C H A P T E R - III

ASSESSMENT OF PREDICTIVE ABILITY OF FINANCIAL RATIOS IN TEA UNITS.

A financial ratio stands as an index of the relationship between two individual or sets of financial variables. Again, every relationship of the financial variables can be transformed into an equation for analytical purposes. "A equation is a truism in the ex post sense. In order to have practical significance, the financial variables of the equation should be interpreted in the ex ante sense or in casual sense"[1]. The abstract relativity depicted in any equation, so formed, is rather suggestive, if not conclusive, of the working of any concern. Hence, mathematical precision arrived at for the ratio analysis has, at times, little relationship with the reality. Inspite of the shortcomings and limitations, the ratios are the most valuable measure to study the financial performances and the various aspects of financial health of the various concerns over times.

Every act in the various areas of a corporate body has its effects on its own corporate structure and its financial health. "Every act causes changes throughout the firm and would be reflected on the balance sheet"[2]. To evaluate these changes and also the changes in the degrees (i.e. sound/sick) of corporate financial health, a single isolated ratio assisted

by the rule of 'Trial and Error' can surely be misleading. Thus, for proper evaluation, it is necessary to start with the financial ratios in sets or the sets of various combination of financial ratios accompanied by statistical and mathematical tools.

The financial ratios so far used to analyse and predict various aspects of the financial health are voluminous; but our study is limited to 52 financial ratios [vide Annexure - III...] grouped under five heads : profitability, financial stability, liquidity, asset utilisation and turn-over.

To identify the financial ratios significant in monitoring various changes in the corporate financial health and to assess their predictive ability (i.e. effectiveness of the financial ratios in predicting the different degrees of corporate financial health) the steps followed by the present study are:

A) Attempts have been made to select a profile of financial ratios significant in discriminating the different degrees of financial health through statistical significance tests: (i) Mean-Test and (ii) F-Test;

B) Attempts have been made to list various combination-sets of the 'significant financial ratios' (i.e. the ratios which were able to discriminate different degrees of corporate financial health of sample units) through the assessment of the relative contribution of these financial ratios (representing the total

significant ratio set and/or the set of a particular ratio-group) to the overall discriminant function, and also on the basis of the financial theories of firms;

C) Attempts have been made to assess the effectiveness of the financial ratios through 'Sets' after finalising the list(s) of the financial ratios which would appear in the various 'Sets' of ratio-combination(s); and for this:

(i) separate discriminant functions have been computed for each separate 'Sets', and

(ii) observations have been made on : (a) their discriminating power, (b) their increment/reduction in discriminating power on/from that of the 'original' discriminant function, (c) relative contribution of the individual financial ratios to the 'reduced' discriminant functions, and (d) their predictive accuracy matrices for predicting various degrees of financial health;

and,

D) Attempts have also been made to interprete and analyse the results of the accuracy matrices of the 'Sets' to select the best 'Set of financial ratios' and the discriminant function represented by those ratios which were found significant in monitoring various degrees of corporate financial health of the Tea units;

A) SELECTION OF THE PROFILE OF THE SIGNIFICANT FINANCIAL RATIOS:

To assess the significance of each and every financial ratio/(s) under consideration of the present study in predicting the degrees of financial health and also to select a profile of the significant financial ratios that were required to use for testing pruposes, the methodology followed is :

(i) Testing the significance of the ratios through Mean-Test,

(ii) Testing the significance of the ratios through F-Test, and

(iii) Selection of a profile of the significant ratios qualified through both the tests (i) and (ii).

(i) MEAN TEST:

Whether the magnitudes of the financial ratios of the sample units belonging to the 'Good financial health' group significantly differ from that of the units belonging to the 'Sick financial health' group could be tested through 'Mean Test'. This test has been performed for all the 52 financial ratios under the present study.

It could be observed (Table III.1) that, the ratios R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R16, R17, R18, R19, R21, R22, R23, R24, R25, R26, R27, R28, R29, R30, R33, R34, R35, R36, R37, R38, R39, R40, R41, R46, R47 and R49 had

Table - III.1

RESULT OF THE MEAN-TEST OF THE 52 SAMPLE FINANCIAL RATIOS

Ratio	Mean-Test Score	Ratio	Mean Test Score
R-1	4.3341081	R-28	12.5323160
R-2	8.5268622	R-29	9.5561995
R-3	9.1196673	R-30	2.9126300
R-4	3.7644189	R-31	0.9639223**
R-5	3.9288881	R-32	1.8022718**
R-6	8.7123213	R-33	14.2368110
R-7	8.8235176	R-34	7.7054828
R-8	3.5386127	R-35	14.5679980
R-9	5.2191605	R-36	14.3174810
R-10	13.0710920	R-37	5.9075115
R-11	14.0940820	R-38	2.3691542*
R-12	7.1327968	R-39	9.7169996
R-13	14.3798550	R-40	11.5760430
R-14	1.3593443**	R-41	11.5126890
R-15	1.7159471**	R-42	1.9229207**
R-16	12.5784800	R-43	1.1166815**
R-17	3.0756500	R-44	0.9789261**
R-18	7.2698673	R-45	1.1745655**
R-19	13.8208440	R-46	2.9796270
R-20	0.2858455*	R-47	8.5690327
R-21	3.9273903	R-48	0.3183312**
R-22	5.1094664	R-49	4.1152276
R-23	12.9572200	R-50	1.5867733**
R-24	7.1664026	R-51	1.3642532**
R-25	2.6022563	R-52	1.6032887**
R-26	5.1524143		
R-27	15.1202040		

NOTE: * Significant at 5 percent level of confidence but insignificant at 1 percent level of confidence.

** Insignificant at both 5 percent and 1 percent level of confidence.

significant differences in the mean values between the units of the two groups ('Good' and 'Sick') at one percent level of confidence. The ratio R-38 had significant difference at only five percent level of confidence. Thus, it was found that the majority of the financial ratios under the study were not coming from the same financial health group, i.e. the magnitudes of the above stated financial ratios of the sample units belonging to the 'Good financial health' group differ considerably from that of the sample units belonging to the 'Sick financial health' group.

Table - III. 2

FINANCIAL RATIOS TURNED INSIGNIFICANT BY THE MEAN-TEST

Ratio	Description of the ratio
R-14	PBT/Net Worth
R-15	PAT/Net Worth
R-20	Depreciation Charges/Sales (net of excise)
R-31	Short-term Bank Borrowing/(Working Capital Gap + Short-term Borrowings from Non-bank sources)
R-32	Short-term Borrowings/Working Capital Gap
R-38	Working Capital/Sales (net of excise)*
R-42	Current Liabilities/Sales (net of excise)
R-43	Trade Creditors/Sales (net of excise)
R-44	(Trade Debtors - Trade Creditors)/Sales (net of excise)
R-45	Current Assets/Sales (net of excise)
R-48	Net Fixed Assets/Gross Fixed Assets
R-50	Stock/Sales (net of excise)
R-51	Trade Debtors/Sales (net of excise)
R-52	Stock/Cost of Goods sold

NOTE: * Significant at 5 percent level but insignificant 1 percent level.

In analysing the financial ratios (Table-III.2) which failed to discriminate between the different degrees of financial health of the sample units, i.e. the financial ratios which had no significant differences between the mean values of the ratios for the two types of sample units - the 'good' and the 'Sick', it was observed that, all the firms under the 'Sick financial health' group incurred losses and disclosed a negative balance in NW, PBT and obviously in PAT. Again, all the firms of the 'Good financial health' group earned profits and disclosed a positive balance in NW, PBT and PAT. When computed, both the ratios (PBT/NW and PAT/NW) disclosed positive balances for the firms under both the groups because of the mathematical impact of signs[3]. Owing to the technical defect (i.e. mathematical impact of signs) inherent in computation process, these ratios were unable to discriminate between the negative (bad) and positive (good) financial characters and thereby failed to convey any significant and meaningful information or signals to discriminate between the different degrees of financial health, and thus the ratios, when tested for significant mean differences, failed to discriminate between units under the 'Good financial health' group and the 'Sick financial health' group and thereby turned out to be insignificant ones.

Again, a close relationship could be observed between the sales revenues and the amount of depreciation provided by the sample units, irrespective of their group belongings. For the ratio, R-20 (Depreciation charges/Sales (net of excise) the

difference between the mean value of the units under the groups (the 'good' and the 'Sick') was 0.0021 which was negligible; and that was the cause of the ratio R-20, to become insignificant.

A close scrutiny of the sampe units revealed that the 'short-term bank borrowings' constituted a lion's share in the working capital and the sample units depended much on the banks for their working capital needs. A shortage in the working capital was recurring every year and was common to all the sample units. The units, irrespective to their financial conditions, were either unable to repay or were in the practice to delay in repaying such bank loans which led the units to bear the burdens of huge debts. The volume of trade debtors, trade creditors, creditors for expenses, were very small and were generally condensed in the published statements; these led it difficult to work out the exact amount of 'working capital gap' which might led to overlook some valuable information which could help to discriminate between the different degrees of financial health. For all these reasons, the ratio R-31, R-32, R-42, R-43, R-44, R-45 and R-51 failed to show any significant differences in the mean values of the ratios between the 'good' and 'sick' groups and became insignificant.

It could be observed that, the ratio R-48 (Net Fixed Assets/Gross Fixed Assets) became insignificant basically owing to the fact that all the sample units, irrespective to their financial conditions, were in operation with a similar

age-old fixed assets and no remarkable volume of replacement had ever been taken place; and the units were following almost similar depreciation policies.

The ratio Stock/Sales (net of excise) (R-50) and Stock/Cost of Goods Sold (R-52) could also be observed as insignificant ones for the sample units under our study. The causes of the failure of these ratio to provide signals to help to discriminate between the degrees of financial health was due to the fact that, the published accounts of the sample units presented the data regarding both the stock and the cost of goods sold in a condensed form with the other presentable items and thus it became impossible to work out the exact amount of the above items which might led to overlook some valuable information which could help to signal and to reflect the different degrees of financial health.

Thus, through the 'mean-test', it could be observed that 38 out of 52 financial ratios under this study (Table - III.1) were showing significant differences in the mean values for the different degrees of financial health of the sample units. In other words, for the majority of the financial ratios under the study, the variations in the financial health of the sample units were reflected by the variations in the magnitudes of the financial ratios.

(ii) F - Test

Whether the financial ratios are able to discriminate between the different degrees of financial health by the

variations in their magnitudes i.e. whether the magnitudes of the financial ratios for the sample units belonging to the 'Good financial health' group and 'Sick Financial health' group differ considerably or not, (so that, one can use the ratios as reflector of financial health), have been studied through the F-test. This test has been performed for all the 52 financial ratios.

Table - III.3

RESULT OF THE F-TEST OF THE 52 SAMPLE FINANCIAL RATIOS

Ratio	F-Test Score	Ratio	F-Test Score
R-1	18.276724	R-23	163.348430
R-2	70.741555	R-24	49.969087
R-3	80.918827	R-25	6.5886912*
R-4	13.782569	R-26	25.799514
R-5	15.018868	R-27	222.439850
R-6	73.851660	R-28	152.812710
R-7	75.749018	R-29	88.987509
R-8	12.178686	R-30	8.2374825
R-9	26.503250	R-31	0.9022086**
R-10	166.228170	R-32	3.1540183**
R-11	193.261900	R-33	196.975680
R-12	49.501440	R-34	57.769495
R-13	201.185030	R-35	206.488930
R-14	1.7978616**	R-36	199.448250
R-15	2.864880**	R-37	33.954962
R-16	153.936480	R-38	5.461164*
R-17	0.00 **	R-39	91.867744
R-18	51.422277	R-40	130.382250
R-19	185.841630	R-41	128.958480
R-20	0 .0794376**	R-42	3.5976744**
R-21	15.006362	R-43	1.2132648**
R-22	25.392045	R-44	0.9323856**

Contd..

Table - III.3 (Contd..)

Ratio	F-Test Score	Ratio	F-Test Score
R-45	1.3423104**	R-49	16.477214
R-46	8.6381856	R-50	2.4497856**
R-47	71.415342	R-51	1.8056025**
R-48	0.0985536**	R-52	2.4763752**

NOTE : * Significant at 5 percent level but insignificant at 1 percent level of confidence.

** Insignificant at both 5 and 1 percent level of confidence.

It could be observed that (Table - III.3) the magnitudes of the majority of the financial ratios (under the study) of the sample units belonging to the 'Good financial health' group differ considerably from that of the sample units under the 'Sick financial health' group. The financial ratios which satisfied the F-test at one percent level of significance were, R-1, R-2, R-3, R-4, R-5, R-6, R-7, R-8, R-9, R-10, R-11, R-12, R-13, R-16, R-18, R-19, R-21, R-22, R-23, R-24, R-26, R-27, R-28, R-29, R-30, R-33, R-34, R-35, R-36, R-37, R-39, R-40, R-41, R-46, R-47 and R-49. The financial ratios R-25 and R-38 only had significance at 5 percent level of confidence.

It could also be observed that the financial ratios which were found insignificant by the 'Mean-test' in discriminating the financial health of the sample units, were also found insignificant by this F-test and in addition to these ratios,

Table - III.4

THE FINANCIAL RATIOS TURNED INSIGNIFICANT BY THE F-TEST.

Ratio	Description of the Ratio
R-14	PBT/Net Worth
R-15	PAT/Net Worth
R-17	Total Dividends/Profit after Tax
R-20	Depreciation Charges/Sales (net of excise)
R-25	Net Worth/Sales (net of excise)*
R-31	Short term Bank Borrowings/W.C. Gap + Short-term Non-Bank Borrowings
R-32	Short-term Borrowings/Working Capital Gap
R-38	Working Capital/Sales (net of excise)*
R-42	Current Liabilities/Sales (net of excise)
R-43	Trade Creditors/Sales (net of excise)
R-44	(Trade Debtors - Trade Creditors)/Sales (net of excise)
R-45	Current Assets/Sales (net of excise)
R-48	Net Fixed Assets/Gross Fixed Assets
R-50	Stock/Sales (net of excise)
R-51	Trade Debtors/Sales (net of excise)
R-52	Stock/Cost of Goods sold.

Note: * Ratios are significant at only 5 percent level of confidence but insignificant at 1 percent level.

Total Dividends/PAT (R-17) and Net Worth/Sales (net of excise) (R-25) were also found insignificant by the F-test (Table - III.4), In analysing the ratio R-17, it was observed that almost all the sample units irrespective of their group belongings (i.e. 'Good' and 'Sick') declared no dividend for a number of years, and as such, this ratio was unable to discriminate between the sample units according to their financial health and thereby turned insignificant. The ratio R-25 was significant at 5 percent level only.

Thus, through the F-test it could be observed that 36 out of the 52 financial ratios selected for the study (Table - III.5) were showing significant differences in their magnitudes for the sample units having dissimilar financial healths.

From the results of the above statistical significance tests (Mean Test and F-test), it could be observed that only 36 financial ratios out of the 52 satisfied both the tests (Table-III.5). (If we consider only 1 per cent level of confidence, then it could also be observed that 36 financial ratios satisfied both the tests and the first hypothesis).

It is to be noted that none of the turn-over ratios [except R-29 (Interest/Sales (net of excise)), and R-30 (Short-term Bank Borrowings/Sales (net of excise)) which have been included in the financial stability group_7 were found significant under both the tests i.e. Mean-test and F-test.

Table - III.5

FINANCIAL RATIOS QUALIFIED THROUGH BOTH THE MEAN TEST AND F-TEST

Ratio No.	Description of the Ratio
PROFITABILITY RATIOS	
R-1	EBDIT/Sales (net of excise)
R-2	EBDIT/Total Assets
R-3	EBDIT/(Total Assets + Accumulated Dep.)
R-4	EBDIT/Interest
R-5	EBIT/Sales(net of excise)
R-6	EBIT/Total Assets
R-7	EBIT/(Total Assets + Accumulated Dep.)
R-8	EBIT/Interest
R-9	OCF/Sales(net of excise)
R-10	OCF/Total Assets
R-11	OCF/(Total Assets + Accumulated Dep.)
R-12	OCF/Debt
R-13	OCF/Current Liabilities
R-16	Retained Profit/ Total Tangible Assets
R-18	(Retained Profit + Dep. charges)/Debt
R-19	(Ret. Profit + Dep. Charges)/ Tangible Assets + Accumulated Dep)
R-21	Depreciation charges/ Net Fixed Assets
R-22	Dep.charges/Gross Fixed Assets
R-23	Net Profit(before Tax)/- Total Capital employed
Financial Stability Ratios	
R-24	Net Worth/Debt
R-26	Net Worth/Long-term Debt
R-27	Debt/Tangible Assets
R-28	All outside liabilities/ Tangible Assets
R-29	Interest/Sales (net of excise)
R-30	Short-term Bank Borrowings/Sales (net of excise)
R-33	All Bank Borrowings/ Total Assets
R-34	Book Value of Equity/ Book Value of Debts
R-35	Net Worth/Total outside liabilities
Liquidity Ratios	
R-36	Current Assets/Current Liabilities
R-37	Quick Assets/Current Liabilities
R-39	Working Capital/Debt
R-40	Working Capital/ Tangible Assets
Asset Utilization Ratios	
R-46	Sales/Total Assets
R-47	Retained Earnings/ Total Assets
R-49	Quick Assets/Current Assets

B) LISTING VARIOUS COMBINATION 'SETS' OF THE FINANCIAL RATIOS, ABLE TO DISCRIMINATE BETWEEN THE DEGREES OF FINANCIAL HEALTH OF THE SAMPLE UNITS

Having the profile of the 36 financial ratios (vide Table - III.5) qualified by the statistical significance tests, their discriminatory ability are needed to be tested, and for this purpose, the present study attempted to assess the overall relative importance of each individual ratio in discriminating different degreees of financial health of the sample units, in a multivariate setting. For this purpose, our study used the 'Multiple Discriminant Analysis' technique (linear form only).

The Discriminant Analysis is well described in the text books of Statistics. It is "designed to establish a procedure for assigning items to predetermined populations. It is to help us distinguish items in one population from those in another"[4].

In the present study, two group situation was considered when 'Good financial health' and 'Sick financial health' bearing units with the variables consisted of financial ratios derived from the conventional published annual accounts and reports consisting the data sample from which the linear discriminant function was derived.

The relative contribution of the individual ratios to the overall discriminating power, were assessed by the 'scaled vector' which have been found out on the basis of some weights (as per the popularity in use in the literature in this matter) and the coefficients of the individual financial ratiosderived

by the linear discriminant function.

The present study considered the linear discriminant function of the form:

$$Z = \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \ldots\ldots + \alpha_k X_k$$

where, $\alpha_1, \alpha_2, \ldots\ldots \alpha_k$ were the discriminant coefficients and, $X_1, X_2 \ldots\ldots X_k$ were the constituent financial ratios[5].

Several computer runs were performed on Multiple (linear) Discriminant Analysis Programme with 36 financial ratios which were significant at one percent level in both the Mean Test and the F-Test. The coefficients of the linear discriminant function so obtained (henceforth referred to as coefficients of 'original' discriminant function) were shown in the Table - III.6.

(i) Test for the discriminating ability of the 'original' discriminant function:

To test the discriminating ability of the discriminant function means testing the hypothesis that, "the population discriminant function does not discriminate. This is equivalent to test that the α_i are all equal to zero"[6].

To judge the situation, the analysis of variance of 'original' function has been done.

It could be observed from the result so obtained (Table - III.7) that the calculated value of F (43.436258) was greater than the Table Value of F at .01 level and thus rejected the hypothesis that 'population discriminant function does not discriminate'. In other words, the discriminant function so obtained (i.e. the original discriminant function) has the discriminating

Table - III.6

Discriminant Co-efficients ('Original' function) of the 'Monitoring' Ratios.

Ratio No.	Discriminant Co-efficients	Ratio No.	Discriminant Co-efficients
PROFITABILITY RATIOS			
1	0.4376749	11	409.151
2	-0.0597458	12	-35.37922
3	-21.24796	13	13.48846
4	-0.4681357	16	14.43773
5	-11.16273	18	41.07085
6	7.309851	19	-421.0584
7	33.84721	21	4.214661
8	0.4147102	22	2.593819
9	10.26926	23	-24.63512
10	-13.05653		
FINANCIAL STABILITY RATIOS			
24	-76.90964	30	-0.3032012
26	-0.0036038	33	-0.3569336
27	-1.706424	34	76.17654
28	-0.5975249	35	1.063056
29	1.285912		
LIQUIDITY RATIOS			
36	0.3390524	40	0.3905871
37	4.716256	41	0.2986426
39	0.8559987		
ASSET UTILISATION RATIOS			
46	-2.26021	49	-3.618119
47	-1.616489		

Table - III.7

ANALYSIS OF VARIANCE OF THE 'ORIGINAL' FUNCTION

Source	Sum of Squares (SS)	Degrees of freedom (m)	Mean of Squares (MS)	F-ratio
Discriminant (between the sample)	KD^2 = 212.96181	P = 36	KD^2/P = 5.9156058	$\frac{KD^2/P}{D/n-p-1}$ =
Residual Error (Within the sample)	D=3.6771436	n-p-1 = 27	D/n-p-1 = 0.1361905	43.436258

NOTE : Table value of F(.99, 30,27)=2.47 and Table Value of F(.99,40,27) = 2.38

Here, $K = \frac{n_1 n_2}{n_1+n_2} = 15.75$;

$$D = \sum_{p=1}^{36} \alpha_p \Delta \bar{X}_{jp},$$

= 3.6771436

where, X_p = Financial Ratios

α_p = Discriminant coefficients

p = No. of financial ratios (1,2,.... 36)

n = Total number of units in 'good' and 'sick' group = 64

n_1 = No. of units in 'good' group = 28

n_2 = No. of units in 'sick' group = 36

j = Group (i.e., Good and Sick, 1 and 2).

ability to discriminate between the two degrees (i.e. the 'good' and the 'sick') of financial health of the sample units.

(ii) Assessment of the Relative Contribution of each Individual Ratio through their Scaled Vector's rank.

The literature in the context of assessing the relative contribution of an individual ratio to the overall discriminating power of the discriminant model is voluminous. According to E.I. Altman, "the relevant statistic is observed as a scaled vector which is computed by multiplying corresponding elements by the square roots of the diagonal elements of the variance - co-variance matrix. Since the actual variable measurement units are not all comparable to each other, simple observation of the discriminant co-efficients is misleading"[7]. According to Taffler "the approach with most intuitive appeal measures the proportion of the Mahalanobis D^2-distance between centroids of the two constituent groups accounted for by each variable according to the following formula:

$$p_j = \frac{C_j(\bar{r}_{jf} - \bar{r}_{js})}{\sum_{i=1}^{K} C_i(\bar{r}_{if} - r_{is})}$$

where, p_j represents the proportion of the D^2-distance accounted for by ratio 'j' and $\bar{r}_{if}$ and $\bar{r}_{is}$ are the means of the 'sick'

and 'good' groups for ratio 'i' respectively"[8]. W. Klecka[9] is in the opinion to obtain scaled vectors for each of the variables through multipying the discriminant co-efficients by the standard deviations of the respective variables.

In the present study, the scaled vectors were computed following (i) the suggestions made by Altman[10]; (ii) the suggestions made by R.J. Taffler[11], and (iii) by multiplying the co-efficients of the individual ratios of the discriminant function by the standard deviations of the respective ratios (i.e. the suggestions made by Klecka[12]). The magnitudes of the scaled vectors so obtained were shown in Table - III.8.

Table - III.8

DISCRIMINANT COEFFICIENTS AND SCALED VECTOR

Ratio No.	Discriminant Coefficient 'original function'	SCALED VECTOR on the suggestions of		
		Altman	Taffler	Klecka
PROFITABILITY RATIOS				
R-1	0.4376749	0.5546099	0.0305579	0.0948729
R-2	-0.0597458	-0.0418708	-0.00349527	-0.0089919
R-3	-21.24796	-13.518887	- 0.9985298	-2.4874179
R-4	- 0.4681357	-24.895524	- 0.8331436	-3.464617
R-5	-11.16273	-12.366268	- 0.8181261	-2.150808
R-6	7.309851	5.9500169	1.5394728	1.0660204
R-7	33.84721	20.970546	1.4884031	3.7780526
R-8	0.4147102	21.055441	0.6384069	2.8790468
R-9	10.26926	10.277481	0.8300008	2.1632319
R-10	-13.05653	-7.9034962	-0.8121997	-1.7833287

Contd..

Table - III.8 (Contd..)

R-11	409.151	181.20508	20.247974	43.393163
R-12	-35.37922	-83.549471	-4.9317583	-13.796455
R-13	13.48846	8.710026	1.0198828	2.1589413
R-16	14.43773	8.4422648	0.8389762	1.8616095
R-18	41.07085	92.434515	5.4311386	15.233708
R-19	-421.0584	-185.90806	-20.435764	-43.99416
R-21	4.214661	1.2486396	0.039764	0.1721726
R-22	2.593819	0.3434395	0.0139237	0.0499024
R-23	-24.63512	17.837107	-1.8849542	-4.1040952
FINANCIAL STABILITY RATIOS				
R-24	-76.90964	-530.85198	-35.195272	-92.424414
R-26	- 0.0036038	- 0.2484104	- 0.0102691	- 0.0362843
R-27	- 1.706424	- 2.6551095	0.3074448	- 0.6526809
R-28	- 0.5975249	- 1.1009291	0.1051217	- 0.236354
R-29	1.285912	0.6245742	-0.0431189	0.11094
R-30	- 0.3032012	- 0.8604695	0.0866171	- 0.1914113
R-33	- 0.3569336	- 0.5096736	0.0588648	- 0.1250489
R-34	76.17654	525.68452	34.888359	91.57015
R-35	1.063056	1.7946708	0.1992211	0.4277206
LIQUIDITY				
R-36	0.3390524	0.5168374	0.0571065	0.1227631
R-37	4.716256	3.9388576	0.1818185	0.5940336
R-39	0.8559987	2.1674086	0.1990307	0.4016902
R-40	0.3905871	0.7979187	0.0691717	0.1610708
R-41	0.2986426	0.6060945	-0.0527946	0.1226924
ASSET UTILIZATION				
R-46	- 2.260210	-5.5467644	-0.1160824	-0.7250891
R-47	- 1.616489	-0.9650993	-0.0611059	-0.1644079
R-49	- 3.618119	-2.7300679	0.0799531	-0.371237

It could be observed from the magnitude of scaled vectors so obtained (Table - III.8) that, the profitability ratios were the majority in showing the highest relative individual discriminating power to overall discriminating power of the 'original' function, i.e. the profitability ratios were the major contributor in the 'original' discriminant function in discriminating the two different degrees of financial health —— the 'good' and the 'sick' (in the first ten ranks in the 'scaled vector', eight were profitability ratios). This result is in consonant with the results obtained by Altman[13], Gupta[14], etc.

(iii) Selection of the Financial Ratios to Form 'Sets' which were used to assess the effectiveness of financial ratios in predicting Corporate Financial Health of the Sample Units:

In this section attempts have been made to select and form smaller sets of significant financial ratios (whose magnitudes varies significantly according to the variations in the financial health of the sample units) through which the effectiveness of the financial ratios in predicting corporate financial health could be assessed. For application in a practical situation, the greater number of variables (financial ratios) in the "best" linear discriminant function can cause difficulties. For this reason, reduced discriminant functions should be developed. Besides, "the reduced model (discriminant function) seems quite appropriate for classification purposes ("prediction") in a practical situation, the full original model can be used in an analytical context (description of the failure process)"[15].

The smaller sets considered by us contain only four financial ratios for each of the sets (save one). The financial ratios for the sets were selected on the basis of : (i) their individual rank-position in the contributors to the discriminating power of the 'original' function of 36 ratios, and (ii) financial standard norms set forth by the financial experts to classify the financial ratios in the groups like, profitability, financial stability, liquidity, asset utilisation, turnover, etc. Thus, attempts have been made by the present study to assess the effectiveness (i.e. predictability) of the financial ratios through the following models:

1. Descriptive model
2. Ratio - representative model
3. Profitability model
4. Financial Stability model
5. Liquidity model
6. Asset Utilisation model.

1. DESCRIPTIVE MODEL

For this model, the financial ratios bearing the highest ranks in the 'scaled vector' irrespective of their ratio-categories, were selected.

It is to be observed that the rank-order of the financial ratios in the 'scaled vectors' so far derived individually on the basis of the methods suggested by Altman[16], Taffler[17] and Klecka[18] disclosed the same rank arrangement of the ratios upto the first six places only (Table - III.9).

Table - III.9

Ranks of the Financial Ratios (first six) as per the 'Scaled Vector'.

Ratio No.	Ratio Description	Ratio Category	Rank-in-Scaled Vector		
			Altman	Taffler	Klecka
R-24	Net worth/Debts	Financial Stability	1	1	1
R-34	Book value of Equity/Book value of Total Debts	"	2	2	2
R-19	(Retained Profit + Depreciation)/ Total Assets + Accumulated Depr.	Profitability	3	3	3
R-11	OCF/Total Assets + Accumulated Depreciation	"	4	4	4
R-18	(Retained Profit + Depreciation)/ Total Debts	"	5	5	5
R-12	OCF/Total Debts	"	6	6	6

It could be observed that the magnitudes of the ratio R-34, of the sample firms, tends to equate with the magnitudes computed for the ratio R-24 as almost all the sample units under the study had no preferred stock. An analysis of the mean, standard deviation, co-efficient of the 'original' discriminant function and the 'scaled vector' of the two ratios (Table- III.10)

revealed that there existed a little difference between the ratio R-34 and ratio R-24. To avoid the effects of the inter-correlation between the two financial ratios, our study considered only the ratio R-24 for this model. It could be observed further that, the ratio R-11 and the ratio R-19 differ only when an unit declared dividend; when an unit declared no dividend, the magnitudes of the two ratios (R-11 and R-19) would be the same. An analysis of the mean, standard deviation, co-efficient of the 'original' discriminant function and the 'scaled vector' of the two ratio (Table - III.10) revealed that there existed negligible difference between the ratios R-11 and R-19, because most of the sample units whether belonging to the 'Good-financial health' group or 'sick financial health' group, either failed to declare or did not declared dividends. The present study considered only ratio R-19 to avoid inter-correlation between the financial ratios themselves and thus finally selected the following ratios for this model and be termed as 1st set of ratios:

i) Net Worth/Debts (R-24)

ii) (Retained Profit + Depreciation)/(Total Assets + Accumulated Depreciation) (R-19)

iii) (Retained Profit + Depreciation)/Total Debts (R-18)

iv) OCF/Total Debts (R-12)

2. RATIO-REPRESENTATIVE MODEL

For this model, attempts were made to select the financial ratios which hold the first rank position amongst the 'scaled vector' of a particular ratio-category. The financial ratios

Table - III.10

Comparative position of the ratios R-19 and R-11, and R-24 and R-34.

Ratio No.	Arithmatic Mean		Standard Deviation		Co-eiffi-eients of the Original Discriminant function	Scaled Vector		
	Good	Sick	Good	Sick		Taffler	Altman	Klecka
R-19	0.0546	-0.1241	0.0293	0.0688	-421.05	-20.43	-185.90	-43.99
R-11	0.0581	-0.1241	0.03	0.0688	409.15	20.24	181.20	43.39
R-24	1.3564	1.2766	-0.3311	0.2350	- 76.9096	-35.1952	-530.85	-92.4244
R-34	1.3564	1.2766	-0.3297	0.2361	76.1765	34.888	525.68	91.5702

which were occupying the highest position in the 'scaled vector' in the ratio categories (vide Table - III.8) were as follows (Table - III.11).

Table - III.11

Rank of the financial ratios in the ratio-categories (as per the magnitude of the Scaled Vector)

Ratio Category	Ratio Description	Ratio No.	Rank of the ratios in the ratio-category		
			Altman	Taffler	Klecka
Profitability	(Retained Profit+Depreciation)/Tangible Assets+Accumulated Depreciation)	R-19	1	1	1
Financial Stability	Net Worth/ Total Debts	R-24	1	1	1
Liquidity	Quick Assets/ Current Liabilities	R-37	1	2	1
	Working Capital/Debts	R-39	2	1	2
Assets Utilization	Sales (Net of excise)/Total Assets	R-46	1	1	1

It could be observed (Table - III.11) that, in the liquidity ratio-category, the 'scaled vector' computed on the basis of the method suggested by Taffler indicated ratio R-39 as the first rank holding ratio but the other two methods (i.e.

suggested by Altman and Klecka) indicated R-37 as the first one. Our study selected the ratio R-37 from the two ratios (i.e. R-37 and R-39) as the representative one of the liquidity-ratio-category because the ratio R-39 could be manipulated by several ways. To some extent, it could be attributed to 'window dressing' by management or to non-disclosure of some important liability items in the balance sheet[19]. This ratio cannot provide better guidelines unless it is studied along with current ratio and turnover ratio[20]. On the other hand, the ratio of Quick Assets to Current Liabilities (R-37) was widely used as a refined measure of firm's liquidity and thus was considered as a more rigorous and penetrating test of the liquidity itself[21]. A careful study of the financial statements of the sample units inidcated that the Commercial Banks were granting short-term loans (to be repaid within one year) to these units against hypothecation of the current crop. These loans constituted the lion's share of the total current liabilities of these units. The Commercial Banks, in general, were interested to see that their lendings were repaid by the units within the stipulated period and for this reason, they attached much importance to the 'Quick ratio' than other liquidity ratios in assessing and granting such short-term finances to these units to meet requirements of their working capital needs.

Thus, our study selected the following financial ratios for this model and be termed as 2nd set of ratios:

i) (Retained Profit + Depreciation)/(Tangible Assets + Accumulated Depreciation)

(R-19) (Profitability-ratio)

ii) Net Worth/Total Debts (R-24)..... (Financial-stability-ratio)

iii) Quick Assets/Current Liabilities (R-37).....

(Liquidity-ratio)

iv) Sales (net of excise)/Total Assets (R-46) .....

(Assets-Utilization-ratio)

3. PROFITABILITY MODEL

For this model, attempts were made to select the financial ratios according to their relative-higher-occupancy in the rank position of the 'scaled vector' of the ratios belonging to the profitability-category only. The financial ratios occupying the first four ranks in the scaled vector of this ratio category were selected. Analysing the scaled vectors (Table - III.8) the following were observed (Table - III.12):

Table - III.12

First Five Ranks of the Ratios in the Profitability-category

Ratio No.	Ratio Description	Ranks based on the Scaled Vector		
		Altman	Taffler	Klecka
R-19	(Retained Profit + Dep.)/ (Tangible Assets + Accumulated Dep.)	1	1	1
R-11	OCF/(Total Assets + Accumulated Depreciation)	2	2	2
R-18	(Retained Profit + Depreciation)/Total Debts	3	3	3
R-12	OCF/Total Debts	4	4	4
R-23	Net Profit (before tax)/ Total Capital Employed	8	5	5
R-4	EBDIT/Interest	5	11	7

All the three methods of computing the scaled vectors agreed to indicate R-19, R-11, R-18 and R-12 as the ratios holding the first four places in the scaled vectors of the ratio-category. For the 5th place, Altman's[22] method indicated the ratio R-4 but the other two methods (Taffler[23] and Klecka[24]) indicated the ratio R-23. To avoid intercorrelation amongst the financial ratios (vide Chapter III, page 123) our study selected R-19 from the pair of the ratios R-11 and R-19. As the the ranks of the scaled vector of the ratio R-23 and the ratio R-4 differ, the present study attempted to test effectiveness

of the profitability ratios in monitoring the financial health of the sample units through two different models - Model 1 (the ratios selected on the basis of the ranks in the scaled vector computed as per the suggestions made by Taffler[25] and Klecka[26]), and Model - 2 (the ratios selected on the basis of the ranks in the scaled vector computed by the suggestion made by Altman[27]), and the financial ratios selected for these models stand as follows:

PROFITABILITY MODEL - 1

i) (Retained Profit + Depreciation)/(Tangible Assets + Accumulated Depreciation)- (R-19)

ii) (Retained Profit + Depreciation)/Total Debts (R-18)

iii) OCF/Total Debts (R-12)

iv) Net Profit (before tax)/Total Capital employed (R-23)

PROFITABILITY MODEL - 2

i) (Retained Profit + Depreciation)/(Tangible Assets + Accumulated Depreciation) ((R-19)

ii) (Retained Profit + Depreciation)/Total Debts (R-18)

iii) OCF/Total Debts (R-12)

iv) EBDIT/Interest (R-4).

The ratios included in 'Profitability Model - 1' be termed as 3rd set of ratios, and likewise the ratios in 'Profitability Model - 2' be termed as 4th set of ratios.

4. FINANCIAL STABILITY MODEL

For this model, attempts were made to select the financial ratios according to their relative-higher-occupancy in the rank position of the 'scaled vector' of the ratios belonging to the financial stability category only. The financial ratios occupying the first four ranks in the scaled vector (Table - III.8) of this ratio category were selected for this model. The ratios so obtained were depicted in Table - III.13 below:

Table - III.13

First Five Ranks of the Ratios in the Financial Stability Category

Ratio No.	Ratio Description	Scaled Vector		
		Altman	Taffler	Klecka
R-24	Net Worth/Total Debts	1	1	1
R-34	Book Value of Equity/ Book Value of Total Debts	2	2	2
R-27	Debts/Tangible Assets	3	3	3
R-35	Net Worth/Total outside liabilities	4	4	4
R-28	All outside liabilities/ Tangible Assets	5	5	5

To avoid intercorrelation amongst the financial ratios (vide Chapter III page 123), our study selected, R-24 from the pair of the ratios R-34 and R-24. Thus the ratios selected for this model were:

i) Net worth/Total Debts (R-24)
ii) Debts/Tangible Assets (R-27)
iii) Net worth/Total outside liabilities (R-35)
iv) All outside liabilities/Tangible Assets (R-28)

The above four ratios be termed as the 5th set of ratios.

5. LIQUIDITY MODEL

For this model, attempts were made to select the financial ratios according to their relative-higher-occupancy in the rank position of the 'scaled vector' of the ratios belonging to the liquidity-category only. The financial ratios occupying the first four ranks in the scaled vector of this ratio-category were selected. Analysing the scaled vectors (vide Table III.8) the following were observed (Table - III.14).

Table - III.14

First Five Ranks of the Financial Ratios of the Liquidity Category

Ratio No.	Ratio Description	Rank based on the Scaled Vector		
		Altman	Taffler	Klecka
R-37	Quick Assets/Current liabilities	1	1	1
R-39	Working Capital/Debts	2	1	2
R-40	Working Capital/ Tangible Assets	3	3	3
R-36	Current Assets/Current liabilities	5	4	4
R-41	Current liabilities/ Tangible Assets	4	5	5

All the three methods used in computing 'scaled vectors' agreed to indicate R-37, R-39 and R-40 as the ratios holding the first three places in the 'scaled vectors'. For the 4th place, only Altman's[28] method indicated the ratio R-41 but other two methods (Taffler[29] and Klecka[30]) indicated the ratio R-36. As the ranks of the scaled vector of the ratio R-36 and the ratio R-41 differ, present study attempted to test the effectiveness of the liquidity ratios in monitoring the financial health of the sample units through two different models - Model 1 (the ratios selected on the basis of the ranks in the 'scaled vector' computed as per suggestions made by Taffler[31] and Klecka[32]),

and Model - 2 (the ratios selected on the basis of the ranks in the scaled vector computed as per suggestions made by Altman[33]):

LIQUIDITY MODEL - 1

i) Quick Assets/Current liabilities (R-37)

ii) Working Capital/Debt (R-39)

iii) Working Capital/Tangible Assets (R-40)

iv) Current Assets/Current liabilities (R-36)

LIQUIDITY MODEL - 2

i) Quick Assets/Current liabilities (R-37)

ii) Working Capital/Debt (R-39)

iii) Working Capital/Tangible Assets (R-40)

iv) Current liabilities/Tangible Assets (R-41).

The ratios included in 'Liquidity Model - 1' be termed as 6th set of ratios and the ratios in the 'Liquidity Model-2' be termed as the 7th set of ratios.

6. ASSET-UTILISATION MODEL

In the asset utilisation ratio-category, only three financial ratios were found qualified by the significance tests (viz. Mean Test and F-test, Table - III .5). Thus, there was no scope to select but only to accept these three ratios for further studies.

The three financial ratios accepted by the present study to test the significance and effectiveness of the asset utilisation ratios in monitoring the financial health of the sample units were:

i) Sales/Total Assets (R-46) - (Rank 1).

ii) Quick Assets/Current Assets (R-49) - (Rank 2).

iii) Retained Earnings/Total Assets (R-47) - (Rank 3)

The above three ratios be termed as 8th 'Set' of ratios.

c) TESTING THE EFFECTIVENESS OF RATIOS THROUGH 'SETS'

The significance and the predictive power of the financial ratios monitoring corporate financial health have been tested by different researchers through model, considering either univariate or multivariate nature of the ratios. Considering the multivariate nature of the financial ratios, the present study attempted to test the effectiveness (i.e. predictive ability) of the financial ratios in 'Sets'. For this purpose, the following were computed and critically observed for each of the eight 'sets' separately:

i) linear discriminant functions,

ii) trace of their discriminating power,

iii) changes, if any, in their (sets) discriminating power from that of the 'original' discriminant function,

iv) relative contribution of the individual financial ratios to the discriminating power of the 'reduced' functions, and

v) their (sets') predictive-accuracy-matrices for predicting different degrees of financial health.

To assess the effectiveness of the financial ratios through 'sets', the present study tested their predictive ability on the basis of those sample ratios which have greater contributions either to the 'original' discriminant function or to the group to which they belong. The highest relative contributions of the individual financial ratios to the group which they belong were identified by the 'ranks' of the 'scaled vectors'. These 'scaled vectors' of the ratio groups were computed on the basis of the co-efficients of the 'original' discriminant function.

DESCRIPTIVE - MODEL (1st Set of Ratios)

For computational purposes, the financial ratios already selected for this model were coded as below:

X_1 = R-12, OCF/Total Debts.

X_2 = R-18, (Retained Profit + Depreciation Charge)/ Total Debts.

X_3 = R-19, (Retained Profit + Depreciation Charge)/ (Tangible Assets + Accumulated Depreciation)

X_4 = R-24, Net Worth/Total Debts.

After several computer runs and calculations the derived linear discriminant function of the financial ratios read as:

$$Z = 0.138338\ X_1 - 0.337754\ X_2 + 1.12135\ X_3 + 0.0734094\ X_4$$

A good trace of the discriminating power of the above function was observed [Appendix I and I.(i)]. The discriminating power of this function was lower than that of the 'original' function (Appendix - II).

In assessing the relative contribution of the individual financial ratios in the overall discriminating power of the function of this 'Set', the ratio (Retained Profit + Depreciation Charge)/Total Debts, (R-18) was found to contribute more than the other ratios [Appendix - III.(i)].

Analysing the 'Z-scores' of the sample units [Appendix - IV(a)(i) and IV(b)(i)] computed on the basis of the above function, the accuracy of the model for predicting the various degrees of corporate financial health i.e. (i) two degrees (the 'good' and the 'sick') and (ii) three degrees (the 'good', the 'semi-good/semi-sick' and the 'sick' financial health) on the basis of (a) the initial cut-offs, and (b) the optimal cut-offs, was depicted in Table - III.15 (Please see next page).

RATIO-REPRESENTATIVE - MODEL (2nd Set of Ratios)

For computational purposes, the financial ratios already selected for this model were coded as below:

X_1 = R-19, (Retained Profit + Depreciation Charge)/ (Tangible Assets + Accumulated Depreciation).

X_2 = R-24, Net Worth/Total Debts

X_3 = R-37, Quick Assets/Current Liabilities

X_4 = R-46, Sales/Total Assets.

After several computer runs and calculations the derived linear discriminant function of the financial ratios read as:

$$Z = 0.8271851\ X_1 + 0.0209116\ X_2 + 0.1211398\ X_3 - 0.0162732\ X_4$$

TABLE - III.15

PREDICTIVE ACCURACY MATRIX OF THE 1ST SET OF RATIOS

Degree of Financial Health	No. of units	Predicting Two Degrees of Financial Health			Predicting Three Degrees of Financial Health						
					On the basis of the Initial Cut-off[1]				On the basis of the Optimum Cut-off[2]		
		No. of Units actually classified		Percentage of Mis-classification	No. of Units actually classified			Percentage of Mis-classification	No. of Units actually classified			Percentage of Mis-classification
		Good	Sick		Good	Semi*	Sick		Good	Semi*	Sick	
Good	37	37	0	NIL	37	0	0	NIL	35	2	0	5.4
Semi*	79	-	-		34	30	15	62.02	19	56	4	29.11
Sick	38	0	38	NIL	0	0	38	NIL	0	3	35	7.89
Total	154			NIL				31.82				18.18

* Semi-good/Semi-sick units

1. Between (+) 0.039254 and (-) 0.025669

2. Between (+) 0.059 and (-) 0.059

Source : Computed from Appendix IV.a(i) and Appendix IV.b(i)

A good trace of the discriminating power of the above function was observed [Appendix I and I(ii)]. The discriminating power of this function was lower than that of the 'original' function [Appendix II].

In assessing the relative contribution of the individual financial ratios in the overall discriminating power of the function of this 'Set', the ratio (Retained Profit + Depreciation charge)/(Tangible Assets + Accumulated Depreciation) (R-19) was found to contribute more than the other ratios [Appendix - III.(ii)].

Analysing the 'Z-scores' of the sample units [Appendix - IV(a)(ii) and IV(b)(ii)] computed on the basis of the above function, the accuracy of the model for predicting the various degrees of corporate financial health i.e. (i) two degrees (the 'good' and the 'sick') and (ii) three degrees (the 'good', the 'semi-good/semi-sick' and the 'sick' financial health) on the basis of (a) the initial cut-offs, and (b) the optimal cut-offs, was depicted in Table - III.16 (Please see next page).

PROFITABILITY - MODEL (3rd Set of Ratios)

For computational purposes, the financial ratios already selected for this model were coded as below:

X_1 = R-12, OCF/Total Debts

X_2 = R-18, (Retained Profit + Depreciation charge)/ Total Debts.

X_3 = R-19, (Retained Profit + Depreciation charge)/ (Tangible Assets + Accumulated Depreciation).

X_4 = R-23, Net Profit (before Tax)/Total Capital Employed.

TABLE - III 16

PREDICTIVE ACCURACY MATRIX OF THE '2ND SET OF RATIOS'

Degree of Financial Health	No. of units	Predicting Two Degrees of Financial Health		Percentage of Mis-classification	Predicting Three Degrees of Financial Health						
					On the basis of[1] the Initial Cut-off				On the basis of[2] the Optimum Cut-off		
		No. of Units actually classified			No. of Units actually classified				No. of Units actually classified		
		Good	Sick		Good	Semi*	Sick	Percentage of Mis-classification	Good	Semi*	Sick	Percentage of Mis-classification
Good	37	37	0	NIL	37	0	0	NIL	33	4	0	10.81
Semi*	79				28	29	22	63.29	16	45	18	43.03
Sick	38	0	38	NIL	0	0	38	NIL	0	1	37	2.63
Total	154			NIL				32.46				25.32

*Semi-good/Semi-sick units

1. Between (+) 0.029780 and (-) 0.03047
2. Between (+) 0.043 and (-) 0.043

Source : Computed from Appendix IV. a(ii) and IV.b (ii)

After several computer runs and calculations the derived linear discriminant function of the financial ratios read as:

$$Z = 0.5603016\ X_1 - 0.570857\ X_2 + 0.8507127\ X_3 + 0.0320233\ X_4$$

A good trace of the discriminating power of the above function was observed [Appendix I and I(iii)]. The discriminating power of this function was lower than that of the 'original' function [Appendix - II].

In assessing the relative contribution of the individual financial ratios in the overall discriminating power of the function of this 'set', the ratio OCF/Total Debts (R-12), was found to contribute more than the other ratios [Appendix III(iii)].

Analysing the 'Z-scores' of the sample units [Appendix IV(a)(iii) and IV(b)(iii)] computed on the basis of the above function, the accuracy of the model for predicting the various degrees of corporate financial health i.e. (i) two degrees (the 'good' and the 'sick') and (ii) three degrees (the 'good', the 'semi-good/semi-sick' and the 'sick' financial health) on the basis of (a) the initial cut-offs, and (b) the optimal cut-offs, was depicted in Table - III.17 (Please see next page).

PROFITABILITY - MODEL -2 (4th Set of Ratios)

For computational purposes, the financial ratios already selected for this model were coded as below:

TABLE - III [17]

PREDICTIVE ACCURACY MATRIX OF THE '3RD SET OF RATIOS'

Degree of Financial Health	No. of units	Predicting Two Degrees of Financial Helath — No. of Units actually classified		Percentage of Mis-classification	Predicting Three Degrees of Financial Health — On the basis of[1] the Initial Cut-off — No. if Units actually classified			Percentage of Mis-classification	On the basis of[2] the optimum Cut-off — No. of Units actually classified			Percentage of Mis-classification
		Good	Sick		Good	Semi*	Sick		Good	Semi*	Sick	
Good	37	37	0	NIL	37	0	0	NIL	34	3	0	8.1
Semi*	79				35	18	26	77.21	24	48	07	39.24
Sick	38	0	38	NIL	0	0	38	NIL	0	11	27	28.94
Total	154			NIL				39.61				29.22

* Semi-good/Semi-sick units
1. Between (+) 0.012846 and (-) 0.027478
2. Between (+) 0.02559 and (-) 0.0688

Source : Computed from Appendix IV.a(iii) and IV.b (iii)

X_1 = R-4, EBDIT/Interest

X_2 = R-12, OCF/Total Debts.

X_3 = R-18, (Retained Profit + Depreciation charge)/ Total Debts.

X_4 = R-19, (Retained Profit + Depreciation charge)/ (Tangible Assets + Accumulated Depreciation).

After several computer runs and calculations the derived linear discriminant function of the financial ratios read as:

$$Z = 0.000503\ X_1 + 0.5844233\ X_2 - 0.6019802\ X_2 + 0.900522\ X_4$$

A good trace of the discriminating power of the above function was observed [Appendix - I and I(iv)]. The discriminating power of this function was lower than that of the 'original' function [Appendix - II].

In assessing the relative contribution of the individual financial ratios in the overall discriminating power of the function of this 'Set', the ratio OCF/Total Debts (R-12) was found to contribute more than the other ratios [Appendix - III. (iv)].

Analysing the 'Z-scores' of the sample units [Appendix - IV(a)(iv) and IV(b)(iv)] computed on the basis of the above function, the accuracy of the model for predicting the various degrees of corporate financial health i.e., (i) two degrees (the 'good' and the 'sick') and (ii) three degrees (the 'good', the 'semi-good/semi-sick' and the 'sick' financial health) on

the basis of (a) the initial cut-offs, and (b) the optimal cut-offs, was depicted in Table - III.18 (Please see next page).

FINANCIAL STABILITY MODEL (5th Set of Ratios)

For computational purposes, the financial ratios already selected for this model were coded as below:

X_1 = R-24, Net Worth/Total Debts

X_2 = R-27, Total Debts/Tangible Assets

X_3 = R-28, All outside Liabilities/Tangible Assets

X_4 = R-35, Net worth/Total outside liabilities.

After several computer runs and calculations the derived linear discriminant function of the financial ratios read as:

$$Z = (-)\ 0.0166212X_1 - 0.1581827X_2 - 0.0614432X_3 + 0.1524073X_4$$

A good trace of the discriminating power of the above function was observed [Appendix I and I.(v)]. The discriminating power of this function was lower than that of the 'original' function [Appendix - II].

In assessing the relative contribution of the individual financial ratios in the overall discriminating power of the function of this 'Set', the ratio Net Worth/Total Outside liabilities, (R-35) was found to contribute more than the other ratios [Appendix - III.(v)].

TABLE - III [18]

PREDICTIVE ACCURACY MATRIX OF THE '4TH SET OF RATIOS'

Degree of Financial Health	No. of units	Predicting Two Degrees of Financial Helath		Percentage of Mis-classification	Predicting Three Degrees of Financial Health						
					On the basis of[1] the Initial Cut-off			Percentage of Mis-classification	On the basis of[2] the optimum Cut-off			Percentage of Mis-classification
		No. of Units actually classified			No. if Units actually classified				No. of Units actually classified			
		Good	Sick		Good	Semi*	Sick		Good	Semi*	Sick	
Good	37	37	0	NIL	37	0	0	NIL	21	16	0	43.24
Semi*	79				34	19	26	75.94	10	67	2	15.19
Sick	38	0	38	NIL	0	0	38	NIL	0	16	22	42.11
Total	154			NIL				38.96				28.57

*Semi-good/Semi-sick units
1. Between (+) 0.014015 and (-) 0.0259
2. Between (+) 0.0549 and (-) 0.106

Source : Computed from Appendix IV.a(iv) and Appendix IB.b(iv)

Analysing 'z-scores' of the sample units [Appendix - IV(a)(v) and IV(b)(v)] computed on the basis of the above function, the accuracy of the model for predicting the various degrees of corporate financial health i.e., (i) two degrees (the 'good' and the 'sick'), and (ii) three degrees (the 'good', the 'semi-good/semi-sick' and the 'sick' financial health) on the basis of (a) the initial cut-offs, and (b) the optimal cut-offs, was depicted in Table - III.19 (Please see next page).

LIQUIDITY - MODEL (6th set of Ratios)

For computational purposes, the financial ratios already selected for this model were coded as below:

X_1 = R-36, Current Assets/Current Liabilities.

X_2 = R-37, Quick Assets/Current Liabilities.

X_3 = R-39, Working Capital/Total Debts.

X_4 = R-40, Working Capital/Tangible Assets.

After several computer runs and calculations the derived linear discriminant function of the financial ratios read as:

$$Z = 0.1940037X_1 + 0.1552836X_2 + 0.0409238X_3 + 0.021835X_4 .$$

A good trace of the discriminating power of the above function was observed [Appendix - I and I.(vi)]. The discriminating power of this function was lower than that of the 'original' function [Appendix - II].

TABLE - III 19

PREDICTIVE ACCURACY MATRIX OF THE '5TH SET OF RATIOS'

Degree of Financial Health	No. of units	Predicting Two Degrees of Financial Helath — No. of Units actually classified		Percentage of Mis-classification	Predicting Three Degrees of Financial Health — On the basis of[1] the Initial Cut-off — No. if Units actually classified			Percentage of Mis-classification	On the basis of[2] the optimum Cut-off — No. of Units actually classified			Percentage of Mis-classification
		Good	Sick		Good	Semi*	Sick		Good	Semi*	Sick	
Good	37	36	1	2.7	36	0	1	2.7	33	4	0	10.81
Semi*	79				56	1	22	98.73	33	33	13	58.23
Sick	38	0	38	NIL	0	0	38	NIL	0	3	35	7.89
Total	154			1.33				51.29				34.42

*Semi-good/Semi-sick units

1. Between (-)0.157764 and (-) 0.161482
2. Between (-) 0.0972082 and (-) 0.2012191

Source: Computed from Appendix IV.a(v) and IV.b(v)

In assessing the relative contribution of the individual financial ratios in the overall discriminating power of the function of this 'set', the ratio, Current Assets/Current Liabilities, (R-36), was found to contributie more than the other ratios [Appendix - III. (vi)].

Analysing the 'z-scores' of the sample units [Appendix - IV(a)(vi) and IV(b)(vi)] computed on the basis of the above function, the accuracy of the model for predicting the various degrees of corporate financial health like, (i) two degrees (the 'good' and the 'sick') and (ii) three degrees (the 'good', the 'semi-good/semi-sick' and the 'sick' financial health) on the basis of (a) the initial cut-offs, and (b) the optimal cut-offs, was depicted in Table - III.20 (Please see next page).

LIQUIDITY - MODEL (7th set of Ratios)

For computational purposes, the financial ratios already selected for this model were coded as below:

X_1 = R-37, Quick Assets/Current Liabilities.

X_2 = R-39, Working Capital/Total Debts.

X_3 = R-40, Working Capital/Tangible Assets.

X_4 = R-41, Current Liabilities/Tangible Assets.

After several computer runs and calculations the derived linear discriminant function of the financial ratios reads as

$$Z = 0.1866785X_1 + 0.1087585X_2 - 0.141728X_3 - 0.2126614X_4$$

Good trace of the discriminating power of the above function was observed [Appendix I and I(vii)]. The discriminating power of this function was lower than that of the 'original' function [Appendix - II].

TABLE - III 20

PREDICTIVE ACCURACY MATRIX OF THE '6TH SET OF RATIOS'

Degree of Financial Health	No. of units	Predicting Two Degrees of Financial Helath		Percentage of Mis-classification	Predicting Three Degrees of Financial Health							
		No. of Units actually classified			On the basis of[1] the Initial Cut-off			Percentage of Mis-classification	On the basis of[2] the optimum Cut-off			Percentage of Mis-classification
		Good	Sick		No. if Units actually classified				No. of Units actually classified			
					Good	Semi*	Sick		Good	Semi*	Sick	
Good	37	37	0	NIL	37	0	0	NIL	33	4	0	10.81
Semi*	79				21	2	56	97.5	12	56	11	29.11
Sick	38	0	38	NIL	0	0	38	NIL	0	12	26	31.58
Total	154			NIL				50.0				25.32

*Semi-good/Semi-sick units

1. Between (+) 0.169569 and (+) 0.172505
2. Between (+) 0.20 and (+) 0.089

Source : Computed from Appendix IV.a(vi) and IVb (vi)

In assessing the relative contribution of the individual financial ratios in the overall discriminating power of the function of the 'set', the ratio, Current liabilities/Tangible Assets, (R-41) was found to contribute more than the other ratios [Appendix - III (vii)].

Analysing the 'z-scores' of the sample units [Appendix - IV(a)(vii) and IV(b)(vii)] computed on the basis of the above function, the accuracy of the model for predicting the various degrees of corporate financial health i.e., (i) two degrees (the 'good' and the 'sick') and (ii) three degrees (the 'good', the 'semi-good/semi-sick' and the 'sick' financial health) on the basis of (a) the initial cut-offs, and (b) the optimal cut-offs, was depicted in Table - III.21 (Please see next page).

ASSET-UTILISATION - MODEL (8th set of Ratios)

For computational purposes, the financial ratios already selected for this model were coded as below:

X_1 = R-46, Sales/Total Assets.

X_2 = R-47, Retained Earnings/Total Assets.

X_3 = R-49, Quick Assets/Current Assets.

After several computer runs and calculations the derived linear discriminant function of the financial ratios read as:

$$Z = 0.2596268X_1 + 1.2316048X_2 - 0.9683406X_3.$$

A good trace of the discriminating power of the above function was observed [Appendix I and I(viii)]. The discriminating power of this function was lower than that of the 'original' function (Appendix-II).

TABLE - III 21

PREDICTIVE ACCURACY MATRIX OF THE '7TH SET OF RATIOS'

Degree of Financial Health	No. of units	Predicting Two Degrees of Financial Helath — No. of Units actually classified		Percentage of Mis-classification	Predicting Three Degrees of Financial Health — On the basis of[1] the Initial Cut-off — No. if Units actually classified			Percentage of Mis-classification	On the basis of[2] the optimum Cut-off — No. of Units actually classified			Percentage of Mis-classification
		Good	Sick		Good	Semi*	Sick		Good	Semi*	Sick	
Good	37	37	0	NIL	37	0	0	NIL	36	1	0	2.7
Semi*	79				17	4	58	94.94	13	59	7	25.31
Sick	38	0	38	NIL	0	0	38	NIL	0	16	22	42.105
Total	154			NIL				48.7				24.025

* Semi-good/Semi-sick units

1. Between (-) 0.12978 and (-) 0.14276
2. Between (-) 0.1265 and (-) 0.215

Source : Computed from Appendix IV.a(vii) and IV.b(vii)

In assessing the relative contribution of the individual financial ratios in the overall discriminating power of the function of the 'set', the ratio, Retained Earnings/Total Assets, (R-47) was found to contribute more than the other ratios [Appendix- III.(viii)].

Analysing the 'z-scores' of the sample units [Appendix - IV(a)(viii) and IV(b)(viii)] computed on the basis of the above function, the accuracy of the model for predicting the various degrees of corporate financial health i.e., (i) two degrees (the 'good' and the 'sick') and (ii) three degrees (the good, the semi-good/semi-sick and the sick financial health) on the basis of (a) the initial cut-offs, and (b) the optimal cut-offs, was depicted in Table - III. 22 (Please see next page).

D) ANALYSIS OF THE PREDICTIVE-ACCURACY-MATRICES OF THE 'SETS' OF RATIOS (THAT IS, OF THE DERIVED 'REDUCED' FUNCTIONS) AND SELECTION OF THE BEST 'SET' TO MONITOR CORPORATE FINANCIAL HEALTH:

In this section attempts have been made to analyse and compare the classification performances of the 'sets' of financial ratios and to select a 'set' which would discriminate the different degrees of corporate financial health, in a better way than the other 'sets' under this study. The best 'set of ratio' was selected on the basis of the classification accuracy in classifying the sample units in both the 'initial' and 'secondary' samples. The discriminant function (of the 'set of ratios') with the highest classification accuracy was chosen

TABLE - III 22

PREDICTIVE ACCURACY MATRIX OF THE '8TH SET OF RATIOS'

Degree of Financial Health	No. of units	Predicting Two Degrees of Financial Helath		Percentage of Mis-classification	Predicting Three Degrees of Financial Health							
		No. of Units actually classified			On the basis of[1] the Initial Cut-off			Percentage of Mis-classification	On the basis of[2] the optimum Cut-off			Percentage of Mis-classification
		Good	Sick		No. if Units actually classified				No. of Units actually classified			
					Good	Semi*	Sick		Good	Semi*	Sick	
Good	36	29	7	19.44	29	0	7	19.44	20	13	3	44.44
Semi*	79				39	2	38	97.46	22	35	22	55.70
Sick	38	4	34	10.52	4	0	34	10.52	1	15	22	42.11
Total	153			14.86				57.52				49.67

* Semi-good/Semi-sick units

1. Between (+) 0.227417 and (+) 0.215778
2. Between (+) 0.30 and (+) 0.151

Source: Computed from Appendix IV.a(viii) and IV.b(viii)

as the best 'set'.

The performances of the 'sets' of financial ratios to discriminate between two extreme degrees (the 'good' and the 'sick') of corporate financial health were shown in Table - III.23.

Table - III.23

Misclassification of the 'Sets' of ratios in classifying two degrees of financial health.

Sets of Ratios	Percentages of Misclassification		
	Good	Sick	Overall
1st	NIL	NIL	NIL
2nd	NIL	NIL	NIL
3rd	NIL	NIL	NIL
4th	NIL	NIL	NIL
5th	2.7	NIL	1.33
6th	NIL	NIL	NIL
7th	NIL	NIL	NIL
8th	19.44	10.52	14.86

NOTE : No. of units in 'Good' group = 37
'Sick' group = 38

All the 'reduced' functions (except Asset-Utilisation function) computed and used to discriminate between the two extreme degrees of financial health (i.e. the 'good' and the 'sick') of the sample units, were found able to predict the actual group membership of the sample units with a high degree of accuracy. The '8th set of ratios' i.e. the discriminant function, computed from the Asset-Utilisation ratios, was able to classify the units of the 'good' group at 80.56% only and the units in the 'sick' group at 89.48% level of accuracy; the overall rate of correct classification was 85.14%. The performance of this 'Set' compared to that of others was found low and the causes for this low performance were : (i) unlike the other 'sets' of ratios, the 8th 'Set' was constructed by only three ratios instead of four and thus, the function computed for this 'Set' was a further reduced one and it was well established in the literature that the performance of the reduced functions were always lower than that of the function consisting more ratios than the reduced one[34], (ii) the ratios of the 8th 'Set' occupied relatively lower rank positions amongst the 'scaled vectors' of the total set of ratios (vide Table - III.24) considered under the eight different 'Sets' (i.e. 17 ratios in total, vide Table - III.8) and also amongst the total set of significant ratios (i.e. 36 ratios in total, vide Table - III.8), in other words, the ratios of the 8th 'Set' had relatively lower contributory shares in the overall discriminating power than that of the ratios used in

other 'sets', (here, the position of the ratio R-46 was found better than the other two ratios in this set), and (iii) the variability of the ratios (except ratio R-46) of this set were found low in comparison to other ratios (vide Table - III.24).

Table - III. 24

Amongst the Total Ratios considered in 8 different 'Sets' of ratios, the Relative Position of the Ratios of the 8th 'Set' in Scaled Vector, Difference of Mean Values, and Standard Deviation.

Ratio No.	Ratio Description	Ranks in Scaled Vector under the methods suggested by			Ranks in	
		Altman	Taffler	Klecka	Difference of Mean	Standard Deviation
R-46	Sales/Total Assets	7 (18)	11 (22)	7 (18)	13 (26)	12 (17)
R-47	Retained Earnings/ Total Assets	9 (20)	12 (24)	11 (23)	16 (32)	16 (33)
R-49	Quick Assets/ Current Assets	14 (26)	14 (27)	12 (27)	17 (34)	17 (32)

NOTE: The rank positions occupied by the ratios amongst the significant ratios (36 in number) were shown in brackets.

Source: Compiled from Table III.8 and Annexure - V.

Again, in the two-degree situation, all the 'sets' of ratios (save the '8th Set' of ratios) with their respective discriminant functions were tested on the 'secondary data' sample containing thirty-six (36) financially 'good' and twenty (20) financial 'sick' units (vide Annexure - II. 2). The '8th' set of ratios was not tested on the secondary data sample because of its relatively lower rate of accuracy in classifying the units in the 'initial' sample. The results of the tests were shown in Table - III.24(a).

Table - III.24(a)

ACCURACY RATES (%) OF PREDICTION OF THE DISCRIMINANT FUNCTIONS OF THE SECONDARY DATA SAMPLE

SET OF RATIOS	ACCURACY RATE (%)		
	ONLY SICK UNITS	ONLY GOOD UNITS	OVERALL RATE
1ST SET	100	94.44	96.43
2ND SET	80	97.22	91.07
3RD SET	15	94.44	66.08
4TH SET	95	94.45	94.63
5TH SET	80	100	92.86
6TH SET	75	100	91.07
7TH SET	70	94.45	85.71

Note : The accuracy rates were computed on the basis of the 'initial' cut-off points in the 'z-scores' of the initial sample units.

It was observed [Table - III.24(a)] that in classifying only the 'sick' units, the discriminant function of the '1st set' of ratios was the best one having the highest classification accuracy (100 percent). In classifying only the 'good' units, the discriminant, functions of the '5th set' and the '6th set' of ratios were the best 'sets' having the highest classification accuracy (100 percent). But, in classifying all the units in the 'secondary' sample, the discriminant function, of the '1st set' of ratios was the best one amongst the functions of the 'sets', having the highest classification accuracy (96.43 percent).

The present study also attempted to extend the levels of the degrees of financial health for prediction i.e. attempted to assess the performances in predicting three degrees of financial health —— the 'good', the 'sick' and the 'semi-good/ semi-sick'.

Table - III.25

Percentage of Misclassification of the 'Sets' of ratios in classifying Three degrees of financial health

Sets of Ratios	Percentage of Misclassification							
	On the basis of Initial cut-offs				On the basis of Optimum cut-offs			
	Good	Semi*	Sick	Overall	Good	Semi*	Sick	Overall
1st	NIL	62.02	NIL	31.82	5.4	29.11	7.89	18.18
2nd	NIL	63.29	NIL	32.4	10.81	43.03	2.63	25.32
3rd	NIL	77.21	NIL	39.61	8.10	39.24	28.94	29.22
4th	NIL	75.94	NIL	38.96	43.24	15.19	42.11	28.57
5th	2.7	98.73	NIL	51.29	10.81	58.23	7.89	34.42
6th	NIL	97.47	NIL	50.0	10.81	29.11	31.58	25.32
7th	NIL	94.94	NIL	48.7	2.7	25.31	42.11	24.03
8th	19.44	97.47	10.52	57.52	44.44	55.69	42.11	49.67

NOTE : No. of units in the Good group = 37
Semi group = 79
Sick group = 38
(Save 8th Set)

*Semi-good/Semi-sick.

It could be observed (Table- III.25) that, all the reduced functions disclosed a poor performance when used to re-classify the sample units in the 'semi-good/semi-sick' group (on the basis of the 'initial' cut-off points). Amongst the 'sets' of ratios, the 1st 'Set' of ratios had the minimum rate of misclassification not only for the units in the 'semi-good/semi-sick' group, but also the units in all the three groups. However, all the 'Sets' were unable to predict the 'semi-good/semi-sick' units with a high degree of accuracy owing to the fact that the financial characteristics and the variabilities in the ratio magnitudes of the 'semi-good/semi-sick' units were not considered at the time of framing and computing the discriminant functions.

It could also be observed (Table - III.25) that, on the basis of the 'optimum' cut-off points, three different 'sets' were found to classify, in a better way than the other 'Sets', the units in three different health-groups. To predict the units in the 'good' group, the 7th 'Set' of ratios was the best (2.7%) amongst the 'Sets'. To predict the units in the 'sick'group, the 2nd 'Set' of ratios was the best (2.63%) amongst the 'Sets'. To predict the units in the 'semi-good/semi-sick' group, the 4th 'Set' of ratios was the best (15.19%) amongst the 'Sets'. The second best 'Sets' to classify the sample units were 1st 'Set' for the 'good' group, and 7th 'Set' for the 'semi-good/semi-sick' group, and 1st and 5th

'Sets' for the 'sick' group. Amongst the 'sets', the performance of the 1st 'Set' of ratios to classify all the sample units (in a three-degree situation) was found the best (18.18 %).

In the three-degree situation, we have attempted to test the predictive ability of the '1st' set of ratios in re-classifying the units in the 'secondary sample', as this particular set disclosed the minimum rate of mis-classification in classifying the units in the 'initial sample'.

The secondary sample was consisted of 36 'good', 91 'Semi-good/semi-sick' and 20 'sick' units (Annexure - II.2). Using the descriptive function

$$Z = 0.138338X_1 - 0.337754X_2 + 1.12135X_3 + 0.0734094X_4$$

the 'Z-scores' of the units of the secondary sample were computed.

Analysing the 'Z-scores' [Appendix - Va(i)& Vb] of the secondary sample units, the accuracy of the 'set' in predicting the two degrees and three degrees of financial health on the basis of (i) the derived 'initial' cut-off points [between (+) 0.039254 and (-) 0.025669], and (ii) the derived 'optimum' cut-off points [between (+) 0.059 and (-) 0.059] was depicted in the Table - III.26 (Please see next page).

It could be observed that the '1st set' of financial ratios with its discriminant function was also effective in classifying the secondary sample units. Like the classification

TABLE - III 26

PREDICTIVE ACCURACY MATRIX OF THE SELECTED 1st SET OF RATIOS' (DESCRIPTIVE MODEL) TESTED ON THE SECONDARY SAMPLE

Degree of Financial Health	No. of units	Predicting Two Degrees of Financial Helath — No. of Units actually classified			Percentage of Mis-classification	Predicting Three Degrees of Financial Health — On the basis of[1] the Initial Cut-off — No. if Units actually classified			Percentage of Mis-classification	On the basis of[2] the optimum Cut-off — No. of Units actually classified			Percentage of Mis-classification
		Good	Semi*	Sick		Good	Semi*	Sick		Good	Semi*	Sick	
Good	36	34	02	0	5.55	34	2	0	5.55	30	6	0	16.66
Semi*	91					51	26	14	71.43	40	44	7	51.64
Sick	20	0	0	20	NIL	0	0	20	NIL	0	1	19	5.0
Total	147				3.57				45.58				36.73

* Semi-good/Semi-sick units

1. Between (+) 0.039254 and (-) 0.025669
2. Between (+) 0.059 and (-) 0.059

Source: Computed from Appendix V.a and V.b

error of the 'initial' sample, the 'set' had also lower accuracy rate (63.27%) in re-classifying the total units of the secondary sample into three different financial health groups - the 'good', the 'semi-good/semi-sick' and the 'sick'.

Thus, in the light of the above observations, the '1st set of ratios' with its discriminant function was found as the best 'set' amongst the others having the highest classification accuracy in classifying the sample tea units.

It could further be observed that (Table - III.27), in the overall discriminating power of the 'original' and 'reduced' discriminant functions the relative share of contributions of the ratios R-24, R-18, R-19, R-12, R-35, R-36, R-41 and R-47 were more than the other financial ratios; the second best financial ratios were, R-27, R-37, R-40, R-49.

Table - III.27

Rank of the Financial Ratios in Discriminating Power of the Discriminant Functions

Ratio No.	Original Discriminant function	Discriminant Functions of the Models						Total number of Appearances
		Descriptive Model	Ratio-representative Model	Profitability Model	Financial Stability Model	Liquidity Model	Asset-Utilisation Model	
R-12				1st				1
R-18		1st		2nd				2
R-19	2nd	2nd	1st					3
R-24	1st		2nd					2
R-27					2nd			1
R-35					1st			1
R-36						1st *		1
R-37						2nd *		
R-40						2nd **		1
R-41						1st **		1
R-47							1st	1
R-49							2nd	1

Compiled from Appendix III(i) to Appendix III.(viii) and Table - III.8.

* Model - 1 (6th set of ratios)

** Model - 2 (7th set of ratios)

Therefore, in the overall discriminating power of the discriminant functions, the relative individual contribution of the ratios R-19 [(Retained Profit + Depreciation charge)/(Total Tangible Assets + Accumulated Depreciation), R-24 (Net Worth/Total Debt), and R-18 [(Retained Profit + Depreciation)/Total Debt] were found more than that of the other sample ratios in discriminating between different degrees of corporate financial health of the Tea units.

Thus, it could be observed that, out of the 52 financial ratios, 36 ratios were found to discriminate between various degrees of corporate financial health, and out of these 36 financial ratios 17 ratios, in eight different sets, were tested further and found that the set of financial ratios comprising R-12, R-18, R-19 and R-24 (i.e. OCF/Total Debts, (Retained Profit + Depreciation charge)/Total Debts, (Retained Profit + Depreciation charge)/(Tangible Assets + Accumulated Depreciation), and Net Worth/Total Debts) has higher predictive ability than other sets in discriminating different (two/three) degrees of financial health of the sample tea units (both in the 'initial' and 'secondary' samples).

* * *

N O T E S AND R E F E R E N C E S

1. Kurihara, R.R., Monetary Theory and Public Policy, George Allen and Urwin, London, 1951, p. 22.
2. Tucker, S.A., Successful Managerial Control by Ratio Analysis, Prentice-Hall Inc., Englewood Cliffs, New Jersey, 1964, p. 261.
3. A negative number divided by a negative number turned the whole to a positive one.
4. Peters, W.S. and Summers, G.W., Statistical Analysis for Business Decisions, Prentice-Hall Inc. Englewood Cliffs, New Jersey, 1968, pp. 401, 408.
5. Ibid, pp. 409-410.
6. Ibid, pp. 413-414.
7. Altman, E.I., "Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy", Journal of Finance, September, 1968, pp. 589-609.
8. Taffler, R.J., "The Assessment of Company Solvency and Performance Using a Statistical Model", Journal of Accounting and Business Research, Autumn 1983, pp. 298-299.
9. Klecka, W.R., Discriminant Analysis, Sage Publications Inc., Beverly Hill, California, 1986.
10. Altman, E.I., op. cit.
11. Taffler, R.J., op. cit.
12. Klecka, W.R., op. cit.
13. Altman, E.I., op. cit.
14. Gupta, L.C., Financial Ratios for Monitoring Corporate Sickness, Oxford University Press, New Delhi, 1983, p. 117.

15. Ooghe, H. and Verbaere, E., "Predicting Business Failure on the Basis of Accounting Data : The Belgian Experience", The International Journal of Accounting Education and Research, Vol. 20, No. 2, Spring 1985, p. 37.

16. Altman, E.I., op. cit.

17. Taffler, R.J., op. cit.

18. Klecka, W.R., op. cit.

19. Gupta, L.C., op. cit., p. 78.

20. Kaveri, V.S., Financial Ratios as Predictors of Borrower's Health (with reference to small-scale industries in India), Sultan Chand and Sons, New Delhi, 1980, p. 62.

21. Pandey, I.M., Financial Management, Vikas Publishing House Pvt. Ltd., New Delhi, pp. 428-432.

22. Altman, E.I., op. cit.

23. Taffler, R.J., op. cit.

24. Klecka, W.R., op. cit.

25. Taffler, R.J., op. cit.

26. Klecka, W.R., op. cit.

27. Altman, E.I., op. cit.

28. Altman, E.I., op. cit.

29. Taffler, R.J., op. cit.

30. Klecka, W.R., op. cit.

31. Taffler, R.J., op. cit.

32. Klecka, W.R., op. cit.

33. Altman, E.I., op. cit.

34. Ooghe, H. and Verbaere, E., op. cit., p. 37.

APPENDIX - I

ANALYSIS OF VARIANCE TEST TO ASSESS THE DISCRIMINATING ABILITY

To assess the discriminating ability of the derived functions, the present study tested the hypothesis that, 'the derived discriminant function does not discriminate'. The hypothesis was tested by using the analysis-of-variance test, and the general form of the analysis-of-variance table used for all the 'sets' of ratios was Table - I.A. In that table

$$K = \frac{n_1 n_2}{n_1+n_2} \quad , D = \bar{Y}_1 - \bar{Y}_2 \ , \quad \bar{Y}_j = \alpha_1 \bar{X}_{1j} + \alpha_2 X_{2j} + \ldots + \alpha_p X_{pj},$$

'p' was the number of financial ratios (X) in the discriminant function, 'j' was the number of financial health groups (here, 1 = 'good' and 2 = 'sick'), $n = n_1 + n_2$, 'n_1' was the number of units in the 'good' group, 'n_2' was the number of units in the 'sick' group, 'α' was the discriminant coefficients.

TABLE - I.A

ANALYSIS OF VARIANCE FOR THE DISCRIMINANT FUNCTION OF THE 'SETS' OF FINANCIAL RATIOS

Source of Variation	Sum of Squares (SS)	Degrees of Freedom (m)	Mean of Squares (MS)	F
Discriminant	KD^2	p	KD^2/p	KD^2/p
Residual Error	D	n-p-1	D/n-p-1	D/n-p-1

Forour 'Sets' of ratios, $n_1 = 28$, $n_2 = 36$, $n = 64$,

$$K = \frac{28(36)}{28+36} = 15.75$$

p = 4 (except the '8th set of ratios' where p = 3), the value of D for the respective 'sets' was computed on the basis of α_p (Table - III.8) and $\bar{X}_{pj}$ (Annexure - V)

APPENDIX - I(i)

ANALYSIS OF VARIANCE TEST TO ASSESS DISCRIMINATING ABILITY OF THE '1ST SET OF RATIOS'

TABLE

ANALYSIS OF VARIANCE FOR THE DISCRIMINANT FUNCTION OF THE '1ST SET OF RATIOS

Source	SS	m	MS	F
Discriminant	0.8390371	4	0.2097592	53.619564
Residual Error	0.2308078	59	0.00391199	

Table Value of F at (.99, 4, 55) = 3.68 and at (.99, 4, 60) = 3.65

The calculated value of F (53.62) was greater than the Table Value of F at one percent level of significance, and thus, the hypothesis 'the population discriminant function does not discriminate' (vide Appendix - I) was rejected, i.e., the derived discriminant function of the '1st set of ratios' would discriminate.

APPENDIX - I.(ii)

ANALYSIS OF VARIANCE TEST TO ASSESS DISCRIMINATING ABILITY OF THE '2ND SET OF RATIOS'

TABLE

ANALYSIS OF VARIANCE FOR THE DISCRIMINANT FUNCTION OF THE '2ND SET OF RATIOS'

Source	SS	m	MS	F
Discriminant	0.6132593	4	0.1533148	45.842243
Residual Error	0.1973249	59	0.0033444	

Table Value of F at (.99, 4, 55) = 3.68 and at (.99, 4, 60)= 3.65.

The calculated value of F (45.842) was greater than the Table Value of F at one percent level of significance, and thus, the hypothesis 'the population discriminant function does not discriminate' (vide Appendix - I) was rejected, i.e., the derived discriminant function of the '2nd set of ratios' would discriminate.

APPENDIX - I. (iii)

ANALYSIS OF VARIANCE TEST TO ASSESS DISCRIMINATING ABILITY OF THE '3RD SET OF RATIOS'

TABLE

ANALYSIS OF VARIANCE FOR THE DISCRIMINANT FUNCTION OF THE '3RD SET OF RATIOS'.

Source	SS	m	MS	F
Discriminant	0.4595078	4	0.1148769	39.680591
Residual Error	0.1708074	59	0.00289504	

Table Value of F at (.99, 4, 55)=3.68 and at (.99, 4,60)= 3.65

The calculated value of F (39.681) was greater than the Table Value of F at one percent level of significance, and thus, the hypothesis 'the population discriminant function does not discriminate' (vide, Appendix - I) was rejected, i.e., the derived discriminant function of the '3rd set of ratios' would discriminate.

APPENDIX - I. (iv)

ANALYSIS OF VARIANCE TEST TO ASSESS DISCRIMINATING ABILITY OF THE '4TH SET OF RATIOS'.

TABLE

ANALYSIS OF VARIANCE FOR THE DISCRIMINANT FUNCTION OF THE '4TH SET OF RATIOS'.

Source	SS	m	MS	F
Discriminant	0.4616797	4	0.1154199	39.775277
Residual Error	0.1712104	59	0.00290187	

Table Value of F at (.99, 4,55) = 3.68 and at (.99,4,60)= 3.65.

The calculated value of F (39.775) was greater than the Table Value of F at one percent level of significance, and thus, the hypothesis 'the population discriminant function does not discriminate' (vide, Appendix-I) was rejected, i.e., the derived discriminant function of the '4th set of ratios' would discriminate.

APPENDIX - I (v)

ANALYSIS OF VARIANCE TEST TO ASSESS DISCRIMINATING ABILITY OF THE '5TH SET OF RATIOS'.

TABLE

ANALYSIS OF VARIANCE FOR THE DISCRIMINANT FUNCTION OF THE '5TH SET OF RATIOS'

Source	SS	m	MS	F
Discriminant	0.7766829	4	0.1941707	51.588731
Residual Error	0.2220658	59	0.00376382	

Table Value of F at (.99, 4, 55) = 3.68 and at (.99, 4,60)= 3.65

The calculated value of F (51.589) was greater than the Table Value of F at one percent level of significance, and thus, the hypothesis 'the population discriminant function does not discriminate' (vide, Appendix - I) was rejected, i.e., the derived discriminant function of the '5th set of ratios' would discriminate.

APPENDIX - I (vi)

ANALYSIS OF VARIANCE TEST TO ASSESS DISCRIMINATING ABILITY OF THE '6TH SET OF RATIOS'

TABLE

ANALYSIS OF VARIANCE FOR THE DISCRIMINANT FUNCTION OF THE '6TH SET OF RATIOS'

Source	SS	m	MS	F
Discriminant	0.5792535	4	0.1448133	44.55
Residual Error	0.191776	59	0.00325044	

Table Value of F at (.99, 4, 55) = 3.68 and at (.99, 4, 60)=3.65

The calculated value of F (44.55) was greater than the Table Value of F at one percent level of significance, and thus, the hypothesis 'the population discriminant function does not discriminate' (vide, Appendix - I) was rejected, i.e., the derived discriminant function of the '6th set of ratios' would discriminate.

APPENDIX - I(vii)

ANALYSIS OF VARIANCE TEST TO ASSESS DISCRIMINATING ABILITY OF THE '7TH SET OF RATIOS'.

TABLE

ANALYSIS OF VARIANCE FOR THE DISCRIMINANT FUNCTION OF THE '7TH SET OF RATIOS'.

Source	SS	m	MS	F
Discriminant	0.4326603	4	0.108165	38.503844
Residual Error	0.1657425	59	0.00280919	

Table Value of F at (.99, 4, 55)=3.68 and at (.99, 4, 60)= 3.65

The calculated value of F (38.504) was greater than the Table Value of F at one percent level of significance, and thus, the hypothesis 'the population discriminant function does not discriminate' (vide, Appendix - I) was rejected, i.e., the derived discriminant function of the '7th set of ratios' would discriminate.

APPENDIX - I (viii)

ANALYSIS OF VARIANCE TEST TO ASSESS DISCRIMINATING ABILITY OF THE '8TH SET OF RATIOS'.

TABLE

ANALYSIS OF VARIANCE FOR THE DISCRIMINANT FUNCTION OF THE '8TH SET OF RATIOS'.

Source	SS	m	MS	F
Discriminant	0.31686	3	0.10562	44.679077
Residual Error	0.1418384	60	0.00236397	

Table Value of F at (.99, 3, 55) = 4.16 and at (.99, 3, 60) = 4.13

The calculated value of F (44.679) was greater than the Table Value of F at one percent level of significance, and thus, the hypothesis 'the population discriminant function does not discriminate' (vide, Appendix - I) was rejected, i.e., the derived discriminant function of the '8th set of ratios' would discriminate.

APPENDIX - II

COMPARISON OF DISCRIMINATING POWERS OF THE 'ORIGINAL DISCRIMINANT' AND 'REDUCED DISCRIMINANTS'.

To compare the discriminating power of the 'original' discriminant function to that of the 'reduced' functions (i.e. the functions of the eight different 'sets' of ratios) or to assess whether the 'original' discriminant function was discriminating the different degrees of financial health significantly better than that of the functions of the different 'sets of ratios', a further test has been attempted. For the assessment, a 'F' - ratio of the definition has been formed[1]:

$$F = \frac{\text{The decrease in the discriminant 'sum of squares' from 'original' discriminant to 'reduced' discriminant}}{\text{Residual error 'mean of square' of the 'original' discriminant}}$$

It was found that (Table - II.A) the calculated values of F were greater than the 'table value' of F at one percent level of significance. The results so obtained indicated to be significant ones and thus it could be stated that the discriminating power of the 'reduced' functions were lower than that of the 'original' function[2].

NOTE : 1. Peters, W.S. and Summers, G.W., Statistical Analysis for Business Decisions, Prentice-Hall Inc., Englewood Cliffs, New Jersey, 1968, pp. 414-415.

2. The result was in consonant with the study made by Hubert Ooghe and Eric Verbaere. Ooghe, H. and Verbaere, E., "Predicting Business Failure on the Basis of Accounting Data : The Belgian Experience", Internation Journal of Accounting Education and Research, Vol. 20, No. 2, Spring 1985, pp. 19-44.

TABLE - II.A (Appendix - II)

'F-ratio' FOR COMPARING THE DISCRIMINATING POWERS

'Sets' of Ratios	Decrease in Discriminant 'Sum of Squares'	Residual Error 'Mean squares' of 'original' function	F-ratio
1st Set	212.12277	0.1361905	1557.5445
2nd Set	212.34855		1559.2023
3rd Set	212.5023		1560.3313
4th Set	212.50013		1560.3153
5th Set	212.18512		1558.0023
6th Set	212.38255		1559.452
7th Set	212.52914		1560.5283
8th Set	212.64495		1561.3787

NOTE : Table Value of F at (.99, 1, 27) is 7.68

Compiled from Appendix I.1 to I.8, and Table - III.7.

APPENDIX - III(i)

RELATIVE CONTRIBUTION OF INDIVIDUAL RATIOS IN THE DISCRIMINATING POWER OF THE FUNCTION OF '1ST SET OF RATIOS'

Ratio Code	Ratio No.	SCALED VECTOR			R A N K S		
		Klecka	Taffler	Altman	Klecka	Taffler	Altman
X_1	R-12	0.0539461	0.3078661	0.3266908	4	4	4
X_2	R-18	0.1252773	0.7130582	0.7601529	1	2	1
X_3	R-19	0.1171639	0.8688744	0.4951108	2	1	3
X_4	R-24	0.088218	0.536318	0.5066923	3	3	2

APPENDIX - III (ii)

RELATIVE CONTRIBUTION OF INDIVIDUAL RATIOS IN THE DISCRIMINATING POWER OF THE FUNCTION OF '2ND SET OF RATIOS'.

Ratio Code	Ratio No.	SCALED VECTOR			R A N K S		
		Klecka	Taffler	Altman	Klecka	Taffler	Altman
X_1	R-19	0.0864281	0.7496991	0.3652279	1	1	1
X_2	R-24	0.02513	0.1787007	0.1443377	2	2	2
X_3	R-37	0.0152581	0.0872089	0.1011718	3	3	3
X_4	R-46	0.00522054	0.0156072	0.0399359	4	4	4

APPENDIX - III (iii)

RELATIVE CONTRIBUTION OF INDIVIDUAL RATIOS IN THE DISCRIMINATING POWER OF THE FUNCTION OF '3RD SET OF RATIOS'

Ratio Code	Ratio No.	SCALED VECTOR			RANKS		
		Klecka	Taffler	Altman	Klecka	Taffler	Altman
X_1	R-12	0.2184948	1.684948	1.323175	1	1	1
X_2	R-18	-0.2117382	1.6285295	1.2847771	2	2	2
X_3	R-19	0.0888864	0.8907225	0.3756161	3	3	3
X_4	R-23	0.00533493	0.0528594	0.0231865	4	4	4

APPENDIX - III (iv)

RELATIVE CONTRIBUTION OF INDIVIDUAL RATIOS IN THE DISCRIMINATING POWER OF THE FUNCTION OF '4TH SET OF RATIOS'.

Ratio Code	Ratio No.	SCALED VECTOR			RANKS		
		Klecka	Taffler	Altman	Klecka	Taffler	Altman
X_1	R-4	0.00372264	0.0192665	0.0267496	4	4	4
X_2	R-12	0.2279013	1.7533502	1.3801394	1	1	1
X_3	R-18	0.2232822	1.713275	1.3548233	2	2	2
X_4	R-19	0.0940907	0.9406548	0.3976084	3	3	3

APPENDIX - III(v)

RELATIVE CONTRIBUTION OF INDIVIDUAL RATIOS IN THE DISCRIMINATING POWER OF THE FUNCTION OF '5TH SET OF RATIOS'

Ratio Code	Ratio No.	SCALED VECTOR			R A N K S		
		Klecka	Taffler	Altman	Klecka	Taffler	Altman
X_1	R-24	-0.0199741	0.1262121	0.1147242	4	4	3
X_2	R-27	-0.0605024	0.4729062	0.2461242	2	2	2
X_3	R-28	-0.0243041	0.1793684	0.113208	3	3	4
X_4	R-35	0.061321	0.4739374	0.2572968	1	1	1

APPENDIX - III (vi)

RELATIVE CONTRIBUTION OF INDIVIDUAL RATIOS IN THE DISCRIMINATING POWER OF THE FUNCTION OE '6TH SET OF RATIOS'.

Ratio Code	Ratio No.	SCALED VECTOR			R A N K S		
		Klecka	Taffler	Altman	Clecka	Taffler	Altman
X_1	R-36	0.0702443	0.6278449	0.2957311	1	1	1
X_2	R-37	0.0195586	0.1150242	0.1296876	2	3	2
X_3	R-39	0.0192041	0.1828294	0.10362	3	2	3
X_4	R-40	0.00900435	0.0743012	0.044607	4	4	4

APPENDIX - III (vii)

RELATIVE CONTRIBUTION OF INDIVIDUAL RATIOS IN THE DISCRIMINATING POWER OF THE FUNCTION OF '7TH SET OF RATIOS'.

Ratio Code	Ratio No.	SCALED VECTOR			RANKS		
		Klecka	Taffler	Altman	Klecka	Taffler	Altman
X_1	R-37	0.0235129	0.1599993	0.1559075	4	4	4
X_2	R-39	0.0510365	0.562204	0.275379	3	2	3
X_3	R-40	-0.058446	0.5580204	0.2895319	2	3	2
X_4	R-41	-0.0873684	0.835817	0.4315957	1	1	1

APPENDIX - III (viii)

RELATIVE CONTRIBUTION OF INDIVIDUAL RATIOS IN THE DISCRIMINATING POWER OF THE FUNCTION OF '8TH SET OF RATIOS'.

Ratio Code	Ratio No.	SCALED VECTOR			RANKS		
		Klecka	Taffler	Altman	Klecka	Taffler	Altman
X_1	R-46	0.0832898	0.3464104	0.6371481	3	3	3
X_2	R-47	0.1252625	1.2094996	0.7353103	1	1	1
X_3	R-49	-0.0993565	0.5559101	0.7306657	2	2	2

APPENDIX - IV.a(i)

Z-SCORE OF 'GOOD' AND 'SICK' UNITS ON THE BASIS OF THE FUNCTION OF '1ST SET OF RATIOS' (INITIAL SAMPLE)

GOOD UNITS				SICK UNITS			
CO. CODE	Z-Score	CO. CODE	Z-Score	CO. CODE	Z-Score	CO. CODE	Z-Score
3_9	0.1464008	5_3	0.0879867	6_9	-0.3330781	15_1	-0.072228
7_9	0.2966953	7_3	0.1367814	19_9	-0.0256696	16_1	-0.1055917
9_9	0.0909529	8_3	0.0895698	21_9	-0.0482001	19_1	-0.195897
11_9	0.0857144	11_3	0.0984812	2_0	-0.1369805	20_1	-0.1444497
25_9	0.1628408	14_3	0.0996009	5_0	-0.0595341	21_1	-0.1496847
7_0	0.1857307	17_3	0.0880447	6_0	-0.4030667	23_1	-0.0936717
11_0	0.0671425	18_3	0.1452121	12_0	-0.1109679	26_1	-0.1952746
22_0	0.0569828	24_3	0.1079668	15_0	-0.195304	2_2	-0.1397211
25_0	0.0902228	25_3	0.1011614	16_0	-0.1577116	6_2	-0.1682912
7_1	0.1494881	3_4	0.4959139	19_0	-0.1441123	12_2	-0.0870316
11_1	0.0641325	7_4	0.1696402	20_0	-0.1613774	15_2	-0.0707329
22_1	0.0590868	8_4	0.0712974	21_0	-0.1642963	16_2	-0.0959307
25_1	0.0873976	11_4	0.1116803	2_1	-0.1671193	19_2	-0.0785377
7_2	0.232606	16_4	0.0678087	4_1	-0.063416	21_2	-0.191907
11_2	0.0646374	18_4	0.122877	5_1	-0.0451212	23_2	-0.0600832
18_2	0.0392545	22_4	0.0794633	6_1	-0.1901704	26_2	-0.2712668
22_2	0.0529737	23_4	0.0544452	8_1	-0.1325141	6_3	-0.1006401
1_3	0.254142	25_4	0.1370256	10_1	-0.1082793	20_4	-0.139858
3_3	0.2600432			12_1	-0.1331438	21_4	-0.1065403

NOTE: Subscripts in the Company Code indicate the years, subscript 9 = 1979, 0=1980, 1 = 1981 and so on.

APPENDIX - IV.a(ii)

Z-SCORE OF 'GOOD' AND 'SICK' UNITS ON THE BASIS OF THE FUNCTION OF '2ND SET OF RATIOS' (INITIAL SAMPLE)

GOOD UNITS				SICK UNITS			
CO. CODE	Z-Score	CO. CODE	Z-Score	CO. CODE	Z-Score	CO. CODE	Z-Score
3_9	0.092042	7_3	0.22057	6_9	-0.280081	16_1	-0.083555
7_9	0.1042094	8_3	0.1533665	19_9	-0.030477	19_1	-0.170575
9_9	0.0495359	11_3	0.1004543	21_9	-0.043648	20_1	-0.132928
11_9	0.0498567	14_3	0.0808071	2_0	-0.133456	21_1	-0.124051
25_9	0.0792719	17_3	0.0511692	5_0	-0.065595	23_1	-0.090687
7_0	0.0715301	18_3	0.1450381	6_0	-0.322898	26_1	-0.205581
11_0	0.0431162	24_3	0.0489086	12_0	-0.112708	2_2	-0.113436
22_0	0.0297805	25_3	0.0709658	15_0	-0.191926	6_2	-0.106714
25_0	0.0510187	3_4	0.2451424	16_0	-0.135839	12_2	-0.068834
7_1	0.0735729	7_4	0.2183673	19_0	-0.134087	15_2	-0.058309
11_1	0.0479335	8_4	0.1420915	20_0	-0.139319	16_2	-0.079558
22_1	0.0340515	11_4	0.1216316	21_0	-0.143921	19_2	-0.058523
25_1	0.0657772	16_4	0.0572409	2_1	-0.147958	21_2	-0.153456
7_2	0.1227106	18_4	0.0911513	4_1	-0.085012	23_2	-0.053593
11_2	0.047557	22_4	0.0664249	5_1	-0.051689	26_2	-0.245749
18_2	0.033945	23_4	0.0577997	6_1	-0.132288	6_3	-0.050481
22_2	0.0339214	25_4	0.1043973	8_1	-0.125144	20_4	-0.113275
1_3	0.1652849			10_1	-0.117644	21_4	-0.072821
3_3	0.259229			12_1	-0.119590		
5_3	0.0935505			15_1	-0.062053		

NOTE : Subscripts in the Company Code indicate the years, subscript 9 = 1979, 0 = 1980, 1 = 1981 and so on.

APPENDIX - IV.a.(iii)

SCORE OF 'GOOD' AND 'SICK' UNITS ON THE BASIS OF THE FUNCTION OF '3RD SET OF RATIOS' (INITIAL SAMPLE)

GOOD CO GROUP		SICK CO GROUP	
CO. CODE	Z-Scores	CO. CODE	Z-Scores
3_9	0.0607902	6_9	-.2786293
7_9	0.0519873	19_9	-.0274783
9_9	0.0308678	21_9	-.0412952
11_9	0.0455154	2_0	-.1400115
25_9	0.0354057	5_0	-.0643219
7_0	0.0282739	6_0	-.3207612
11_0	0.0332958	12_0	-.10804
22_0	0.02617	15_0	-.1909926
25_0	0.0128461	16_0	-.142911
7_1	0.0271349	19_0	-.1299465
11_1	0.0393773	20_0	-.1879425
22_1	0.025592	21_0	-.1396381
25_1	0.0195819	2_1	-.1439637
7_2	0.0538473	4_1	-.0774652
11_2	0.0424029	5_1	-.04035
18_2	0.0135247	6_1	-.1139112
22_2	0.0276829	8_1	-.1275886
1_3	0.1283425	10_1	-.1145362
3_3	0.2235141	12_1	-.1129545
5_3	0.096813	15_1	-.0506276
7_3	0.1123006	16_1	-.0836705
8_3	0.0967126	19_1	-.1617991
11_3	0.0980347	20_1	-.1241129
14_3	0.0999731	21_1	-.1161358
17_3	0.070297	23_1	-.0855725
18_3	0.091651	26_1	-.1984094
24_3	0.0894566	2_2	-.1079506
25_3	0.0596047	6_2	-.0881822
3_4	0.1950873	12_2	-.0597559
7_4	0.1257814	15_2	-.0425232

Contd..

APPENDIX - IV.a.(iii) (Contd..)

GOOD CO GROUP		SICK CO GROUP	
CO. CODE	Z-Scores	CO. CODE	Z-Scores
8_4	0.0870297	16_2	-.0688127
11_4	0.1084226	19_2	-.0484754
16_4	0.0693408	21_2	-.1474727
18_4	0.0563166	23_2	-.0447683
22_4	0.0594532	26_2	-.2303619
23_4	0.0537346	6_3	-.0308537
25_4	0.0671555	20_4	-.1073071
		21_4	-.0666365

NOTE : Subscripts in the Company Code indicate the years, subscript 9 = 1979, 0 = 1980,1= 1981 and so on.

APPENDIX - IV. a. (iv)

Z-SCORE OF 'GOOD' AND 'SICK' UNITS ON THE BASIS OF THE FUNCTION OF '4TH SET OF RATIOS' (INITIAL SAMPLE)

GOOD CO GROUP		SICK CO GROUP	
CO. CODE	Z-Scores	CO. CODE	Z-Scores
3_9	0.0626874	6_9	-.27983
7_9	0.0549089	19_9	-.02598
9_9	0.0322648	21_9	-.040536
11_9	0.0472919	2_0	-.139536
25_9	0.0369709	5_0	-.063694
7_0	0.0300612	6_0	-.321878
11_0	0.0349237	12_0	-.106929
22_0	0.0278405	15_0	-.190729
25_0	0.0140158	16_0	-.143833
7_1	0.0280966	19_0	-.129211
11_1	0.0407959	20_0	-.190053
22_1	0.0271461	21_0	-.140103
25_1	0.0206805	2_1	-.142972
7_2	0.0532269	4_1	-.075909
11_2	0.0434940	5_1	-.039449
18_2	0.0145317	6_1	-.134758
22_2	0.0290241	8_1	-.126126
1_3	0.1220796	10_1	-.113445
3_3	0.2474946	12_1	-.112105
5_3	0.0949588	15_1	-.049623
7_3	0.1136695	16_1	-.08373
8_3	0.0950308	19_1	-.161255
11_3	0.0974201	20_1	-.123758
14_3	0.0961764	21_1	-.116167
17_3	0.0676489	23_1	-.084693
18_3	0.0876142	26_1	-.196922
24_3	0.0862651	2_2	-.107116
25_3	0.0599517	6_2	-.088067

Contd..

APPENDIX - IV.a(iv) (Contd..)

GOOD CO GROUP		SICK CO GROUP	
CO. CODE	Z-Scores	CO. CODE	Z-Scores
3_4	0.2094333	12_2	-.058857
7_4	0.1308568	15_2	-.041355
8_4	0.0863562	16_2	-.068726
11_4	0.1104497	19_2	-.047411
16_4	0.0681545	21_2	-.147946
18_4	0.0563484	23_2	-.043406
22_4	0.0610564	26_2	-.22813
23_4	0.0537845	6_3	-.031085
25_4	0.0676912	20_4	-.106494
		21_4	-.066194

NOTE : Subscripts in the Company Code indicate the years, subscript 9 = 1979, 0 = 1980, 1 = 1981 and so on.

APPENDIX - IV.a (v)

Z-SCORE OF 'GOOD' AND 'SICK' UNITS ON THE BASIS OF THE FUNCTION OF '5TH SET OF RATIOS' (INITIAL SAMPLE)

GOOD CO GROUP		SICK CO GROUP	
CO. CODE	Z-Scores	CO. CODE	Z-Scores
3_9	-.0298533	6_9	-.3423123
7_9	-.0100187	19_9	-.1786406
9_9	-.0349776	21_9	-.22015
11_9	-.04193	2_0	-.2087046
25_9	-.0226825	5_0	-.179553
7_0	-.0008251	6_0	-.4307351
11_0	-.066028	12_0	-.2176802
22_0	-.0521534	15_0	-.2247463
25_0	-.0341775	16_0	-.2330249
7_1	-.0064857	19_0	-.2546885
11_1	-.0775572	20_0	-.2068048
22_1	-.0703575	21_0	-.2857252
25_1	-.0101042	2_1	-.3090656
7_2	-.0016814	4_1	-.1614821
11_2	-.0766778	5_1	-.2113839
18_2	-.0911126	6_1	-.4013031
22_2	-.0639256	8_1	-.2275491
1_3	0.1251315	10_1	-.2012191
3_3	-.0036246	12_1	-.2692174
5_3	-.0927527	15_1	-.245296
7_3	-.0301136	16_1	-.2641709
8_3	-.1577641	19_1	-.3265912
11_3	-.0442616	20_1	-.2657384
14_3	-.0324518	21_1	-.3319886
17_3	-.0483339	23_1	-.2299501
18_3	0.0038188	26_1	-.216921

Contd..

APPENDIX - IV.a(v) (Contd..)

GOOD CO GROUP		SICK CO GROUP	
CO. CODE	Z-Scores	CO. CODE	Z-Scores
24_3	-.0035768	2_2	-.3547604
25_3	-.026894	6_2	-.3058014
3_4	-.0972082	12_2	-.2928058
7_4	-.0336272	15_2	-.2700011
8_4	-.1294939	16_2	-.2946984
11_4	-.0339139	19_2	-.3206419
16_4	-.1725759	21_2	-.3850713
18_4	-.0042556	23_2	-.255703
22_4	-.053273	26_2	-.3232426
23_4	-.1540241	6_3	-.298023
25_4	-.0081718	20_4	-.3175239
		21_4	-.3630924

NOTE : Subscripts in the Company Code indicate the years, subscript 9 = 1979, 0 = 1980, 1 = 1981 and so on.

APPENDIX - IV.a (vi)

Z-SCORE OF 'GOOD' AND 'SICK' UNITS ON THE BASIS OF THE FUNCTION OF '6TH SET OF RATIOS' (INITIAL SAMPLE)

GOOD CO GROUP		SICK CO GROUP	
CO. CODE	Z-Scores	CO. CODE	Z-Scores
3_9	0.3735928	6_9	-.0302974
7_9	0.3498658	19_9	0.0852013
9_9	0.2278596	21_9	0.1441115
11_9	0.1725058	2_0	0.1396303
25_9	0.3277369	5_0	0.0776054
7_0	0.3029155	6_0	-.0272573
11_0	0.1812113	12_0	0.101207
22_0	0.2025601	15_0	0.0811479
25_0	0.2721166	16_0	0.1385752
7_1	0.3274915	19_0	0.0690471
11_1	0.1785094	20_0	0.1055208
22_1	0.2137106	21_0	0.0945479
25_1	0.3265746	2_1	0.097116
7_2	0.4009879	4_1	0.1112151
11_2	0.1991985	5_1	0.0636519
18_2	0.2618664	6_1	-.0291465
22_2	0.2193422	8_1	0.0942927
1_3	0.348813	10_1	0.0725119
3_3	0.4628902	12_1	0.0829168
5_3	0.2987981	15_1	0.0853141
7_3	0.2723146	16_1	0.1151649
8_3	0.428387	19_1	0.0355033
11_3	0.2197869	20_1	0.0693875
14_3	0.2293821	21_1	0.0637654
17_3	0.3264606	23_1	0.0985099

Contd..

APPENDIX - IV.a (vi) (Contd..)

GOOD CO GROUP		SICK CO GROUP	
CO. CODE	Z-Scores	CO. CODE	Z-Scores
18_3	0.5177134	26_1	0.0505365
24_3	0.2284033	2_2	0.0740777
25_3	0.2381619	6_2	-.0098939
3_4	0.3196788	12_2	0.0807244
7_4	0.265539	15_2	0.0677214
8_4	0.4274721	16_2	0.1695699
11_4	0.2327531	19_2	0.0597994
16_4	0.433504	21_2	0.0524286
18_4	0.2988579	23_2	0.0888948
22_4	0.2196924	26_2	-.0101803
23_4	0.3289806	6_3	0.0211837
25_4	0.2601303	20_4	0.0524229
		21_4	0.0761012

NOTE : Subscripts in the Company Code indicate the years, subscript 9 = 1979, 0 = 1980, 1 = 1981 and so on.

APPENDIX - IV.a(vii)

Z-SCORE OF 'GOOD' AND 'SICK' UNITS ON THE BASIS OF THE FUNCTION OF '7TH SET OF RATIOS' (INITIAL SAMPLE)

GOOD CO GROUP		SICK CO GROUP	
CO. CODE	Z-Scores	CO. CODE	Z-Scores
3_9	0.0578284	6_9	-.319891
7_9	0.0675535	19_9	-.199137
9_9	-.099382	21_9	-.1595
11_9	-.120423	2_0	-.184537
25_9	0.0098434	5_0	-.192606
7_0	-.023894	6_0	-.347732
11_0	-.116567	12_0	-.203959
22_0	-.104527	15_0	-.218563
25_0	-.065694	16_0	-.15126
7_1	-.008212	19_0	-.222343
11_1	-.129789	20_0	-.205121
22_1	-.112745	21_0	-.192821
25_1	-.017372	2_1	-.226835
7_2	0.1195697	4_1	-.215053
11_2	-.121169	5_1	-.203257
18_2	-.025371	6_1	-.375111
22_2	-.110673	8_1	-.215591
1_3	0.0426349	10_1	-.200469
3_3	0.2361804	12_1	-.234305
5_3	-.049225	15_1	-.217798
7_3	-.029134	16_1	-.175023
8_3	0.0249339	19_1	-.263523
11_3	-.096467	20_1	-.254501
14_3	-.086232	21_1	-.209853
17_3	-.087212	23_1	-.19474
18_3	0.159937	26_1	-.268657
24_3	-.071591	2_2	-.240462
25_3	-.073364	6_2	-.394953

Contd..

APPENDIX - IV.a(vii) (Contd..)

GOOD CO GROUP		SICK CO GROUP	
CO. CODE	Z-Scores	CO. CODE	Z-Scores
3_4	0.0730742	12_2	-.243288
7_4	-.03575	15_2	-.23397
8_4	0.0552565	16_2	-.142761
11_4	-0.082055	19_2	-.249529
16_4	-.04693	21_2	-.229388
18_4	-.023904	23_2	-.199173
22_4	-.110087	26_2	-.316952
23_4	-.050342	6_3	-.360039
25_4	-.040776	20_4	-.243648
		21_4	-.204304

NOTE : Subscripts in the Company Code indicate the years, subscript 9 = 1979, 0 = 1980, 1 = 1981 and so on.

APPENDIX - IV.a (viii)

Z-SCORE OF 'GOOD' AND 'SICK' UNITS ON THE BASIS OF THE FUNCTION OF '8TH SET OF RATIOS' (INITIAL SAMPLE)

GOOD CO GROUP		SICK CO GROUP	
CO CODE	Z-Scores	CO. CODE	Z-Scores
3_9	0.1358465	6_9	0.1600888
7_9	0.4744262	19_9	0.0923746
9_9	0.2813687	21_9	0.0895081
11_9	0.3162094	2_0	0.1478576
25_9	0.3196517	5_0	0.10126
7_0	0.489842	6_0	0.1443415
11_0	0.2441955	12_0	0.1572362
22_0	0.3079102	15_0	0.2547738
25_0	0.2607493	16_0	0.0472238
7_1	0.4445116	19_0	0.1375783
11_1	0.1870368	20_0	0.1330706
22_1	0.2612557	21_0	0.1411685
25_1	0.3569382	2_1	0.2424224
7_2	0.5562887	4_1	0.2012175
11_2	0.2274173	5_1	0.2086787
18_2	0.0232758	6_1	0.1706669
22_2	0.3118202	8_1	0.1822225
1_3	0.4616203	10_1	0.2157789
3_3	0.3718358	12_1	0.1466388
5_3	0.2502074	15_1	0.2674765
3_3	0.2790628	16_1	0.0513844
8_3	—	19_1	0.1899417
11_3	0.2630466	20_1	0.1831311
14_3	0.5353721	21_1	0.1440969
17_3	0.3688182	23_1	0.1457117

Contd..

APPENDIX - IV.a (viii) (Contd..)

GOOD CO GROUP		SICK CO GROUP	
CO. CODE	Z-Scores	CO. CODE	Z-Scores
18_3	0.3716702	26_1	0.1610451
24_3	0.8611013	2_2	0.106381
25_3	0.4451225	6_2	0.0744464
3_4	0.4430934	12_2	0.1205916
7_4	0.3084956	15_2	0.3011898
8_4	0.1708488	16_2	0.1719828
11_4	0.145357	19_2	0.1053587
16_4	0.2792822	21_2	0.1114666
18_4	0.3915047	23_2	0.1500122
22_4	0.1676885	26_2	0.1936458
23_4	0.161335	6_3	0.078632
25_4	0.4036089	20_4	0.1064899
		21_4	0.0003372

NOTE : Subscripts in the Compandy Code indicate the years, subscript 9=1979, 0 = 1980, 1 = 1981 and so on.

APPENDIX - IV. b (i)

Z-SCORE OF 'SEMI-GOOD/SEMI-SICK' UNITS ON THE BASIS OF THE FUNCTION OF '1ST SET OF RATIOS' (INITIAL SAMPLE).

CO. CODE	Z-Score	CO. CODE	Z-Score	CO. CODE	Z-Score	CO. CODE	Z-Score
1979							
1	0.0420792	4	-0.0281623	3	0.1563256	19	0.042686
2	-0.0171283	8	-0.0531083	4	-0.0068227	20	0.0437665
4	0.0427158	9	0.0394029	5	0.0245745	21	-0.003262
5	-0.0253931	10	-0.0564597	8	-0.0400837	22	0.0960683
8	0.0032843	13	-0.0068723	9	0.0706512	23	0.0519002
10	0.0698253	14	0.0016719	10	0.0179486	26	-0.048023
12	-0.0569909	17	0.0318163	13	0.0178735	1984	
13	0.0719547	18	0.003757	14	0.0190739	2	0.0323068
14	0.1413559	23	-0.0562788	17	-0.0088909	4	0.0655404
15	-0.0328255	24	-0.0133804	20	-0.0079904	5	0.04885
16	-0.0146797	16	-0.0789982	24	0.0083827	6	-0.0643422
17	0.133921	1981		25	0.0462368	9	0.0778785
18	0.0500528	1	0.018255	1983		10	0.0505212
20	-0.0532022	3	0.1291095	2	-0.00072446	12	0.034404
22	0.1048498	9	0.0442069	4	0.0492385	13	-0.1026428
23	0.0048793	13	-0.0703597	9	0.1148487	14	0.0889017
24	0.0149998	14	-0.0155269	10	0.0493501	15	0.0634564
26	0.0750078	17	-0.0125274	12	0.0370689	17	0.0726827
1980		18	0.0197501	13	0.0821709	19	0.0322741
1	0.035943	24	-0.0283528	15	0.0521809	26	-0.0348589
3	0.1497849	1982		16	0.0729522		
		1	0.0458592				

APPENDIX - IV. b (ii)

Z-SCORE OF 'SEMI-GOOD/SEMI-SICK' UNITS ON THE BASIS OF THE FUNCTION OF '2ND SET OF RATIOS' (INITIAL SAMPLE)

CO. CODE	Z-Score	CO. CODE	Z-Score	CO. CODE	Z-Score	CO. CODE	Z-Score
1979							
1	-0.006084	4	-0.073022	3	0.1692871	19	0.040999
2	-0.036281	8	-0.053653	4	-0.007738	20	0.0455594
4	-0.01587	9	-0.003228	5	0.0184115	21	0.0090822
5	-0.053101	10	-0.079383	8	-0.04739	22	0.0736012
8	-0.006544	13	-0.044416	9	0.0222403	23	0.0691308
10	0.0206822	14	-0.06457	10	0.0098929	26	-0.024711
						1984	
12	-0.08038	17	-0.026727	13	-0.005671	2	0.0586012
13	0.0312323	18	-0.036027	14	-0.001798	4	0.0392012
14	0.0411648	23	-0.064468	17	-0.036207	5	0.0509128
15	-0.061253	24	-0.065846	20	-0.000687	6	-0.025162
16	-0.02166	26	-0.123582	24	-0.011143	9	0.0540159
		1981					
17	0.0347408	1	-0.022639	25	0.0238086	10	0.0425319
18	0.0227286	3	0.0487667	1983 2	0.0076392	12	0.0349456
20	-0.082119	9	-0.003936	4	0.050645	13	-0.132573
22	0.050775	13	-0.098631	9	0.0607026	14	0.0417199
23	-0.029211	14	-0.056412	10	0.0402908	15	0.0491713
24	-0.03862	17	-0.062985	12	0.041605	17	0.0276718
26	0.0316414	18	0.005094	13	0.051836	19	0.0353694
1980							
1	-0.003785	24	-0.076483	15	0.0510902	26	-0.018679
3	0.047986	1982 1	0.0158382	16	0.0553954		

APPENDIX - IV. b (iii)

Z-SCORE OF 'SEMI-GOOD/SEMI-SICK' UNITS ON THE BASIS OF THE FUNCTION OF '3RD SET OF RATIOS' (INITIAL SAMPLE)

CO. CODE	Z-Scores	CO. CODE	Z-Score	CO. CODE	Z-Scores
1979					
1	-.024353	23	-.0673195	13	0.0650784
2	-.0449286	24	-.0685724	15	0.0736954
4	-.0294035	26	-.1208202	16	0.0867627
5	-.0519441	1981		19	0.0668643
8	-.0261983	1	-.031034	20	0.0692908
10	0.0101766	3	0.0180359	21	0.0242672
12	-.0791949	9	-.0125137	22	0.0666493
13	0.0140247	13	-.094165	23	0.0640756
14	0.0193152	14	-.0492595	26	0.0107598
15	-.0584764	17	-.0648187	1984	
16	-.0213679	18	-.0131718	2	0.0559858
17	0.0155442	24	-.0667821	4	0.0560915
18	-.0045205	1982		5	0.0487319
20	-.0873241	1	0.0124395	6	0.00297728
22	0.0363213	3	0.0461171	9	0.0639401
23	-.0337856	4	0.00361148	10	0.0433406
24	-.0466144	5	0.0239039	12	0.0458111
26	0.0178502	8	-.053905	13	-.1227099
1980		9	0.0290951	14	0.0479916
1	-.0159604	10	0.0244752	15	0.0688675
3	-.0122183	13	-.0049794	17	0.0355309
4	-.07251	14	0.00694599	19	0.0467656
8	-.0663625	17	-0.0342372	26	0.0132111
9	-.0166638	20	0.0154866		
10	-.0895321	24	-.0077042		
13	-.0502682	25	-.0141782		
14	-.0650882	1983			
17	-.0384904	2	0.0216521		
18	-.0563271	4	0.0660217		
		9	0.0914038		
		10	0.051831		
		12	0.0543016		

APPENDIX - IV. b (iv)

Z-SCORE OF 'SEMI-GOOD/SEMI-SICK' UNITS ON THE BASIS OF THE FUNCTION OF '4TH SET OF RATIOS' (INITIAL SAMPLE)

CO. CODE	Z-Score	CO. CODE	Z-Score		
1979					
1	-.022882	24	-.066456	12	0.0532612
2	-.043694	26	-.119372	13	0.0624017
4	-.027604	1981		15	0.0712328
5	-.05111	1	-.029422	16	0.0841253
8	-.024825	3	0.0203784	19	0.065332
10	0.0115789	9	-.011022	20	0.0691227
12	-.0773	13	-.093264	21	0.0247411
13	0.0152186	14	-.047426	22	0.0649477
14	0.0233582	17	-.063506	23	0.0447379
15	-.057518	18	-.012009	26	0.011393
16	-.020502	24	-.064192	1984	
17	0.0185744	1982		2	0.0543772
18	-.003345	1	0.0137964	4	0.0546757
20	-.086431	3	0.0487901	5	0.0490865
22	0.0378685	4	0.0047848	6	0.0037424
23	-.032328	5	0.0255359	9	0.0650336
24	-.044626	8	-.052515	10	0.0430507
26	0.0188613	9	0.0299563	12	0.0451614
1980		10	0.0258121	13	-.121448
1	-.014628	13	-.003962	14	0.0482212
3	-.010589	14	0.0081288	15	0.0668159
4	-.071037	17	-.033088	17	0.0355518
8	-.065317	20	0.0166237	19	0.0468625
9	-.015364	24	-.006431	26	0.0128931
10	-.088268	25	-.013067		
13	-.049588	1983			
14	-.067771	2	0.0225192		
17	-.037615	4	0.0634568		
18	-.055144	9	0.0903298		
23	-.066363	10	0.0507836		

APPENDIX - IV. b (v)

Z-SCORE OF 'SEMI-GOOD/SEMI-SICK' UNITS ON THE BASIS OF THE FUNCTION OF '5TH SET OF RATIOS' (INITIAL SAMPLE)

CO. CODE	Z-Score	CO. CODE	Z-Scores	CO. CODE	Z-Scores
1979					
1	-.0538107	23	-.1994218	9	-.0279995
2	-.1229258	24	-.0986674	10	-.1431442
4	-.0590961	26	-.1375265	12	-.2466179
5	-.1220196	1981		13	-.0888261
8	-.1098649	1	-.0830772	15	-.2383527
10	-.0495161	3	-.021865	16	-.240053
12	-.1512495	9	-.0592857	19	-.2395012
13	-.0411881	13	-.1479524	20	-.2520622
14	-.0276765	14	-.1204928	21	-.3289509
15	-.1291993	17	-.0967049	22	-.0297457
16	-.1640482	18	-.0950906	23	-.1947168
17	-.022743	24	-.1285978	26	-.3444611
18	-.0642751	1982		1984	
20	-.1312127	1	-.0821972	2	-.2755407
22	-.0210843	3	.0745421	4	-.0730149
23	-.975315	4	-.1387645	5	-.083224
24	-.0705818	5	-.1586304	6	-.2926111
26	-.0341945	8	-.221729	9	-.0589439
1980		9	-.0463718	10	-.1273052
1	-.725952	10	-.1948472	12	-.173601
3	-.0281639	13	-.1471447	13	-.1711626
4	-.113273	14	-.118219	14	-.0330058
8	-.1620895	17	-.1198049	15	-.1638644
9	-.0640709	20	-.2659775	17	-.0508328
10	-.131965	24	-.1344192	19	-.1757284
13	-.1090139	25	-.0420507	26	-.281124
14	-.0854097	1983			
17	-.0587997	2	-.3107278		
18	-.0872575	4	-.1093012		

APPENDIX - IV. b (vi)

Z-SCORE OF 'SEMI-GOOD/SEMI-SICK' UNITS ON THE BASIS OF THE FUNCTION OF '6TH SET OF RATIOS' (INITIAL SAMPLE)

CO. CODE	Z-Scores	CO. CODE	Z-Scores	CO. CODE	Z-Scores
1979					
1	0.1414933	24	0.1618206	12	0.1147163
2	0.1929959	26	0.1083601	13	0.1156452
4	0.1902448	1981		15	0.3786335
5	0.0779299	1	0.1331262	16	0.3132357
8	0.1728337	3	0.3379602	19	0.0936585
10	0.1659825	9	0.1705765	20	0.0907762
12	0.1209318	13	0.0615747	21	0.0900147
13	0.1557182	14	0.091409	22	0.1995217
14	0.1881632	17	0.1172957	23	0.4402742
15	0.1432712	18	0.2119744	26	-0.0245051
16	0.1641909	24	0.1223764	1984	
17	0.1650224	1982		2	0.4729334
18	0.258363	1	0.104331	4	0.1299928
20	0.1484726	3	0.6976305	5	0.1898342
22	0.1985937	4	0.1306025	6	0.0203727
23	0.1327252	5	0.0819336	9	0.1665616
24	0.2312397	8	0.0904747	10	0.1455374
26	0.1949308	9	0.1709229	12	0.1439453
1980		10	0.0619643	13	0.0353178
1	0.1327114	13	0.0783628	14	0.1624278
3	0.3401426	14	0.1212551	15	0.1239329
4	0.1510786	17	0.1037537	17	0.076313
8	0.1442717	20	0.0744503	19	0.1176006
9	0.1859942	24	0.1614246	26	-0.0157675
10	0.1265942	25	0.2623462		
13	0.1198401	1983			
14	0.1325654	2	0.0880173		
17	0.1498793	4	0.1096433		
18	0.220418	9	0.1546654		
23	0.1239848	10	0.0892694		

APPENDIX - IV. b (vii)

Z-SCORE OF 'SEMI-GOOD/SEMI-SICK' UNITS ON THE BASIS OF THE FUNCTION OF '7TH SET OF RATIOS' (INITIAL SAMPLE)

CO. CODE	Z-Score	CO. CODE	Z-Score	CO. CODE	Z-Score
1979					
1	-.143396	18	-.140296	4	-.213865
2	-.144293	23	-.177644	9	-.153364
4	-.136736	24	-.145343	10	-.174061
5	-.192318	26	-.207921	12	-.209775
8	-.155398	1981		13	-.161324
10	-.148523	1	-.153411	15	-.062359
12	-.181928	3	0.0155405	16	-.082045
13	-.145267	9	-.126501	19	-.235141
14	-.129001	13	-.198911	20	-.227425
15	-.187352	14	-.209053	21	-.207502
16	-.150369	17	-.187287	22	-.093817
17	-.143349	18	-.143824	23	-.014478
18	-.106921	24	-.156677	26	-.321191
20	-.178574	1982		1984	
22	-.110844	1	-.159192	2	-.024095
23	-.165989	3	0.2464122	4	-.171372
24	-.098902	4	-.178832	5	-.1293
26	-.110003	5	-.208834	6	-.360827
1980		8	-.214755	9	-.160895
1	-.170384	9	-.12746	10	-.145337
3	0.023094	10	-.196735	12	-.202532
4	-.184224	13	-.191815	13	-.190827
8	-.180942	14	-.180111	14	-.135436
9	-.133635	17	-.201054	15	-.173016
10	-.15703	20	-.243641	17	-.162053
13	-.175611	24	-.149993	19	-.210558
14	-.18834	25	-.062946	26	-.294619
17	-.158467	1983			
		2	-.236037		

APPENDIX - IV.b(viii)

Z-SCORE OF 'SEMI-GOOD/SEMI-SICK' UNITS ON THE BASIS OF THE FUNCTION OF '8TH SET OF RATIOS' (INITIAL SAMPLE)

CO. CODE	Z-Scores	CO. CODE	Z-Scores	CO. CODE	Z-Scores
1979					
1	0.2292657	23	0.0664903	10	0.2548881
2	0.1645544	24	0.3063314	12	0.1270538
4	0.3441233	26	0.194913	13	0.3216059
5	0.1535993	1981		15	0.2812256
8	-.0189849	1	0.114618	16	0.3864659
10	0.3731257	3	0.2740424	19	0.4710923
12	0.1627557	9	0.393262	20	0.2186384
13	0.1429993	13	0.2474987	21	0.11712
14	0.4062133	14	0.293563	22	0.4916008
15	0.3082775	17	0.1737284	23	0.2097331
16	0.123995	18	0.0551105	26	0.2856261
17	0.2745099	24	0.3405521	1984	
18	0.1168825	1982		2	0.4489553
20	0.1397117	1	0.1753034	4	0.5342849
22	0.2906049	3	0.3087839	5	0.080944
23	0.1101691	4	0.1826385	6	0.2105501
24	0.3976757	5	0.0979665	9	0.3336792
26	0.0958498	8	0.0279397	10	0.1696512
1980		9	0.475439	12	0.1604483
1	0.0660731	10	0.271424	13	0.3619799
3	0.2548882	13	0.2174979	14	0.5565814
4	0.1061107	14	0.2771577	15	0.2836315
8	0.068159	17	0.1596065	17	0.3385998
9	0.2990601	20	0.1725675	19	0.4218367
10	0.1097125	24	0.1985635	26	0.2615358
13	0.1221996	25	0.2531538		
14	0.2400271	1983			
17	0.1540012	2	0.1297394		
18	0.0340538	4	0.202843		
		9	0.5779407		

APPENDIX - V a)

Z-SCORE OF 'GOOD' AND 'SICK' UNITS ON THE BASIS OF THE FUNCTION OF '1ST SET OF RATIOS' (SECONDARY SAMPLE).

CO. CODE	GOOD UNITS			SICK UNITS	
	Z-Score	CO. CODE	Z-Score	CO. CODE	Z-Score
2_4	0.089489	14_7	0.1145134	9_5	-0.112493
3_4	0.1646839	15_7	0.083126	9_6	-0.066221
6_4	0.0931652	2_8	0.0855276	5_8	-0.401052
12_4	0.1113075	7_8	0.0472515	9_8	-0.177997
14_4	0.1229695	14_8	0.0955522	6_9	-0.114259
15_4	0.1468156	15_8	0.0728897	9_9	-0.146481
18_4	0.0680731	18_8	0.0508603	1_0	-0.073113
2_5	0.0998131	2_9	0.0661309	4_0	-0.06668
12_5	0.1029641	14_9	0.0714087	6_0	-0.156191
14_5	0.1020219	18_9	0.0388943	11_0	-0.06353
15_5	0.105664	2_0	0.0605568	12_0	-0.140504
16_5	0.1172138	16_0	0.0537776	17_0	-0.104396
18_5	0.1023678	2_1	0.0698799	19_0	-0.047215
12_6	0.1490186	15_1	0.0903348	4_1	-0.261906
14_6	0.0992391	16_1	0.0529176	6_1	-0.065749
15_6	0.1399673	18_1	0.0249926	7_1	-0.102113
18_6	0.0782076			11_1	-0.061521
2_7	0.1122426			12_1	-0.128006
7_7	0.1611154			17_1	-0.128006
12_7	0.1433071			19_1	-0.411557

APPENDIX - V.a(ii)

Z-Score of the Units in 'Good' and 'Sick' Groups (Secondary Sample) on the Basis of the Discriminant Function of the '2nd Set of Ratios'

GOOD UNITS				SICK UNITS	
CO CODE	Z-Score	CO CODE	Z-Score	CO CODE	Z-Score
1974		14	0.1234345	1975	
2	0.2158506	15	0.0531638	9	-0.0872282
3	0.3554956	1978		1976	
6	0.1583582	2	0.1704078	9	-0.0546935
12	0.150762	7	0.0469522	1978	
14	0.1339927	14	0.0692233	5	-0.3397111
15	0.111773	15	0.0569997	9	-0.1466879
18	0.2379367	18	0.1492605	1979	
1975		1979		6	-0.0690585
2	0.1983936	2	0.1542035	9	-0.1013153
12	0.1324878	14	0.0278671	1980	
14	0.0920194	18	0.1029865	1	-0.068394
15	0.0881027	1980		4	-0.0302565
16	0.0990258	2	0.1554832	6	-0.2340318
18	0.1369967	16	0.0694293	11	-0.1203342
1976		1981		12	-0.0237778
12	0.1995193	2	0.1565028	17	-0.113245
14	0.0702508	15	0.0718936	19	-0.0919979
15	0.0944676	16	0.0679536	1981	
18	0.110884	18	0.1041206	4	-0.029177
1977				6	-0.197063
2	0.1853557			7	-0.0614998
7	0.1771942			11	-0.0723316
12	0.2055044			12	-0.0299483
				17	-0.1023163
				19	-0.3419038

APPENDIX - V.a(iii)

Z-Score of the Units in 'Good' and 'Sick' Groups (Secondary Sample) on the Basis of the Discriminant Function of the '3rd Set of Ratios'.

GOOD UNITS				SICK UNITS	
CO CODE	Z-Score	CO CODE	Z-Score	CO CODE	Z-Score
1974				1975	
2	0.1235056	14	0.394912	9	-0.0127216
3	0.1309992	15	0.3608609	1976	
6	0.2030317	1978		9	-0.0103836
12	0.2217472	2	0.1710674	1978	
14	0.1721063	7	0.2946672	5	-0.3401404
15	0.3496012	14	0.1558205	9	-0.0256164
18	0.0156775	15	0.0884447	1979	
1975		18	0.0241337	6	22.846006
2	0.3093745	1979		9	0.0009974
12	0.1717287	2	0.087835	1980	
14	0.1634449	14	0.0124026	1	0.5256924
15	0.246346	18	0.0061367	4	11.466134
16	0.1322675	1980		6	0.0406526
18	0.1290676	2	0.0311252	11	0.2908774
1976		16	0.0361316	12	0.6084422
12	0.2499302	1981		17	0 .3029612
14	0.1505747	2	0.0389898	19	0.6092378
15	0.3581644	15	0.108803	1981	
18	0.1291857	16	0.0381604	4	0.268685
1977		18	0.0141681	6	-0.0627718
2	0.2745286			7	0.6063513
7	0.3274509			11	0.0726266
12	0.2451203			12	0.61835
				17	0.0815844
				19	-0.0610089

APPENDIX - V. a (iv)

Z-Score of the Units in 'Good' and 'Sick' Groups (Secondary Sample) on the Basis of the Discriminant Function of the '4th Set of Ratios'.

GOOD UNITS				SICK UNITS	
CO CODE	Z-Score	CO CODE	Z-Score	CO CODE	Z-Score
1974				1975	
2	0.0999376	14	0.1251723	9	-0.0754791
3	0.0776641	15	0.0874563	1976	
6	0.0866708	1978		9	-0.0254631
12	0.093269	2	0.0929122	1978	
14	0.0745845	7	0.0223215	5	-0.3649545
15	0.199487	14	0.0438448	9	-0.1354261
18	0.00253953	15	0.0632009	1979	
1975		18	0.0285088	6	-0.1210672
2	0.2338016	1979		9	-0.1144626
12	0.0720345	2	0.0393667	1980	
14	0.0699806	14	0.0172781	1	-0.0692573
15	0.0917899	18	0.0198321	4	-0.0653562
16	0.0747322	1980		6	-0.264154
18	0.0558707	2	0.0175925	11	-0.1393266
1976		16	0.0296271	12	-0.0607757
12	0.1549959	1981		17	-0.1264516
14	0.0645937	2	0.0255147	19	-0.095354
15	0.1731614	15	0.0569337	1981	
18	0.0491417	16	0.030818	4	-0.0404228
1977		18	0.00496803	6	-0.2090492
2	0.1785576			7	-0.0624074
7	0.1510976			11	-0.0811436
12	0.1330247			12	-0.0590691
				17	-0.1052714
				19	-0.3495009

APPENDIX - V.a(v)

Z-Score of the Units in 'Good' and 'Sick' Groups (Secondary Sample) on the Basis of the Discriminant Function of the '5th Set of Ratios'.

GOOD UNITS				SICK UNITS	
CO CODE	Z-Score	CO CODE	Z-Score	CO CODE	Z-Score
1974				1975	
2	-0.056643	14	-0.0212281	9	-0.431665
3	0.1631897	15	-0.1039072	1976	
6	-0.079543	1978		9	-0.4789268
12	-0.017728	2	-0.0358193	1978	
14	0.107657	7	-0.0725305	5	-0.3391609
15	0.0691345	14	-0.0038543	9	-0.4442314
18	0.0099582	15	-0.0880297	1979	
1975		18	-0.10727	6	-0.220733
2	-0.0348836	1979		9	-0.359689
12	0.0202167	2	-0.048798	1980	
14	0.028978	14	-0.003979	1	-0.2477322
15	0.0372371	18	-0.129288	4	-0.132842
16	0.0736887	1980		6	-0.380859
18	0.0232299	2	-0.0415424	11	-0.268782
1976		16	-0.1193678	12	-0.159324
2	0.0298535	1981		17	-0.262016
14	0.0351165	2	-0.026625	19	-0.1590036
15	-0.0248776	15	-0.016059	1981	
18	-0.0513564	16	-0.1330406	4	-0.246793
1977		18	-0.131704	6	-0.480585
2	-0.0196159			7	-0.235725
7	0.0378211			11	-0.304864
12	0.0822328			12	-0.1547753
				17	-0.308349
				19	-0.378208

APPENDIX - V.a(vi)

Z-Score of the Units in 'Good' and 'Sick' Groups (Secondary Sample) on the Basis of the Discriminant Function of the '6th Set of Ratios'.

GOOD UNITS				SICK UNITS	
CO CODE	Z-Scores	CO CODE	Z-Scores	CO CODE	Z-Scores
1974				1975	
2	0.5803862	14	0.3049247	9	0.00165019
3	0.8270644	15	0.256479	1976	
6	0.3253319	1978		9	0.0011781
12	0.3910213	2	0.4027914	1978	
14	0.5113471	7	0.2581351	5	0.0237132
15	0.4169969	14	0.2811628	9	0.0051423
18	0.8208279	15	0.2512868	1979	
1975		18	0.4670317	6	0.184493
2	0.4560952	1979		9	0.0544478
12	0.4103319	2	0.4064433	1980	
14	0.3681546	14	0.2668371	1	0.0833719
15	0.3821906	18	0.4305782	4	0.133428
16	0.2861751	1980		6	0.0801153
18	0.3767403	2	0.4261736	11	0.1011866
1976		16	0.2571364	12	0.1572724
12	0.4236566	1981		17	0.2017244
14	0.347854	2	0.4489738	19	0.1806615
15	0.2968145	15	0.2487788	1981	
18	0.2981006	16	0.2573758	4	0.2060715
1977		18	0.4262025	6	0.0439864
2	0.3827795			7	0.11551
7	0.3050864			11	0.0878424
12	0.4978807			12	0.1800463
				17	0.0687931
				19	0.0796006

APPENDIX - V.a(vii)

Z-Scores of the Units in 'Good' and 'Sick' Groups (Secondary Sample) on the Basis of the Discriminant Function of the '7th Set of Ratios'

GOOD UNITS				SICK UNITS	
CO CODE	Z-Scores	CO CODE	Z-Scores	CO CODE	Z-Scores
1974				1975	
2	0.2093255	14	-0.0160975	9	-0.2552149
3	0.3945787	15	-0.1503995	1976	
6	0.0332651	1978		9	-0.1337727
12	0.0475507	2	0.0906737	1978	
14	0.1135535	7	-0.0783274	5	-0.1904831
15	0.0245008	14	-0.0509753	9	-0.2396052
18	0.3380746	15	-0.1327724	1979	
1975		18	0.1166873	6	-0.1005545
2	0.1587525	1979		9	-0.169331
12	0.0643254	2	0.0934038	1980	
14	0.0010072	14	-0.0591395	1	-0.1778366
15	0.0069404	18	0.0503673	4	-0.0663528
16	0.0254444	1980		6	-0.2062165
18	0.0502311	2	0.1139231	11	-0.1782156
1976		16	-0.055401	12	-0.0708182
12	0.0777013	1981		17	-0.1745431
14	0.0010903	2	0.1302	19	-0.1234143
15	-0.1238641	15	-0.067996	1981	
18	-0.0080699	16	-0.0791547	4	-0.181047
1977		18	0.1009325	6	-0.2417229
2	0.0882787			7	-0.1942352
7	-0.0138705			11	-0.1961419
12	0.1605362			12	-0.0848944
				17	-0.180391
				19	-0.2126492

APPENDIX - V.b

Z-SCORE OF THE 'SEMI-GOOD/SEMI-SICK' UNITS ON THE BASIS OF THE FUNCTION OF '1ST SET OF RATIOS' (SECONDARY SAMPLE)

CO. CODE	Z-Score	CO. CODE	Z-Score	CO. CODE	Z-Score
1974		1976		1979	
1	0.0755411	10	0.0690057	1	0.0476189
4	0.1179166	11	0.2423574	3	0.0055096
5	0.1383033	13	0.0705824	4	-0.043159
7	0.0592437	16	0.13793	7	-0.042372
8	0.0000108	17	0.1069214	8	0.0494355
9	0.0232459	19	0.0121109	10	-0.323968
10	0.1206533	1977			
11	0.1079031	1	0.0612242	11	-0.016853
13	0.0558635	3	0.1481208	12	0.0092875
16	0.1613107	4	0.0890306	13	0.038839
17	0.0650286	5	0.0450448	15	0.0775924
19	0.1283225	6	0.0631787	16	0.0685849
1975		8	0.1103477	17	-0.03241
1	0.0303321	9	0.0900343	19	0.0350133
3	0.0745435	10	0.081631	1980	
4	0.0444558	11	0.2670928	3	-0.008567
5	0.0254242	13	0.0954713	7	-0.118416
6	0.0026583	16	0.1053928	8	-0.026375
7	0.0459347	17	0.0686259	10	-0.688062
8	0.0809457	18	0.0943889	13	-0.024705
10	0.0357202	19	0.0452059	14	-0.025117
11	0.0618474			15	0.0564859
13	0.0042912			18	-0.011811
17	0.0339964			1981	
19	0.0508584			1	-0.003668
				3	-0.017611
				8	-0.0836691
				10	-0.720129
				13	0.0160579
				14	0.0553312

APPENDIX - V.b (Contd..)

CO. CODE	Z-Score	CO. CODE	Z-Score	CO. CODE	Z-Score
1976		1978			
1	0.0713201	1	-0.020276		
2	0.1073141	3	0.0843076		
3	0.17344	4	-0.034514		
4	0.1096649	6	-0.036612		
5	0.0264085	8	0.0545401		
6	0.0761623	10	-0.219307		
7	0.0728962	11	0.0261877		
8	0.0999314	12	-0.144989		
		13	0.0178693		
		16	0.0872224		
		17	-0.033496		
		19	-0.023299		

* * *