

Master thesis:
Early prediction of bank failures in the Republic of Croatia
- Summary -

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Introduction_____

Total fiscal expenditure of bank failures in the Republic of Croatia in 1996 and 1998 were no less than 27% of Croatia's GDP. These are one of the most expensive bank crises in the history of bank failures in the world, when compared to the size of a nation's economy. Having this in mind, it is surprising that (prior to this work) only one research in this field has been done in Croatia.

History_____

Although the quest for finding the best ratios and the best model for predicting business failure has begun in the early XIX century (A. Wall, 1919), first credible scientific work was made in the 1945 (C. Merwin), and after that in 1966 (W. Beaver).

Only two years after Beaver, E. Altman published his Z-score model - the turning point and maybe the most significant milestone in this field.

When examining predicting failures of banks as specific economic subjects, we find the origins in the 1920's USA (Sprague, 1927; Spahr, 1932). Modern history begins with Meyer and Pifer in 1970, and especially Sinkey (1975, 1978), who used Altman's methodology.

Present-day econometric models of predicting business failure apply wide array of complex methods, from theories of chaos to often-used neural networks. This work will mention R. Ohlson and Mar-Molinero, as they used logit model and multidimensional scaling method - both methods that were applied in this paper as well.

Research_____

The goal of this research is to try to determine which variables (ratios) could serve best for predicting which banks will go bankrupt or will undergo the government's process of rehabilitation up to 6 years after 1995¹.

It is based on the data in the report named "Analysis of the financial condition and the result of the functioning of Croatian banks in 1995", a report that was made in 1996 by Croatian National Bank (central bank in Croatia) for Croatian Parliament and Government (hereafter: Report).

This Report consists of the financial statements and additional accountancy data provided by banks themselves, and it contains data for all banks in Croatia - 54 of them in the 1995; a pool from which four banks were extracted for having specific irregularities in the data. The sample therefore contains of 50 banks, or 99,9% of total assets of the total of 54 banks. After creating 45 ratios from the Report, 12 of them were selected for the process of predicting bank failures.

Being in the process of transition, caring the legacy of communist concept of centrally governed bank system, and being in War at the time, the Government of

¹ In this paper the term 'failed bank' relates to a bank that filed for bankruptcy, or to a bank that underwent the government's process of rehabilitation.

Croatia restructured almost all large banks in Croatia (at the tax payers expense). This was necessary primarily for constituting a stable and trustworthy bank system.

One of the questions is, did the data in financial statements contain information about forthcoming failures, was the data credible, and if it was, which ratios constituted from the data could predict best the problems soon to come?

Methods

The methods used are: multiple discriminant analysis, logit model, and multidimensional scaling method.

Introduced by Altman and being a standard in the field, multiple discriminant analysis was the first method applied. The banks were a priori classified in one of two groups: with or without problems (the bank with problems being bankrupt or rehabilitated). Twenty banks were in the problem group, and thirty in non-problem group. Variables used for discrimination between groups were 12 ratios for each bank, computed from the Report.

Backward stepwise method was specified, meaning that we included all variables in the model and then, at each step, eliminated the variable that contributes least to the prediction of group membership. In the end, four variables were left in the model, and using them 80% of cases were correctly classified.

Type I error (65%) was significantly lower than the Type II error (90%), and the Wilks' Lambda is relatively average positioned and amounts 0,57. The most effective variable for classifying is receivables from potential liabilities, and risk-based capital.

R. Ohlson (1980.) stated certain remarks about discriminant analysis when used in predicting business failure. They were taken into consideration, and the logit model was used as well.

In the logit regression model, the predicted values for the dependent variable will never be less than (or equal to) 0, or greater than (or equal to) 1, regardless of the values of the independent variables. Explanation of the final result is, therefore, much more intuitive.

As well as in discriminant analysis, the same 12 variables (ratios) for 50 banks were used, and the same prior classification was carried out. Backward stepwise specification of the logit model was set up, and two variables (ratios) were left in the model (one of whom is consistent with discriminant analysis result ratios). Total accuracy is somewhat lower - 78%, or 2% less than discriminant analysis. The most contributing variable to the discrimination between groups is capital adequacy coefficient.

Multidimensional scaling method was used because it does not require prior classification. In other words - we do not need to know if certain bank had problems, or if it went bankrupt. In addition, results of multidimensional scaling method are multidimensional maps, and their interpretation is more intuitive and more easily perceptible to the human eye than a mere sequence of numbers.

Again, the same 12 variables for the same 50 banks were used, and after conducting Scree test five dimensions were set. Ten two-dimensional maps were drawn, four of which were relatively easy to interpret. After these maps were formed, lines were drawn to try to separate failed and non-failed banks.

Grouped like this, approx. 76% of banks was classified congruently with the prior classification at the discriminant analysis and the logit model. The cases whose

positions on the maps were determined to be in the opposite group were the same cases that were incorrectly classified in the discriminant analysis and the logit model.

Therefore, it was decided that the discriminant analysis and the logit model should be repeated, this time with prior classification done according to the positions that banks held on the multidimensional scaling method maps.

Both discriminant analysis and logit model were fed with the above-mentioned 12 variables (ratios), and the prior classification was done according to the multidimensional scaling method. Results were significantly better: discriminant analysis and logit model both produced 100% accuracy. Wilks' Lambda (0,20) of the discriminant analysis denoted statistically significant, high discriminatory power of the current model.

These results suggest that the reclassified groups are not fictitious considering financial data presented by the banks themselves for the Central bank.

Conclusion_____

Several possible conclusions can be made:

1. Information content of the ratios for certain banks is not completely trustworthy and credible. Particular banks have formed their financial statements with the sole purpose of making a positive - not realistic - image in the eye of the public.
2. Particular banks did not end up bankrupt or restructured, although their financial data suggested otherwise. Having this in mind, it is very likely that they avoided financial breakdown by some techniques of crisis management, or by other means.
3. Time horizon of this prediction is too distant for certain banks. In other words, financial statements from 1995. did not contain information about the upcoming bankruptcy after 2001.

Following these conclusions, banks did not group themselves in the multidimensional scaling maps according to our historical experience, but after the reclassification models produced 100% accurate classification.

In the end we can say that certain bank managements have taken too much liberty in forming financial statements, and the control mechanisms (commercial audit, internal control, Central bank control) have not functioned properly in the mid 1990s.

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