

PREDICTING BANK LOAN DEFAULTS: STATISTICAL VERSUS BANK LOAN OFFICERS' EVALUATION

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This empirical study compares various ways of forecasting company failure. Multiple discriminant analysis (MDA) was used to come up with a mathematical model using financial accounting ratios as variables to predict business firms' capability to repay loans, thus classifying firms as "non-failing" and "failing". Four ratios were identified as good discriminators between would-be failures and non-failures. These ratios, plus the current ratio, were used by bank loan officers in the Philippines and the United States for application in their financial evaluations. The study came up with interesting results in the performance of the MDA model and the loan officers in failure prediction.

The overall predictive ability of the MDA model was higher than that of the loan officers. In particular, the MDA model fared better in predicting the failing firms. There is a basic agreement between the Filipino and U.S. leading officers except that the Filipino officers were slightly more accurate in predicting failing firms than their American counterparts. Experience during the early 1980's made the Filipino loan officers more sensitive to this issue.

When loan officers consider prospective borrowers, one invariable question they would ask themselves would be the credit-worthiness of the client. Translated into operational terms, it means ascertaining the viability of the company or the probability of financial failure. If the possibility of financial failure exists, credit would normally be denied. Hence, it is useful to know some techniques for predicting impending failure in business. Financial failure is here defined as the inability of a firm to pay its principal and/or interest obligations for a prolonged period of time.

An earlier study¹ looked for accounting ratios which could serve as predictors of company failure. Multiple Discriminant Analysis (MDA) was used to come up with a mathematical model using accounting ratios as variables to predict company failure. Discriminant analysis is a statistical technique used to segregate two or more

mutually exclusive groups based on some characteristics. For instance, Filipinos and Americans can be separated by their dissimilar characteristics. Business firms can likewise be classified as failing and non-failing on the basis of a set of characteristics manifested in their financial accounting ratios. If these ratios can be found to accurately discriminate or classify firms as failing or non-failing, these same variables can be used to assess firms not yet classified but with established characteristics. The degree of success in predicting failure is measured by the percentage of correct prediction. This is done by selecting a group of firms which *a priori* are known to have failed and another group composed of non-failing firms. The model with the highest prediction accuracy is considered the "best" model.

The firms chosen to develop the model were 52 Philippine manufacturing firms belonging to 13 industries. One half was classified as "company failures" or firms considered "distressed" by their creditors due to nonpayment of loans for prolonged periods. These were paired with an equal number of non-failing firms belonging to the same industry. Their audited financial statements for five years prior to failure were compiled and selected ratios were computed from which the MDA model was developed. The following ratios were selected by the MDA model to be good discriminators

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¹Lina J. Valcarcel, "An Empirical Study on the Ability of Accounting Ratios to Predict Failure of Philippine Business Firms," *Accountants' Journal* 34 (1984): 3 - 14.

between failing and non-failing firms: Total Liabilities/Total Assets (TL/TA), Cash Flow/Total Liabilities (CF/TL), Net Income/Total Liabilities (NI/TL), and Sales/Total Assets (S/TA).

These ratios with the addition of Current Assets/Current Liabilities (CA/CL) ratio, better known as the current ratio, were used to observe the perception of bank loan officers and to see how their perception compares with the mathematical model in successfully predicting company failure. The current ratio was added not because of its ability to predict company failure since a number of studies have shown otherwise but because of the common perception that it is a good predictor of failure.

The study therefore looks at the performance of loan officers in predicting failure. If loan officers can predict company failure better than the mathematical model or even just as well, then there is no reason to spend time and money in designing such models. However, if it can be shown that these models are better predictors, then they can aid financial analysts in improving their judgment and their construction is justifiable.

At the same time, the study would like to compare the profile and performance of loan officers belonging to different cultures and environment to see whether these differences would affect their perceptions regarding financial information made available to them. If their predictions differ significantly then we might say, subject to further validation, that the information contained in financial statements conveys different messages to different groups of people, in which case, it is important to know how these messages are perceived. Modifications might have to be made by information providers like accountants, to adjust to the differences in perception of information receivers. For this reason, a study of the kind undertaken here is deemed important.

Finally, the study compares the prediction accuracy of individual loan officers with their consensus judgment. This is of interest because decisions on whether to grant loans to borrowers are sometimes decided by committees. If individuals deciding singly perform just as well or even better than a group, then there is no need to convene a committee, a process which is more time-consuming and relatively more expensive.

THE STUDY

The present study looks at some behavior and practices of bank loan officers not only in the Philippines but

also across the continent. It also compares the predictive ability of these two groups of loan officers and their predictive ability as a group (based on their subjective judgment) with that of multiple discriminant analysis (based on an objective, mathematical model). Finally, it compares the performance of individual loan officers vis-a-vis their consensus judgment. Some of the specific issues addressed in this study are:

- *the ability of two groups of loan officers to predict company failure using specific accounting ratios*
- *a comparison of the performance of loan officers and the MDA model in predicting company failure*
- *the similarities and differences between loan officers of two different cultures*
- *a comparison between the individual performance of loan officers and their consensus judgement.*

This study borrowed heavily from a similar research made by Libby² in terms of methodology but different variables were used. Libby conducted a behavioral field study on financial ratios as predictors of company failure. He wanted to evaluate the predictive power of ratio information and the ability of loan officers to evaluate that information in the business failure prediction context. Loan officers were provided with financial ratios of bankrupt and non-bankrupt firms and were asked to classify the firms under those two groups. The usefulness of ratio information was measured in terms of the accuracy of the loan officers' prediction. He concluded that financial analysts can use financial ratio data to develop fairly accurate predictions³ of bankruptcy. A similar study was made by Zimmer³ covering Australian loan officers and he came up with fairly similar findings.

In this study, a group of 26 manufacturing companies operating in the Philippines, previously identified as failing, and an equal number of non-failing firms were chosen as subjects. These were the same firms used in developing the multiple discriminant model mentioned previously. The firms identified as failing were those which

²R. Libby, "Accounting Ratios and the Prediction of Failure: Some Behavioural Evidences," *Journal of Accounting Research* (Spring 1975): 150-161.

³Ian and Zimmer, "A Lens Study of the Prediction of Corporate Failure by Bank Loan Officers," *Journal of Accounting Research* (Autumn 1980): 629-636.

Table 1. AVERAGE CORRECT PREDICTIONS
Percentage of Firms Correctly Classified

Firms	MDA Model	Loan Officers	
		Filipinos	Americans
Non-failing	80.00	85.42	85.77
Failing	86.96	41.88	35.77
Total	83.33	63.65	61.54

defaulted on their principal and/or interest payments for fairly long periods of time and were thus considered as financially distressed by their bank and non-bank creditors. While financial difficulties may be temporary in nature and may not be considered as business failures in the strict sense of the word, their choice as subjects for this study is considered appropriate. First of all, it is quite difficult, with our present legal system, to identify bankrupt firms since most firms stop short of filing bankruptcy proceedings. Some go into receivership while others resort to selling out as when they are taken over by other companies. Creditors are not really that interested in legal niceties when deciding whether to extend credit or not. They are more concerned about the reality of a firm's ability or inability to repay their loans. Secondly, distressed firms may still be rehabilitated. If the characteristics of these firms can be identified and used in a failure prediction model, then such a model can be used for firms in similar situations and major bankruptcies could be prevented if identified early enough and rehabilitated on time. Thus, company failure is defined in this study as those firms considered financially distressed by their creditors due to prolonged nonpayment of their loans.

Five consecutive years of selected financial ratios derived from the audited financial statements of each of the 52 firms were sent to participating loan officers who were asked to evaluate the firms and predict which ones would fail and which would not fail within a year after the fifth year. Information on the location of the firms was withheld from them. The study was conducted in 1987 in the U.S. and in 1988 in the Philippines. Thirty bank loan officers in Pittsburgh, Pennsylvania, U.S.A. and 38 bank loan officers in Manila participated in the study. The results of the survey, tabulated and compared with the results obtained in the MDA model, as shown in Table 1.

Table 1 shows that in terms of overall prediction accuracy, the Filipinos performed slightly better because they were able to predict more accurately the failing firms. Both groups did better than the MDA in predicting non-failing firms, enjoying practically the same rate of accuracy (85 percent) but more errors were made in predicting business failures. This is important to note since this result is contrary to the outcome of the mathematical model which showed a higher prediction accuracy for failing firms.

Loan officers as a whole, however, performed poorly in comparison with the MDA model which predicted correctly 83 percent of the firms while they rated 64 percent and 62 percent. This is already an indication that mathematical models can greatly aid decision makers in predicting business failure instead of relying solely on people's perception.

The correct prediction of Filipinos ranged from 54 percent to 71 percent whereas the Americans' prediction accuracy ranged from 46 percent to 73 percent.

In terms of individual performance, all but one Filipino and one American had an overall prediction accuracy at a rate higher than 50 percent, again, with a better performance in the prediction of non-failure. Only one Filipino among all the respondents predicted non-failure lower than chance, whereas only nine Filipinos out of 38 and three Americans out of 30 predicted failure correctly higher than chance, showing a marked contrast in prediction accuracy between non-failing and failing firms (refer to Tables 2 and 3).

How did individual loan officers perform vis-a-vis consensus judgment? Consensus judgment was constituted by each loan officer acting as a member of a panel which responded to each firm on the basis of a majority

Table 2. SUMMARY OF PREDICTION RESULTS

Number of Correct Predictions	Number of Respondents			
	Filipinos		Americans	
	Non-Fail	Fail	Non-Fail	Fail
21 - 26	28	1	23	-
15 - 20	9	4	7	2
9 - 14	1	21	-	14
Below 9	-	12	-	14
Total	38	38	30	30

Table 3. RANGE OF CORRECT PREDICTION
Number of Firms Correctly Classified

Firms	Loan Officers	
	Filipinos	Americans
Non-failing	11 - 26	15 - 26
Failing	5 - 22	5 - 17

vote. Using this rule, the consensus judgment for the Filipino group was 34 and 33 (out of 52) for the American group although it must be mentioned that this poor performance is due to the high rate of error in predicting failing firms, because the consensus judgment on non-failing firms is extremely high (96 percent for both groups). The consensus judgment, however, is still slightly better than the mean scores of the individual loan officers which were 33 and 32, respectively. Still on consensus judgment, it is interesting to note that five of the 30 American respondents and five of the 38 Filipino respondents had perfect agreement on the non-failure of four firms and the failure of one.

PROFILE OF RESPONDENTS

Do the two groups of loan officers differ significantly? What are their similarities?

In terms of age, the Filipino respondents were younger. Twenty six (68 percent) of the Filipinos and 12 (40 percent) of the Americans were born in 1960 or even later.

As can be expected, the American respondents had higher educational attainment with 60 percent of them going beyond college as compared with only 29 percent of the Filipinos.

Most Filipinos were new in the job with 82 percent of them having worked as loan officers for four years or less as compared with 60 percent of the Americans. In fact, none of the Filipinos had been in the job for more than 15 years while 27 percent of the Americans had been in the job for 16 years or more.

Both groups considered themselves non-specialists, with a greater percentage of Filipinos in that category. On the whole, they were not risk-takers. Only three from each group considered themselves more risk-oriented.

There was no attempt to compare the assets of client firms because of the difference in money values.

However, it was evident that the average resources of American client firms were bigger than those of the Filipino firms. This, however, was not considered a limitation of the study.

Most of the respondents took between 30 - 60 minutes to answer the questionnaire. Some 76 percent of the Americans and 95 percent of the Filipinos answered the survey in an hour or less. The Americans were more optimistic in getting the right answers. Thirty two percent expected to get 42 to 52 correct answers while only 20 percent of the Filipinos expected to get 41 to 47 correct answers. In terms of actual performance, however, the Filipinos did better. In fact there was a negative correlation between accuracy and predicted correct responses for the American group indicating over-optimism by this group.

The loan officers were asked to rank the importance of the financial ratios in their evaluation. It is significant to note that both groups considered the TL/TA ratio to be the most important ratio. The Americans, however, gave it more weight, (60 percent versus 24 percent). The same ratio ranked highest among the predictors of the discriminant model. The CF/TL ratio was ranked second by the Americans and third by the Filipinos while the CA/CL ratio was ranked third by the Americans and second by the Filipinos. The CF/TL ratio was ranked third in importance by the MDA model while CA/CL was not at all considered important for this purpose. It is worth stressing that other studies have mentioned the insignificance of this ratio in predicting failure. However, it was a common perception among analysts (even in this study) that this ratio is important. S/TA was ranked fourth by the Americans with NI/TL considered as the least important while the Filipinos considered these two ratios of equal importance. The S/TA ratio was ranked second in importance by the MDA model while the NI/TL was considered the least important among the four. When asked what other ratios the analysts would consider in making the prediction, both groups rated Debt/Equity ratio as the most important. This is consistent with the finding about the TL/TA ratio since they are very much related to each other.

In terms of other information considered significant in evaluating the firms, both groups were in agreement that the type of business and industry was the most important. Both groups indicated that the inclusion of additional ratios and information would increase their prediction accuracy, but the study showed otherwise.

Finally, when asked whether they considered the work interesting, 84 percent of the Filipino respondents and 77 percent of the Americans found it so. All but one American found the instructions clear.

Accuracy of responses was correlated with some demographic variables. Only a few variables were found to be correlated with accuracy like clarity of instructions and interest in the work. In addition, expected correct answers and additional information did have a bearing on their final correct answers as far as the Americans were concerned, but in a negative way. The only possible explanation here is that the group was generally optimistic as shown by their high rate of correct prediction for non-failure and the high error in predicting failure. Also, the Americans performed worse than the Filipinos in predicting failure for the latter was more pessimistic in its judgment regarding company failure. The following variables were found to have no correlation with prediction accuracy:

- *age of respondent*
- *average assets of clients*
- *length of service*
- *educational attainment*
- *time in answering questionnaire*
- *degree of risk of respondent*
- *industry specialization*

CONCLUSION

This study looked at various issues. One of them was to observe some characteristics of loan officers across cultures in evaluating business firms. The results showed that while Filipino and American loan officers differed in age, education and work experience, their perceptions about non-failure of business firms do not differ significantly although the Filipinos were more pessimistic in their perception of failing firms resulting in higher prediction accuracy in this bracket. It could be that experience during this decade regarding firm failure made the Filipino loan officers more sensitive to this issue. The significance of the difference, however, disappears at the one percent significance level, which shows that the variation is not that much. Both groups predicted more accurately and equally well the non-failing firms. But they were inferior in performance when compared with the results of multiple discriminant analysis.

In general the Filipino respondents did slightly better than their American counterparts even though they were younger, had lower educational attainment, had less experience and exposure in their field. This is not surprising since this study showed that the above variables were not correlated with accuracy of failure prediction. However, their perceptions tended to be convergent.

The consensus judgment of the groups of loan officers was almost identical in terms of overall perfor-

mance, which judgment did not differ significantly from their individual judgments. However, considering that the consensus judgment about non-failing firms was extremely high, there is justification for meeting as a group in deciding about the failure or non-failure of firms prior to granting loans.

With regard to financial indicators deemed important, both groups considered TL/TA as the most important predictor of company failure which is consistent with the result of the MDA model. This is worth noting because an examination of failing firms showed that their TL/TA ratio differed significantly from that of non-failing firms. This can be explained by the fact that in times of tight money supply as we experienced in the early '80s, highly leveraged firms had greater difficulty surviving because of high interest rates. Both groups of loan officers were in near perfect agreement with respect to the importance of the other ratios.

The high level of agreement between the loan officers implies a relatively uniform interpretation of the accounting data over time and even across cultures. This means that the information contained in financial ratios are perceived in much the same way by them, regardless of cultural and environmental differences. This speaks well of the accountant as information provider and the financial analyst as information user. This could imply that accountants may not have to concern themselves with individual differences between credit analysts when providing them with financial information.

Another aspect worth investigating would be the importance given by loan officers to the current ratio, the value of which is being questioned by many researchers on failure prediction. There might be a need for decision makers to change their way of thinking regarding this ratio.

Last but not least, this study compared the failure prediction abilities of the multiple discriminant model and the loan officers. The study showed that the MDA model had a better performance on two counts. First, the overall predictive ability of the discriminant model was higher than the loan officers'. Secondly, the MDA predicted the failing firms better than the loan officers. This seems preferable because of the cost of misclassification. Misclassifying a firm as non-failing when in fact it is failing has more serious consequences than misclassifying a non-failing firm as failing. When a firm defaults on its loan, the loss is represented by the unpaid portion of the loan plus interest, without counting the cost related to collection efforts, whereas the cost of misclassifying a non-failing firm is limited to the opportunity cost of lost interest, which would not be much, consider-

ing the dearth of capital in the Philippines. This highlights the usefulness of mathematical models as an aid to decision making.

Since the results obtained by the MDA model differ from the loan officers' decision (Filipinos and Americans combined), statistical tests were conducted to validate the significance of differences obtained. Statistical tests were applied on the data as a whole as well as on disaggregated data.

First, the MDA model showed a better performance in predicting failing firms and the test showed that the difference was not merely due to chance but was statistically significant.

Conversely, the loan officers' prediction about non-failing firms was more accurate. The difference was also statistically significant. This was justified earlier as arising from their general bias regarding non-failure.

Finally, the MDA's total performance was compared with the loan officers' total performance. The MDA showed a better performance which was statistically significant. This brings out the superiority of mathematical models over people's judgment. Besides, the usefulness of mathematical models has been shown by many earlier studies like Altman's⁴ and Beaver's,⁵ to name a few.

The two ways of judging performance need not be at odds with each other. The mathematical model is there to help the decision maker. If a tool can be used to improve decision making, there is no reason for it to be rejected. This does not mean that people's judgments are to be ignored but rather they should be supported by decision rules derived objectively. The mathematical models can serve as a screening device for loan applications and as a supplement to human perception. In the final analysis it is the person who makes the decision but he can be greatly aided by the MDA in making such a decision.

While the results of this study do not claim general applicability, the exercise hopes to provide a basis for future research and to encourage future researchers.

⁴E. Altman, "The Prediction of Corporate Bankruptcy: A Discriminant Analysis," (Ph.D. dissertation, University of California, 1967).

⁵W. Beaver, "Financial Ratios as Predictors of Failure," *Empirical Research in Accounting: Selected Cases 1966*, *Journal of Accounting Research* Supplement to Vol. 4 (1966): 71 - 111.