Score	4.5641	2.2193	3.1365	2.4401	8.3946	3.8155
Sales fourth year	47941	35585	40885	64387	24179	31992
Sales fifty year	45587	40992	40208	73147	23132	17426
5 Yr Growth Rate	1.79%	14.68%	9.79%	-0.03%	3.20%	33.31%

	61	62	63	64	65	66
Stock Symbol	TNL	OAKS	COLL	WEST	DRKN	RESP
SIC Code	3596	2512	3711	2835	3714	3842
Date of Bankruptcy						
Year of Data	12/31/92	12/31/94	10/31/92	5/30/92	12/31/94	6/30/95
DISC Disk Date	Dec-93	Dec-95	Dec-93	Dec-96	Dec-95	Dec-95
current assets	33,362	33,695	53,766	50,115	45,107	52,864
total assets	55,708	59,312	72,879	74,417	77,057	78,039
current liability	10,184	11,465	47,526	14,787	19,568	13,450
total liabilities	17,051	26,742	51,700	16,741	22,539	18,988
Retained Earnings	40,614	5,807	1,099	46,099	33,026	38,947
equity	38,657	32,570	21,179	54,900	54,237	58,369
sales	98,554	107,811	143,502	88,467	144,483	99,450
EBIT&Extraordinary	5,056	8,392	3,785	5,714	19,857	18,729
X1	0.4161	0.3748	0.0856	0.4747	0.3314	0.5051
X2	0.7291	0.0979	0.0151	0.6195	0.4286	0.4991
X3	0.0908	0.1415	0.0519	0.0768	0.2577	0.2400
X4	2.2671	1.2179	0.4097	3.2794	2.4064	3.0740
X5	1.7691	1.8177	1.9690	1.1888	1.8750	1.2744
Z-Score	3.9156	3.1169	2.3727	3.6674	4.2832	4.0934
current assets	34,753	18,978	42,521	43,159	42,585	40,206
total assets	52,512	27,619	61,792	70,433	57,716	58,917
current liability	11,592	5,745	33,530	13,931	14,816	9,174
total liabilities	14,209	6,153	48,257	15,700	15,803	14,029
Retained Earnings	40,005	1,352	2,791	43,098	20,925	27,270
equity	38,303	21,466	13,535	51,918	41,673	44,224
sales	81,169	70,051	145,580	75,241	105,738	78,171
EBIT&Extraordinary	5,285	5,211	6,925	798	17,419	6,987
X1	0.4411	0.4791	0.1455	0.4150	0.4811	0.5267
X2	0.7618	0.0490	0.0452	0.6119	0.3626	0.4629
X3	0.1006	0.1887	0.1121	0.0113	0.3018	0.1186
X4	2.6957	3.4887	0.2805	3.3069	2.6370	3.1523
X5	1.5457	2.5363	2.3560	1.0683	1.8320	1.3268
Z-Score	3.9490	4.9677	2.9598	3.3060	4.5257	3.7863
current assets	35,326	7,483	31,765	40,240	34,829	36,067
total assets	51,552	13,473	52,278	66,877	47,415	54,331
current liability	8,998	7,687	23,062	9,185	13,163	10,895
total liabilities	14,110	11,985	40,914	10,871	18,213	15,183
Retained Earnings	39,451	997	1,176	44,314	8,951	22,529
equity	37,442	1,488	11,363	53,203	29,202	39,148
sales	83,614	46,192	140,045	79,371	47,415	69,286
EBIT&Extraordinary	8,374	2,218	6,897	-1,444	86,961	11,272
X1	0.5107	-0.0151	0.1665	0.4644	0.4569	0.4633
X2	0.7653	0.0740	0.0225	0.6626	0.1888	0.4147
X3	0.1624	0.1646	0.1319	-0.0216	1.8340	0.2075
X4	2.6536	0.1242	0.2777	4.8940	1.6034	2.5784
X5	1.6219	3.4285	2.6789	1.1868	1.0000	1.2753
Z-Score	4.2522	4.0371	3.3385	4.0670	7.8573	3.6837
Sales fourth year	91940	30898	134477	77694	68427	48976
Sales fifty year	68890	17389	120061	59837	112402	36031
5 Yr Growth Rate	9.37%	57.80%	4.56%	10.27%	6.48%	28.89%

	67	68	69	70	Mean	Mean times weight
Stock Symbol	AEPI	BJICA	HAI	ODC		
SIC Code	3089	2024	2321	3295		
Date of Bankruptcy						
Year of Data	10/31/92	12/30/92	12/31/94	7/31/92		
DISC Disk Date	Dec-93	Sep-94	Dec-95	Sep-96		
current assets	33,081	35,541	64,855	37,631		
total assets	84,393	88,207	90,616	95,018		
current liability	18,619	17,487	15,649	13,272		
total liabilities	40,659	21,447	38,341	34,461		
Retained Earnings	37,253	19,984	17,942	55,192		
equity	43,734	66,760	52,275	60,556		
sales	142,621	131,969	172,024	118,750		
EBIT&Extraordinary	7,072	11,496	3,889	11,095		
X1	0.1714	0.2047	0.5430	0.2564	0.4448	0.3190
X2	0.4414	0.2266	0.1980	0.5809	0.3684	0.3120
X3	0.0838	0.1303	0.0429	0.1168	0.1203	0.3737
X4	1.0756	3.1128	1.3634	1.7572	3.9877	1.6748
X5	1.6900	1.4961	1.8984	1.2498	1.4883	1.4853
						4.1648
Z-Score	2.8955	3.5441	3.1576	3.0239	4.1648	
current assets	32,783	23,735	61,560	35,195		
total assets	79,298	43,056	90,168	89,394		
current liability	16,410	12,700	12,919	10,432		
total liabilities	39,313	16,878	38,895	33,776		
Retained Earnings	33,676	13,309	16,940	49,687		
equity	39,985	26,269	51,273	55,617		
sales	133,448	96,997	196,438	102,283		
EBIT&Extraordinary	8,544	7,240	-1,053	10,535		
X1	0.2065	0.2563	0.5394	0.2770	0.4826	0.3460
X2	0.4247	0.3091	0.1879	0.5558	0.3410	0.2888
X3	0.1077	0.1682	-0.0117	0.1178	0.1632	0.5070
X4	1.0171	1.5564	1.3182	1.6466	3.8651	1.6234
X5	1.6829	2.2528	2.1786	1.1442	1.5942	1.5910
						4.3563
Z-Score	2.9492	3.8700	3.2375	2.8690	4.3563	
current assets	32,893	16,442	88,917	28,174		
total assets	73,365	34,299	118,942	76,779		
current liability	17,131	8,240	39,416	12,025		
total liabilities	37,094	18,198	65,235	26,824		
Retained Earnings	30,171	9,570	23,090	44,073		
equity	36,271	16,101	53,707	49,954		
sales	119,267	77,024	203,736	94,192		
EBIT&Extraordinary	7,793	5,342	4,726	10,294		
X1	0.2148	0.2391	0.4162	0.2103	0.4212	0.3020
X2	0.4112	0.2790	0.1941	0.5740	0.3048	0.2581
X3	0.1062	0.1557	0.0397	0.1341	0.1487	0.4619
X4	0.9778	0.8848	0.8233	1.8623	3.0306	1.2729
X5	1.6257	2.2457	1.7129	1.2268	1.5989	1.5957
						3.8906
Z-Score	2.8655	3.5045	2.6415	3.0601	3.8906	
Sales fourth year	120959	58464	162160	82596		
Sales fifty year	100660		166884	68131		
5 Yr Growth Rate	9.10%		0.76%	14.90%		

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151

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