Credit Granting: A Comparative Analysis of Classification Procedures: Discussion

Robert A. Eisenbeis

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DISCUSSION

ROBERT A. EISENBEIS*: This tutorial paper examines the performance of six different classification techniques (linear and quadratic discriminant analysis, unordered logit analysis, goal programing, a recursive partitioning algorithm, and an analytic hierarchy process) as a tools in credit granting problems. The procedures are compared using data on loans extended by a nonfinancial corporation.

The first main section sets forth the authors' view of the credit granting process and the problem of setting credit limits. Following others, Kim and Srinivasan indicate that in extending credit, the objective should be to maximize the expected payoff from making a loan. That payoff depends not only on the returns from the loan under consideration but also all future credit extensions as well.[1] Formulated in this way, credit extension is a dynamic programing problem. However, as the authors point out it is essential intractable.[2] To circumvent this dead end, they collapse the problem, as others have done before them, into a single period problem where the period is the maturity of the loan, and the net future benefits from future transactions are ignored.[3] Given the purpose of the paper, the authors should have started with the single period model which would have simplified their discussion considerably. Their approach is further muddled by not providing a clear link between the structure of the single period credit granting problem presented in equation 2 and the problem of setting of credit limits described in equation 3.

Setting credit limits is irrelevant for certain types of loans but may be very important in providing trade credit (or in issuing credit cards to individuals or

* University of North Carolina at Chapel Hill

[1] See, for example, Mehta (1968, 1970), Bierman and Hausman (1970) and Dirickx and Wakeman (1976).

[2] Here the authors employ cumbersome and confusing notation, and the model they specify does not fully capture the payment performance over the life of the loan as compared with the value of future credit extensions.

[3] Even this formulation, however, does not recognize that different types of credit with different payment patterns may be requested (eg. single payment v revolving lines, personal v corporate, mortgage v credit card, short term working capital v long term borrowings, etc.), and that the expected probabilities of repayment may be functions of different characteristics of the firm for different types of credit.

to extensions under revolving credit arrangements). Here the lender commits to multiple extensions of credit to be taken down and repaid at the option of the borrower within contractually specified limits. The lender forgoes future credit investigations and possibly negotiations of other terms over the period of the agreement.[4] More discussion should be provided of why credit limits are useful for certain types of credit and how the tradeoffs are achieved between risk and return in such arrangements.

In sum, the authors embark on an elaborate but confusing and imprecise formulation of the credit granting problem. It does not reflect the variety of different types of credit being extended which may require different models, and more importantly, the models specified are not the ones estimated later in the empirical portion of the paper.

The second section illustrates both the difficulties of attempting to do too much in a tutorial paper and the problem of not precisely defining what will be assumed about the audience's understanding of both the credit granting problem and the statistical techniques being evaluated. In particular, the discussion of goal programing is too sketchy to enable unfamiliar readers to implement it. Similarly, the reader is directed to other work for discussions of discriminant analysis and logit analysis. On the other hand, the presentations of recursive partitioning and analytic hierarchy algorithms, while more detailed, are obtuse and full of undefined terms (such as nodes, terminal nodes, spanning trees and measures of impurity), which have little meaning to uninformed readers. The tutorial value of the presentation of the analytic hierarchy method, in particular, could be improved by embedding the discussion of its objectives and process in the credit granting problem rather than keeping the presentation in the abstract.[5] Overall, this section falls short in being a useful tutorial.

The third main section of the study reviews the performance of the alternative statistical techniques using data from the commercial credit experience of a particular company. There are several problems with this portion of the paper.

First, the data consist of lons that were actually granted and, on subsequent review by the lender, were perceived to be high risk. This latter review process is the focus of the empirical work which means that a loan performance/monitoring system is being estimated. Its objective is to replicate a loan officer's risk rating of loans, after they were granted and on the books. This differs substantially from the type of credit granting system described in the first section of the paper. While loan review is a legitimate objective, this portion of the paper does not draw on the modeling framework established in the first major section of the paper.[6]

[4] In the case of take downs under commercial lines of credit, it is common now for the rate to float over the term of the agreement. See Fischer (1982).

[5] It is not clear from the presentation that partitioning techniques are especially useful for behavioral studies where one usually wants to test hypotheses.

[6] This also raises the question of why the lender should be interested in replicating the loan officer's judgments instead of seeking to avoid making loans that turn out to be high risk loans? A related problem with replicating the loan officer's judgment in assessing the performance of statistical models is the problem of determining whether an error (misclassification) represents an error on the part of the statistical model or an error on the part of the loan officer.

A second problem is the use of a relatively small sample to draw inferences about the comparative performance of alternative statistical methods. A better procedure would employ Monte Carlo experiments drawing samples from known distributions and populations with known parameters. In the instant study, one can't tell whether the differences in performance are due to differences in the robustness of techniques when the underlying assumptions are violated or whether they are truly due to superior or inferior performance. An example is in the comparison of the linear and quadratic discriminant analysis results. The reader doesn't know whether the results follow from differences between quadratic and linear techniques when the dispersions are unequal, from differences in robustness when the underlying distributions of the variables are not normal or from a significant degrees of freedom problem for the quadratic results. Note too that the bootstrap classification results for these two techniques are within one standard deviation of each other, so we don't really know whether the results are significantly different or not.

In view of these problems and questions, this sample and approach is not the best to illustrate differences in particular techniques. What remains would be to use these examples to illustrate how the different methods enhance our understanding of the underlying finance or economics of the problem being studied. Unfortunately, this objective is dealt with least in this particular study.

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