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A FIELD STUDY ON THE COMPARISON OF THE
MANUFACTURING COMPANIES BEFORE AND AFTER THE
POSITIVE REAL INTEREST POLICY WAS PUT INTO EFFECT

by

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ABSTRACT

A COMPARATIVE STUDY ON THE FINANCIAL STRUCTURES AND OPERATING RESULTS OF MANUFACTURING COMPANIES BEFORE AND AFTER THE POSITIVE REAL INTEREST RATE POLICY WAS PUT INTO EFFECT

In this thesis, the financial structure and operating results of manufacturing companies before and after the positive real interest rate policy was put into effect are compared.

This study was conducted by way of analyzing the financial structure and operating results of manufacturing companies from those two time periods. All required figures related with the operating results of these companies were obtained from Istanbul Chamber of Industry Periodicals dated October 1985 and 1984 and Financial Analysis book written by Cihangir Samin. By using these figures, firstly the financial ratios that are used in financial analysis were calculated, and then these ratios were compared with each other by using statistical analysis methods.

The findings of this study showed that in the aspect of financial structure, the difference between the two groups of manufacturing companies from those two time periods was significant.

The discriminant function, mentioned in section 2.2.1, explains approximately 20% of the discrimination, leaving 80% unexplained, which means that there might be other independent variables that would effect the discriminant function. According to findings, it came out that var 4-Return to Equity, var 2-Equity/Total Asset and var 6-Return on Sales each can be accepted as a discriminator between the two groups of companies. According to coefficients of the above variables, it is understood that companies from Group Two use more equity than companies from Group One, thus they have higher Equity/Total Asset Ratio and smaller Return to Equity Ratio. Return on Sales Ratio is higher for Group One companies which means that since financial expenses became higher due to the increase in interest rates, Return on Sales Ratio has decreased.

In the study, the following limitations were encountered. Under the facility of the given figures, only six ratios were calculated. The other ratios that would be used in the analysis are indicated in Appendix I. The shareholders' equity figures include revaluation adjustment which otherwise would have changed the results. The selected 90 companies for each year were not the same in the four years which otherwise might have changed the results. Additionally, in the selection of dependent variables, Group Two companies were selected from the years of 1983 and 1984 which otherwise would also have changed the results of the study.

We hope that the results obtained from this study may contribute to the understanding of financial analysis of the manufacturing companies.

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INTRODUCTION

The study aimed to see, statistically, whether there happened any differences between the financial structures and operating results of the manufacturing companies, after the positive real interest policy was put into effect in 1980. Since the interest rate is one of the major determinants in deciding the type of financing, the study aimed to show how a change in the interest rate policy effected the financial structures of the companies. Thus, the study sought for whether the manufacturing companies adjusted their financial structures and began to use more equity because of high cost of external borrowings.

The study included two groups of companies, Group One was comprised of 180 companies from the years of 1979 and 1980, and Group Two was comprised of 180 companies from the years of 1983 and 1984.

The financial ratios that are used in the financial analysis were calculated, and those ratios were compared with each other by using Multiple Discriminant Analysis and Z-tests.

CHAPTER I

THEORETICAL AND CONCEPTUAL BACKGROUND

As it is known, developed and developing countries have encountered an inflationary economy in 1970's. They adapted same policies to cure those inflationary effects in their economies. Turkey is also one of those developing countries that faced the same problem. To override this problem, Turkey took same measures on January 24, 1980; called "January 24 Economic Decisions Package". These decisions were further supported by freeing of interest rates on July 1, 1980 and applying daily foreign exchange rate policy; floating exchange rate, effective May 1, 1981. In the following paragraphs, the historical development of legal aspects of interest policies will be discussed.

1.1. HISTORICAL DEVELOPMENT OF LEGAL ASPECTS OF INTEREST POLICIES IN TURKEY

Interest policies can be grouped in two; one is the planned interest policies that had been applied until July 1, 1980 and the second one is the real interest rate policy that has been effective since July 1, 1980.

1.1.1. Planned Interest Policies

The determination of interest rates could not have been explained through economic theories in Turkey. It was planned by the governments which determined the maximum interest rates above which any increases were not allowed. As a result, there happened an interest rate which was lower than the rate that would have been economically effective, if planned interest policies had not been used.

This planned interest policy stems from the regulation called "Murabaha Nizamnamesi" dated 1887 which had aimed to prevent usury. As commerce and banking activities had developed, that regulation had become ineffective (ÖCAL, 1978, p.114-115).

After Turkish Republic was founded, interest rates began to be determined through laws. Maximum interest rates had been determined by the Lending law 2279 dated June 8, 1933. This law had been amended three times, the law 3399 dated June 25, 1938, the law 5841 dated August 15, 1951 and the law 18 dated July, 1960, respectively. At May 18, 1961, it had been given up to determine interest rates through laws with the law 302 dated May 5, 1961. After that time, maximum interest rates had been determined through regulations instead of laws. With the law 1211 dated January 26, 1970, the authority to determine the interest rates had been given to Turkish Central Bank.

1.1.2. Change in the Interest Policies and Free Interest Policy

Free interest policy was put into effect after July 1, 1980 with a decision 8/909 dated May 5, 1980 of the Council of Ministers and regulation 17007 dated June 4, 1980.

This regulation states that banks determine interest rates on credits freely according to the terms of the credits. Although it is called free interest rate policy, it can be argued that since only interests of time deposits were freed and the amendments of credit interests could be accepted only with a notice for 6 months ahead of time it is not as flexible as intended. Also due to oligopolistical structure of the Turkish banking system, banks had come together and declared "the Gentilmen's Agreement" at June 6, 1980. Through this agreement, free determination of credit interests had been prevented.

So, interest rate policies, put into effect on July 1, 1980, are not that much free as it is called. They are in a way planned interest rates, as they had been before but the difference is that the new planned interest rates are close to positive real interest rates. This also means that depositors could get positive real interest rate for their savings.

Table 1.1.2.1

Inflation, Nominal and Real Interest Rates

Year	Inflation Rate %	Nominal Rate* %	Real Rate** %
1977	24.08	7.00	-12.15
1978	52.57	7.00	-26.59
1979	63.92	12.00	-26.57
1980	107.25	26.50	-38.96
1981	36.77	49.17	9.07
1982	25.25	50.00	19.76
1983	30.64	42.66	9.20
1984	52.04	45.42	-4.35
1985	40.25	50.50	7.31

*Average interest rates are considered.

**Real rate is calculated as follows: $(\frac{1+NR}{1+IR} - 1)$

where NR-nominal interest rate
IR-inflation rate

SOURCE: Akalu, "Türkiye Ekonomisi ve İstikrar Politikaları 1980-85", İstanbul, 1986, p.38

As it can be seen from Table 1.1.2.1. real interest rates are positive after 1980 except the year of 1984 at which time in spite of higher nominal interest rates given to deposits, since the inflation rate was the highest after 1980, the real interest rate became negative.

1.2. THE STRUCTURE OF CREDITS AND DEVELOPMENTS IN TURKEY

The following table shows how the structures of bank

credits had changed for manufacturing companies from 1977 to 1985 monetary wise and on real terms

Table 1.2.1

Bank Credits to Manufacturing Companies

Years	Nominal ('000000') TL	Real ('000000') TL	Incerase in % Nominal	Real
1977	99.155	201	25.81	1.01
1978	119.158	159	20.17	-20.90
1979	156.360	127	31.22	-20.13
1980	283.108	111	81.06	-12.60
1981	459.295	132	62.23	18.92
1982	557.177	128	21.31	-3.03
1983	525.613	92	-5.66	-28.13
1984	860.587	99	63.73	7.61
1985	1.751.020	144	103.46	45.41

SOURCE: T.C.Central Bank, "Üç Aylık Bülteni" 1984,
1 Ocak-Mart, Ankara, p. 24.

T.C.Central Bank, "Üç Aylık Bülteni" 1985,
1 Ocak-Mart, Ankara, p.24.

T.C.Central Bank, 1985 Annual Report, Ankara,
1986, p.100.

As it can be seen from Table 1.2.1, except 1983, the credits granted by the banks to manufacturing companies have increased monetary wise. But when the real credits granted by the banks are investigated it can be seen that the changes between the years are not that much stable.

1.3. CREDIT SUPPLY AND DEMAND

Due to inadequate accumulation of capital in Turkey, the demand for borrowings is higher than the availability of funds. If governments or other regulatory agencies such as Turkish Central Bank, give up determining interest rates and the determination of interest rates is left to market conditions, interest rates come to a high equilibrium due to excess demand. Thus, the cost structure of the companies will be affected and prices will increase. Then, the economy will face inflationary pressures.

The purpose of planned interest rate till 1980 had been to prevent the economy from inflationary effects and to encourage investments. But there are other conditions that also effect the decisions for investments such as uncertainties about the future. Additionally, banks apply some measures such as recompensating balances at 10-39% (ARTUN, 1980, p.155-160), interest difference return funds, bank commissions and other charges which also increase the cost of credit to the companies. Also it should be taken into consideration that the main item that effects the investment decision is the availability of the funds (HATİPOĞLU, 1974, p.243, ABAÇ, p.123).

One of the main purposes of January 24, Decisions, instead of having companies which had utilized the benefits of import substitution, expanding domestic demand and cheap credits and foreign currencies for many years, was to create

a change in the financial structure of the companies.

So the purpose was to provide for equity external financing balance in the financial structure of the companies.

CHAPTER II

A FIELD STUDY ON THE COMPARISON OF THE MANUFACTURING COMPANIES BEFORE AND AFTER THE POSITIVE REAL INTEREST POLICY WAS PUT INTO EFFECT

2.1. RESEARCH DESIGN AND METHODOLOGY

2.1.1. Research Objective

The main objective of this study is to test whether positive real interest rate policy created any differences in the financial structure and operating results of the companies in the manufacturing industry.

2.1.2. Sampling and Data Collection Procedure

The required data for this study were obtained from Istanbul Chamber of Industry Periodicals dated 1984 and 1985 and from Financial Analysis book written by Cihangir Samin.

For this study two groups of companies are determined. Data for the "Group One" are selected from the years of 1979 and 1980 since it was assumed that new economic policies have effected operating results and financial structures of the Companies in these two years.

As a second group, "Group Two", assuming that it would take a few years for the Companies to adapt their financial structures and operations to the new free interest rate policy, data was selected from the years of 1983 and 1984.

Each group has 180 companies consisting of 90 companies from each year.

2.1.3. Data Analysis Methods

In this study, Multiple Discriminant Analysis and Z. test were utilized to see whether above mentioned two groups statistically differ from each other in the aspect of financial structures and operating results.

a) Discriminant Analysis

Discriminant Analysis is the appropriate statistical technique when the dependent variable is categorical and the independent variables are metric. Since the dependent variables to be used in the study consist of classifications and the independents are metric, this analysis method is going to be used in the study.

Discriminant Analysis involves deriving the linear combination of the two (or more) independent variables that will discriminate best between the a priori defined groups. This is achieved by the statistical decision rule of maximizing the between-group variance relative to the within-group variance- this relationship is expressed as the ratio

of the between-group to the within group variance (Hair and Andersan, 1979, p.85). The linear combinations for a discriminant analysis are derived from an equation which takes the following form:

$$Z = W_1X_1 + W_2X_2 + W_3X_3 + \dots + W_nX_n$$

where

Z = the discriminant score

W = the discriminant weights or discriminant coefficient

X = the independent variables

The discriminant coefficients are assigned according to the discriminating power of independent variables. Disregarding signs, the higher the discriminant coefficient, the more important the independent variable is (Hair and Anderson, 1979, p.110). The discriminant coefficients take into account correlations among variables. In this regard, MDA minimizes the multicollinearity among the independent variables (Massy, 1965).

b) Z - test*

Z - test analysis, which is one of the univariate statistical techniques, focuses on the differences in the means between two groups. It is an appropriate statistical technique for hypothesis when the variables are measured in at least an interval scale and the sample size is greater than 30.

Testing this hypothesis involves:

- The estimated standard error of the differences between two means:

$$\lambda_{X_{1-2}} = \sqrt{\frac{1}{n_1} + \frac{2}{n_2}}$$

λ_1 = estimated standard deviation of Group One

λ_2 = estimated standard deviation of Group Two

n_1 = sample size for Group One

n_2 = sample size for Group Two

- The exact probability can be calculated as

$$Z = \frac{I(X_1 - X_2) - (X_1 - X_2) I}{X_{1-2}}$$

The null hypothesis is stated as "the means are equal", i.e. $M_1 - M_2 = 0$, therefore Z value was calculated as

$$Z = \frac{X_1 - X_2}{X_{1-2}}$$

The probability corresponding to calculated Z value is obtained from the table showing the area under the normal curve. This section is summarized from Tull Hawkins, 1984, p.463.

2.1.4. Variable Selection

To apply discriminant analysis, it must be first specified which variables are to be independent variables and

which is to be the dependent variable recalling that the dependent variable is categorical and in dependent variables are metric.

The aim of this study is to see whether there are any statistitcal differences between two groups of companies in the aspect of their financial structures and operating results or not.

In light of this fact, the dependent variable was two groups of manufacturing companies called as Group One and Group Two.

Since these two groups are identified as dependent variables are financially compared with each other; as financial indicators the following ratios were computed for each group and they were determined as independent variables.

$$X_1 = \text{Asset Turnover} = \text{Sales, net} / \text{Total Asset}$$

$$X_2 = \text{Equity} / \text{Total Asset}$$

$$X_3 = \text{Equity Turnover} = \text{Sales, net} / \text{Equity}$$

$$X_4 = \text{Return to Equity} = \text{Profit before tax} / \text{Equity}$$

$$X_5 = \text{Return on Assets} = \text{Profit before tax} / \text{Total Asset}$$

$$X_6 = \text{Return on Sales} = \text{Profit before tax} / \text{Sales, net}$$

2.1.5. Limitations of the Study

In this study, the following limitation was encountered in the identification of independent variables. Under the facility of given figures in the Istanbul Chamber

of Industry Periodical and Financial Analysis book written by Cihangir Samin, only six ratios including Asset Turnover, Equity/Total Asset, Equity Turnover, Return to Equity, Return on Assets and Return on Sales could be computed. The other ratios indicated in Appendix I, that would be used in the analysis of financial structure could not be computed due to lack of information.

The other limitation encountered in the calculation of financial ratios is that given figures for the shareholders' equity includes revaluation adjustment of the fixed assets that was allowed to the Companies after 1982 which would have given a better prediction in the analysis if the figures for shareholders' equity were net-off revaluation adjustment.

Additionally in the selection of dependent variables two groups of years were determined. Group One and Group Two, and 180 companies that comprise Group Two were selected from the years of 1983 and 1984 and 180 companies that comprise Group One were selected from the years of 1979 and 1980. Since the Group Two was determined based upon the assumption that it would take a few years for the manufacturing companies to adapt their financial structures to the new free interest rate policy, it leads to a limitation that the results would have been different if the Group Two were determined from the years of 1982 and 83 or 1981 and 82.

During the construction of two dependent variables, Group One and Group Two, 90 companies from each year i.e. 1979, 1980, 1983 and 1984 were used. Since these 90 companies of the four years were selected from the manufacturing companies and it does not necessarily mean that these 90 companies for each year are the same, it creates a limitation that, the results of this study would have been different, if 90 companies for each year were the same.

2.2. RESEARCH FINDINGS

2.2.1. Results of Discriminant Findings

As can be seen in Table 2.2.1.1., the discriminant function was found to be statistically significant ($X^2 = 76.805$, $x = .0000$). As indicated by the values of Canonical Correlation and Wilks' lambda which are equal to 4410772 and 8054509 respectively it is also seen that the differences between the two groups can be properly explained. If the square of canonical correlation is taken, 194549 is found, which means that the following discriminant function,

$$Z = W_1X_1 + W_2X_2 + W_3X_3 + \dots + W_nX_n$$
$$Z = .30117 X_1 + .73085 X_2 + .01108 X_3 - .42622 X_4 - .19140 X_5 - .38820 X_6$$

explains approximately 20% of the discrimination, leaving 80% unexplained, which also implies that there might be other independent variables in the discriminant function.

Table 2.2.1.1

Canonical Discriminant Functions of Two Groups

<u>Canonical Correlation</u>	<u>Wilks' Lambda</u>	<u>Chi-Square</u>	<u>d.f.</u>	<u>Significance</u>
4410772	8054509	76.805	6	0.0000

Although univariate comparisons of group means do not produce information about the net contribution of the variables in discriminating between the groups, they provide profile information which aids the interpretation of results of multivariate analysis.

Table 2.2.1.2 presents the standardized coefficients of the six independent variables for the discriminant function. Table 2.2.1.2 presents also the discriminating variables.

The results of Standardized Canonical Discriminant Function Coefficients and Structure Matrix indicate that var 4-Return to Equity, var 2-Equity/Total Asset and var 6-Return on Sales can be accepted as a discriminant or between the two groups of companies, but limitation caused by revaluation adjustment needs to be taken into consideration.

Table 2.2.1.2

Standardized Canonical Discriminant Function
Coefficients and Structure Matrix

<u>Ratios</u>	<u>Standardized Canonical Discriminant Function Coefficients</u>	<u>Structure Matrix</u>
1. Asset Turnover	.30117	.27885
2. Equity/Total Asset	.73085	.54872
3. Equity Turnover	.01108	.07465
4. Return to Equity	-.42622	-.69233
5. Return on Assets	-.19140	-.22420
6. Return on Sales	-.38820	-.45380
Group Centroids	Group One	-.49010
	Group Two	.49010

$$\text{Cutting Score } (Z_{CE}) = \frac{Z_A + Z_B}{Z} = \frac{-.49010 + .49010}{Z} = 0$$

It is understood from the coefficients of variables 4, 2 and 6 that companies from 1983 and 1984 use more equity than the companies from 1979 and 1980 and due to the fact that companies from 1979 and 1980 use less equity than the companies from 1983 and 1984, their Return to Equity ratio is greater than the companies from 1983 and 1984's ratio. Additionally since financial expenses became higher due to increase in interest rates, return on sales has decreased after the positive real interest policy was put into effect.

Group centroids as given Table 2.2.1.2 indicate that mean discriminant scores of the groups are not close to each other, thus yielding a significant discrimination.

Table 2.2.1.3 is known as a confusion matrix and helps visualize exactly how accurate the discriminant function was in predicting group function membership.

Table 2.2.1.3
Confusion Matrix

Actual Group Membership	Number of Cases	Predicted Group Membership	
		Group One	Group Two
Group One	180	133 73.9 p	47 26.1 p
Group Two	180	43 23.9 p	137 76.1 p

The results of the classification procedure are presented in Table 2.2.1.3. The entries on the diagonal of the matrix represent the number of companies correctly assigned to their group. The numbers of the diagonal represent the incorrect classifications. In this study, the number of firms actually in and correctly assigned to Actual Group One was 133. The number incorrectly assigned to Actual Group Two was 47. Similarly the number of correct classifications to Group Two was 137 and the number of incorrect assignments to Group One was 43. Thus, the percentage classification accuracy of the discriminant function for the Group One and Group Two would be 73.9% and 76.1% respectively.

Percent of "Grouped" cases correctly

$$\text{Classified: } \frac{133 + 137}{360} = 75\%$$

$$C_{\text{proportional}} = p^2 + (1-p)^2 \quad 0$$

p = the proportion of individuals in Group One

$1-p$ = the proportion of individuals in Group Two

$$C_{\text{prop}} = \left(\frac{180}{360}\right)^2 + \left(\frac{180}{360}\right)^2$$

$$= 0.50$$

Since the percentage of correct classifications is significantly larger than would be by chance, the discriminate function derived gives a better prediction than chance. The proportional chance criterion is 50% which differs from the overall classification accuracy, meaning an improvement is provided in prediction accuracy through the use of discriminant function.

2.2.2. Results of Z-Test Analysis

As can be seen from Table 2.2.2.1 the differences between the means of var 4-Return to Equity, var 2-Equity/Total Asset and var 6-Return on sales ratios for the Group One and Group Two are significant. i.e. they differentiate two groups significantly. The differences between the means of the other variables except the var 3-Equity Turnover, for the two groups of companies are also significant which mean that they also differentiate two groups of companies

significantly but not as much as the above three variables do.

If Table 2.2.2.1 is further analyzed, it is seen that the means of var 1, var 2 and var 3 are higher for the Group Two companies whereas the means of var 4, var 5 and var 6 are higher for the Group One companies, which leads to higher Asset Turnover, Equity/Total Asset and Equity Turnover Ratio and smaller Return on Assets, Return on sales and Return to Equity Ratios for the Group Two Companies. These mean that the companies in Group Two, after the positive real interest rate policy was put into effect, began to use more equity than debt in their financing and because of their utilization of more equity as can be seen from the Equity/Total Asset Ratio, Return to Equity Ratio is higher for the Group One companies. Also since the cost of borrowings became higher, the financial expenses have increased which caused the companies from Group Two to have smaller Return on Sales Ratio.

Table 2.2.2.1

Z-Test Results

Variables	Group One		Group Two		Z*
	$\bar{X}_1$	λ_1	$\bar{X}_2$	λ_2	
1. Asset Turnover	1.25000	1.19951	1.61167	1.43629	-2.5926
2. Equity/Total Asset	24.24778	18.76513	35.00889	21.17673	-5.1027
3. Equity Turnover	6.49722	5.49544	8.31556	34.70997	-0.6942
4. Return to Equity	81.22833	83.43527	32.18500	59.02658	6.4379
5. Return on Assets	17.66278	29.73065	12.35833	16.77365	2.0848
6. Return on Sales	15.72389	18.65996	8.47833	13.50831	4.2198

*Calculations of Z values are given in Appendix III.

CHAPTER III

SUMMARY AND CONCLUSION

3.1. CONCLUSION OF THE STUDY FINDINGS

The study aimed to see statistically whether there happened any differences between the financial structures and operating results of the manufacturing companies after positive real interest rate policy was put into effect in 1980.

The study included two groups, Group One was comprised of 180 companies from the years of 1979 and 1980 and Group Two was comprised of 180 companies from the years of 1983 and 1984.

The required data for the study was obtained from Istanbul Chamber of Industry Periodical and Financial Analysis book written by Cihangir Samin. Financial ratios calculated through the data including operating results and financial structures of the companies from those four years were analyzed by using Z-test and Multiple Discriminant Analysis methods.

The conclusions of this study will be discussed in the following section:

Findings of the study showed that the difference between the financial structures and operating results of the manufacturing companies from Group One and Group Two was significant.

Giving effect that the results of analysis were significant, an essential finding derived from the analysis in the aspect of shareholders' equity is that the companies from Group Two, that is after the positive real interest rate policy was put into effect, use more equity rather than debt in their financing. Because of their utilization of equity more than the companies from Group One, Return to Equity Ratio is greater for the Group One companies.

Since the cost of loans granted by the banks or other financial institutions is fairly expensive, to finance the operations and investments through external financing will create an enormous amount of financial expenses which decrease the profitability and financial strengths of the companies. This can also be seen from Group One companies having higher return on sales' ratio but the important fact is that the significance of Return to Equity Ratio and Equity/Total Asset Ratios is higher than the significance of Return an Sales Ratio. Considering this fact, it can be seen from the results of analysis that companies began to use more equity than external financing in the financing of its

operations. Thus this adjustment by the manufacturing companies to the positive real interest rate policy will lead the manufacturing companies to have more equity based financial structure, which will also give a better position to the debtors and decrease their risks.

One major aim of the positive real interest rate policy was to have equity-external borrowing balance in the companies, those of which had used cheap credits for many years and had not seen any need to use equity in the financing. For that reason they haven't had any experience in the adjustment process for the changes in the interest rates. But this study showed that these companies had adjusted their financial structures and began to use more equity. This study also showed that the government and other public agencies such as Central Bank obtained the results that they had sought for when they first began to apply positive real interest rate policy in 1980. This study also implies that due to the adjustment process of the companies to the positive real interest policy, the risk of creditors have decreased, due to the increase in the probability of repayment of loans as a result of using more equity.

Having this study being done by eliminating the limitations explained in detail in section 2.1.5 and further on subsectoral basis, instead of manufacturing sector in general, would give important findings both to management of the companies and to such public authorities as governments

or Central Bank. By that way, they could see how changes in the interest rate policies effect the financial structures and operating results of the manufacturing companies and how those companies adapt their financial structures without having limitations explained before.

In spite of the limitations that were explained in the section 5 of Research Design and Methodology, this study may provide a guideline for studying the effects of the positive real interest rate policy on the operating results and financial structures of the manufacturing companies. This study may also provide a useful understanding of how the positive real interest rate policy has effected the financial structures of the manufacturing companies.

APPENDIX I

THE OTHER FINANCIAL RATIOS THAT COULD BE USED IN THE STUDY

- Debt/Total Asset*
- Debt/Equity*
- S/T Borrowings/Total Assets
- S/T Borrowings/Total Debt
- L/T Debt/Total Assets
- L/T Debt/L/T Debt + Equity
- Equity/Fixed Assets, net
- Fixed Assets, net/L/T Debt

*These two ratios are the same as the Equity/Total Asset Ratio which was already used in the study.

APPENDIX II

DEFINITIONS OF KEY TERMS

Centroid

The mean value for the discriminant Z-scores for a particular category or group. A two-group discriminant analysis that was used in this study has two centroids, one for each of the groups.

Classification Matrix

Also referred to as a confusion, assignment, or prediction matrix. It is a matrix containing numbers which reveal the predictive ability of the discriminant function. The numbers on the diagonal of the matrix represent correct classifications and the off diagonal numbers are incorrect classifications.

Canonical Correlation

Measures the strength of the overall relationships between the linear composites of the predictor (independent) and the criterion (dependent) sets of variables. In effect, it represents the bivariate correlation between the two linear composites, i.e. it tells us how closely the function and the "group variable" are related, which is just another measure of the functions ability to discriminate among the groups.

Wilks' Lambda

Lambda is an inverse measure of the discriminating power in the original variables which has not yet been removed by the discriminant functions-the larger lambda is, the less information remaining Lambda can be transformed into. a chi-square statistic for an easy test of statistical significance.

APPENDIX III

CALCULATIONS OF Z VALUES

- For the first variable (Asset Turnover):

$$\lambda_{1-2} = \sqrt{\frac{1.19951^2}{180} + \frac{1.43629^2}{180}} = 0.1395$$

$$Z = \frac{1.25000 - 1.61167}{0.1395} = -2.5926$$

- For the second variable (Equity/Total Asset):

$$\lambda_{1-2} = \sqrt{\frac{18.76513^2}{180} + \frac{21.17673^2}{180}} = 2.1089$$

$$Z = \frac{24.24778 - 35.00889}{2.1089} = -5.1027$$

- For the third variable (Equity Turnover)

$$\lambda_{1-2} = \sqrt{\frac{5.49544^2}{180} + \frac{34.70997^2}{180}} = 2.61935$$

$$Z = \frac{6.49722 - 8.31556}{2.161935} = -0.69419$$

- For the fourth variable (Return to Equity):

$$\lambda_{1-2} = \sqrt{\frac{83.43527^2}{180} + \frac{59.02658^2}{180}} = 7.6178$$

$$Z = \frac{81.22833 - 32.18500}{7.6178} = 6.4379$$

- For the fifth variable (Return on Assets):

$$\lambda_{1-2} = \sqrt{\frac{29.73065^2}{180} + \frac{16.77365^2}{180}} = 2.5443$$

$$Z = \frac{17.66278 - 12.35833}{2.5443} = 2.0848$$

- For the sixth variable (Return on Sales):

$$\lambda_{1-2} = \sqrt{\frac{18.65996^2}{180} + \frac{13.50831^2}{180}} = 1.7170$$

$$Z = \frac{15.72389 - 8.47833}{1.7170} = 4.2198$$

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