C H A P T E R - IV

RELEVANCE OF THE FINDINGS OF PRESENT STUDY

Over the past years, a number of empirical studies have been undertaken to examine the relationship between the financial ratios and a firms' state of health, its chance of survival and/or failure. Several attempts have been made to search the financial ratios with a view to show which one or which set of them really reflects better the financial health of a firm. Researchers have applied sophisticated statistical and mathematical techniques to ratio analysis and tried to predict certain economic and financial events. But the results of those studies could not be compared with each other because "the time periods, predictors and the data sets are different"[1].

Again, "there is no way one can completely order the predictive power of a set of models used for predictive (decision) purpose. As a minimum, this requires a complete specification of the decision problem, including a preference structure defined over the appropriate state-space. Previous work in the area of bankruptcy prediction has generally been based on two highly specific and restrictive assumptions when predictive performance is evaluated. First, a (mis)classification matrix is assumed to be an adequate partition of the pay off structure. Second, the

two types of classification error have an additive property and the "best" model is one which minimise the sums of percentage errors. Both of these assumptions are arbitrary, although it must be admitted that the first assumption is of some value if one is to describe at least one implication of using a model"[2].

In this section, our study would attempt to focus on above (mis)classification description and also on the assumption (i.e. the additive property of the two types of classification errors) as it would help to ascertain as to what extent the results of the models of other researchers conform to our study.

Univariate models and our study

In an univariate setting, Beaver[3], Belkaoui[4], Gupta[5] studied and tested the power of individual financial ratios and attempted to search out the ratio/ratios which would discriminate better between the different degrees of financial health of firms. Beaver, in predicting the two events like, failure and non-failure, showed that the failure of an enterprise could be forewarned reliably through combined utilisation of quantitative technique and financial ratio analysis; and observed that the ratio 'Cash Flow to Total Debts' misclassified only 13, 21,23,24 and 22 percent of the sample units for the one, two, three, four and five years before bankruptcy, respectively. Belkaoui, in predicting two events like, take-over and non take-over, observed that the performance of the non-liquid-asset ratios were better than the 'liquid-asset' ratios; the predictive power of the 'non-liquid-asset' ratios

was more striking in the short-term period and amongst the 'liquid-asset' ratios, the performance of the 'Working Capital to Total Assets' ratio was better. Belkaoui, did not clearly stated the classification rate of his univariate analysis. Gupta in predicting two events like, the 'sick' and the 'non-sick' in Indian context, reported that the two ratios, namely, EBDIT/Sales (net of excise) and OCF/Sales (net of excise) were the best and were of about equal merits amongst the ratios (56 in number) under his study. Gupta's mis-classification rate was '3 to 10' percent for '1 to 2 ' years, and '11 to 16' percent for '3 to 4' years prior to bankruptcy. The performance of our model, though tested in multivariate-setting in predicting the two events like, the 'good' and the 'sick', was better than the performances reported by these researchers (vide, Table - IV.1). Moreover, the performance of our model, in predicting three events like, the 'good', the 'semi-good/semi-sick', and the 'sick' financial health, was slightly lower than the performances of the models suggested by Beaver and Gupta (Table - IV.1).

Table - IV.1

Accuracy rates (%) of our model and Univariate models

Models suggested by	Accuracy of the models (%)				
	Years prior to the event				
	1	2	3	4	5
W.H. Beaver	87	79	77	76	78
L.C. Gupta	(97 to 90)		(89 to 84)		-
A. Belkaoui	Not available.				
Our study					
(i) Two degree Situation	100				
(ii) Three-degree Situation	81.82				

It is to be noted that the ratio 'Cash flow to Debts' suggested by Beaver[6] as the 'best' was ranked 6th in our study; and the ratio 'EBDIT/Total Assets + Accumulated Depreciation' and 'OCF/Total Assets + Accumulated Dep.' suggested by Gupta[7] as the 'best amongst the return on investment measures' was ranked 4th and second best amongst the 'set of ratios' selected as 'best', in our study.

Multivariate Models and our study

i) In multivariate setting, Meyer & Piffer[8] attempted to present a model for predicting bank failures using the Multiple Regression Analysis technique, and Chesser[9], in predicting two events like, acceptable and un-acceptable risk of commercial loan customers to comply with their loan agreement, used a mathematical technique based on the theories of probability. Meyer & Piffer reported that their model correctly classified 80 percent and 72 percent of the sample units for one year and two year prior to failure, respectively. Chesser reported that his model correctly classified 76 percent and 57.14 percent of the units in the initial sample for one and two year prior to the event, respectively; and 75 percent of the units in the secondary sample for one year prior to the event.

Model used in our study is neither the Multiple Regression Analysis nor the mathematical technique of probability, however, it outperformed the performance of both the models of Meyer & Piffer and Chesser; even the performance of our model in classifying the units of the secondary sample into two groups, was better than the performance of Chesser's model in classifying the secondary sample units (Table - IV.2)

Table - IV.2

Accuracy Rates of the Models (%) (Multiple Regression Analysis and Probability Analysis)

Model suggested by	Accuracy of the Model (%) prior to the event		
	Initial sample		Secondary Sample
	1-year	2-year	
Meyer and Piffer	80	72	-
Chesser	76	57.14	75
Our Study			
i) Two Degree Situation	100		96.43
ii) Three Degree Situation	81.82		63.27

ii) Again, in the multivariate setting of the financial ratios, the techniques of Maximum Likelihood Estimation were used by James Ohlson[10], Ingram & Frazier[11], Gentry et al[12] and Casey et al[13]. Ohlson used conditional logit method in predicting two events like bankruptcy and non-bankruptcy, and reported that his probabilistic model correctly classified 96.12 percent, 95.55 percent and 92.84 percent of the sample firms for the bankruptcy within one-year, two-year and 'one or two year', respectively. Besides, Ingram,&Frazier, Gentry et al and Casey et al used both the probit and the logit methods

of analysis (Casey et al used only probit method) and also studied the performance of the Multiple discriminant Analysis in that context. Ingram & Frazier reported that the performance of all the models employed by them were significant at .01 level of accuracy and the "logit model's classification accuracy was slightly higher than that of the probit model and both utperformed the MDA but only marginally"[14]. Gentry et al reported that their logit model classified 77 to 83 percent of the companies correctly and "the mis-classified logit results were similar to the probit and MDA results"[15]. Gentry et al, stated further that their model when applied to classify only the companies rated as financially weak, correctly classified 70 to 78 percent of the units in the initial sample; and 74 to 70 percent of the units in the secondary sample. Casey et al, reported that their 'probit' model was able to classify correctly 69% and 59% of the firms in the 'estimation' sample and 'validation' sample, respectively; and their model using discriminant analysis had "slightly higher classification accuracy"[16].

Our study, unlike the above studies, used only the discriminant analysis (linear form). The performance of our model was similar to the results stated by Ingram and Frazier; and slightly higher than that of Ohlson's model. However, the results of our model outperformed the results of the models suggested by Gentry et al and Casey et al, in all the sample cases (Table - IV.3).

Table - IV.3

Accuracy rates (%) of the Models (Maximum Likelihood Estimation).

Models suggested by	Accuracy of the Models (%) for the	
	Initial Sample	Secondary Sample
Ohlson	96.12 for 1-year data 95.55 for 2-year data 92.84 for '1 or 2'-year data	-
Ingram and Frazier	99.0	-
Gentry et al (i) 'Failure'	77 to 83	-
(ii) Financially Weak companies	70 to 78	74 to 70
Casey et al	69.4	58.5
Our Study		
(i) Two-degree Situation	100	96.43
(ii) Three-year Situation	81.82	63.27
(iii) Only 'Sick' units	100	100

iii) In the multivariate setting of the financial ratios, the Multiple Discriminant Analysis technique was also used by a number of researchers like, Altman[17], Ewert[18], Blum[19],

Edmister[20], Deakin[21], Belkaoui[22], Kaveri[23], Taffler[24], Ooghe & Verbaere[25], Casey et al[26] and Houghton and Woodliff[27]. Most of these researchers have chosen two events (like, bankrupt - non-bakrupt, failure - non-failure, repayment - non-repayment of loans, take overs - non-take overs, good-bad credit risks, 'success' - 'failure' of bankrupt firms that had reorganisation plans, etc.) for prediction except Kaveri who attempted to predict three events - good, irregular and sick accounts of Banks. Ewert, Edmister and Taffler reported that their models correctly classified 82 percent, 92 percent, and 97.8 percent of the units in the initial sample, respectively. Amongst these researchers, only Edmister tested his model on the secondary data sample and observed that his model correctly classified the 80 percent of the units in the secondary sample. The performances so reported were slightly lower than the performance of our model in classifying both the initial and secondary sample units. The performance of the Deakin's model was slightly lower than the performance of our model for both the initial and secondary sample units. The results of our model, both for the initial and secondary sample, (in two-degree-situation) totally outperformed the results of the models of Casey et al and Houghton and Woodliff (for both the 'success' and 'failure' cases); but the results of our model in a 'three-degree' situation were similar to that of the results reported by Casey et al and Houghton and Woodliff. The performances of the models of Altman,

Blum, and Ooghee & Verbaere, prior to the events, for (i) the one year, ranged between 95 to 89 percent, (ii) the two year, ranged between 80 to 72 percent, (iii) the three year, ranged between 72.4 to 48 percent, (iv) the four year, ranged between 75.6 to 29 percent; and for the Altman's model only 36 percent for the five-year prior to the events. Amongst these researchers, Altman only tested his model on the secondary data sample and observed that his model correctly classified[29] 83.5 percent of the units for one year prior to the bankruptcy. The performances of the models suggested by Kaveri and Belkaoui were slightly lower than the models stated above (i.e., studies based on the Multiple Discriminant Analysis) including the performance of the model of the present study. The model developed in this study maintained 100 percent accuracy for the initial sample and 96.43 percent accuracy for the secondary (i.e. validation) sample when examined in a 'two-degree situation (i.e. the 'good' and the 'sick' groups only). This model maintained 81.82 percent accuracy for the initial sample and 63.27 percent accuracy for the secondary sample when examined in a 'three-degree' situation (i.e. the 'good', the 'semi-good/semi-sick', and the 'sick' groups). The decrease in accuracy rate in the case of secondary sample was also witnessed by almost all the previous researchers. The table (Table - IV.4) below depicts the position.

Table - IV.4

Accuracy rates (%) of the Models (Discriminant Analysis)

Models suggested by	Accuracy of the Models (%), years prior to the event				
	1-year	2-year	3-year	4-year	5-year
Altman	95 (79)	72	48	29	36
Ewert	82				
Blum	93	80	70		
Edmister	92 (80)				
Deakin	97 (78)	95.5 (94)	96 (88)	79 (77)	83 (85)
Belkaoui	72 (70)	80 (76)	84 (85)	78 (76)	80 (75)
Kaveri	76.0 (69)	69.4 (67.4)	66.7 (69.5)	60.86 (67.3)	65.0 (62.0)
Taffler	97.8				
Ooghe and Varbaere	89.0	78.0	72.4	75.6	
Casey et al	72.6 to 80.5 (61)				
Houghton and Woodliff	80.56 (66.67) - for 'Success' cases 83.33 (58.33) - for 'Failure' cases				
Our study					
i) Two-degree-situation	100(96.43)				
ii) Three-degree situation	81.82 (63.27)				

NOTE : The results of the secondary sample are shown in the 'brackets'.

A close examination of the classification accuracy of (our) discriminant function (Descriptive function) derived on the basis of the '1st Set of ratios' revealed that the rate of accuracy considerably decreased when the model was examined in a 'three-degree' situation to classify the sample units i.e. the performance of the model by extending the predictable degrees of financial health from 'two-degree' situation to a 'three-degree' situation (Vide Table - III·15. and Table - III·23&25). On the basis of both the 'initial' and 'optimum' cut-off points, the function was unable to classify the units under the 'semi-good/semi-sick' group with high degree of accuracy. It could also be observed that the 'Z-Scores' of the misclassified 'semi-good/semi-sick' units were more close to the 'Z-Scores' of the units in the 'good' group than the 'sick' group. In the 'initial' sample, amongst the misclassified 'semi-good/semi-sick' units, the units (mis) identified as 'good' (82.61 percent) were more than those as 'sick' (17.39 percent) ones (Vide Table - III·15). Similar results were observed when the function was tested on the 'secondary' data sample; amongst the misclassified units of the 'semi-good/semi-sick' group, the units identified/classified as 'good' were 87.23 percent and as 'sick' were 12.77 percent (Vide Table - III·15). The reasons for such performance were:

(i) the financial characteristics (reflected by the financial ratios) of the 'semi-good/semi-sick' units were not taken at the time of : (a) selecting the 'monitoring' ratios, (b) selecting the ratios to form small 'sets' and (c) computing the discriminant functions;

(ii) the relatively lower effectiveness of the 'reduced' functions;

(iii) the overlaps between the financial characteristics of the 'good', the 'sick' and the 'semi-good/semi-sick' units were not sufficiently covered and reflected by the definitional parameters (the positive and negative values of OCF, NW and WC); and

(iv) the difference between the average magnitudes of the financial ratios of the 'good'/the 'sick' units and the 'semi-good/semi-sick' units were lower than that between the 'good' units and the 'sick' units (Vide **Annexure**-VI).

Thus, it could be stressed that, in the light of the results reported by the researchers (as far as available and discussed above) the classification accuracy of the discriminant function based on the '1st set of ratios' containing R-12 (OCF/Total Debts), R-18 [(Retained Profit + Depreciation Charge)/Total Debts], R-19 [(Retained Profit + Depreciation Charge)/(Tangible Assets + Accumulated Depreciation)], and R-24 (Net Worth/Total Debts) was highly satisfactory in classifying the different degrees of corporate financial health of the Tea units, considering at least 'two-degrees' of financial health. Furthermore, in a 'three-degrees of financial health' situation, this '1st set of ratios' could also be used satisfactorily for the same purpose, at least in Tea units.

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NOTES AND REFERENCES

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28. Out of 25 bankrupt firms 24 correctly classified and out of 66 non-bankrupt firms 52 correctly classified.

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