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Impact of the Structure of Financial Markets on Rural Economic Development: An Empirical Test of a Decision-Making Approach

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Biographical Sketch

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Abstract

Proposed structural changes in banking institutions, i.e., deregulation and interstate branching, could have a potentially great impact on local economic development in rural communities. This paper attempts to identify these potential impacts by looking at the decision-making processes of unit bank presidents and branch bank presidents. The lexicographic ordering technique is contrasted with a Bernoullian approach to eliciting preference orderings of decisionmakers. The lexicographic ordering technique is used to determine differences in the goal hierarchies elicited from unit bank versus branch bank presidents. The technique is then analyzed to determine how well it describes actual portfolio behavior.

Although the importance of financial institutions in the functioning of the national economy is widely acknowledged, the role of these same institutions in the economic growth of rural communities has not been fully explored. Several studies have attempted to evaluate this crucial issue. Sullivan attempted to determine what effect commercial bank support of municipal bonds has had on rural development. His results were inconclusive as to any credit shortage facing rural governments. Shaffer identified the potential role of commercial banks in a community's economic development process. His study of Wisconsin banks concluded that banks play a crucial role in the economic future of communities, yet all too often fail to utilize community funds to create jobs and income for the community. The solution he sees is for commercial bank owners and managers to be more sensitive to community implications of their decision-making. This emphasis on decision-making has important bearing on the present analysis, as discussed later in the paper.

Even as the role of commercial banks in the process of rural economic growth is being analyzed, two major institutional changes in the banking industry are being discussed and implemented. The first major change comes with the Depository Institutions Deregulation and Monetary Control Act of 1980. This act eventually reduces the technical distinctions between commercial banks and nonbank thrift institutions. The changes mandated by the act are to be gradually phased in over a six year period. The second major potential change is the proposed reevaluation of the McFadden Act, passed in 1927, which prohibits interstate branching of commercial bank institutions. A change to enable interstate branching has a potentially great impact on the structure of financial markets in rural areas. According to Rhoades and Savage, such institutional changes will increase competition for small banks from increased

numbers of near substitutes, e.g., thrift institutions and from very large banks which could proliferate as a result of a move to allow interstate branching. Interest in potential changes in the bank market structure and the consequent impact on rural economic development motivates this study.

The purpose of this paper is to analyze any differences that may exist in bank decision-making based on whether the bank is classified as a unit bank or a branch bank.[1] The focus on an individual bank's decision-making is an attempt to identify important differences in the way in which banks view their role in a community's economic development process. Preference structures for alternative types of investments and bank operating objectives are elicited to provide a basis for the comparison of decision-making processes across banks in a lexicographic ordering framework. In addition, the analysis is framed in an expected utility context.

This study represents the first step in a more comprehensive investigation of the impact of changes in the structure of financial markets on rural economic development. As such, this paper also serves the purpose of testing the proposed technique for evaluating bank decision-making. The sample for this analysis, therefore, was purposefully chosen to include only one unit bank president and one branch bank president within a single rural community. While such a sample size prohibits any generalization of results, it does serve as an affordable means of testing a time-consuming, but potentially rewarding research technique for future analysis on larger, more representative samples.

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[1] In this study, branch banks include strictly branch banks and those banks that are members of multi-bank holding companies. Unit banks are independent banks, whose policies are established locally.

Eliciting Goals and Preferences

Two techniques were applied to identify the individual banker's preference orderings. First, each banker completed a lexicographic ordering of goals important to the overall operating plan of the bank. The application of this technique is based on the assumption that a banker has multiple goals and that a multiattribute utility function is the best representation of a banker's preferences. However, the lexicographic ordering provides only an approximation to a continuous utility function and should not be classified as a type of utility function. Halter and Dean and Lin, Dean, and Moore describe models which apply lexicographic ordering as representations of lexicographic utility functions. Roumasset notes that such terminology is conceptually incorrect and the lexicographic ordering applied here is not said to yield a utility function, but rather a preference structure underlying decision-making.

The lexicographic ordering technique assumes a set of goals which the decisionmaker can rank as to order of importance, $Z_1, Z_2, \ldots Z_n$, where Z_1 is more important than Z_2, etc. The decisionmaker is then asked to determine a satisfactory level of achievement, $Z_1^*, Z_2^*, \ldots Z_n^*$, for each of the goals in the hierarchy. The objective is to maximize the least important goal, Z_n, subject to achievement of the satisfactory levels of the more important goals, Z_1^*, $Z_2^*, \ldots Z_{n-1}^*$. If no feasible solution exists to this problem, then one formulates the alternative -- maximize Z_{n-1} subject to achievement of satisfactory levels of higher order goals. Several assumptions are implicit in this model. First, marginal utility associated with overachievement, i.e., $Z_i \geq Z_i^*$, is zero. Second, there can be no tradeoff between goals. One might argue that both assumptions are not met in realistic decision-making situations.

While there are problems with this technique, it has potential for accurately describing actual decision-making processes. In order to compare this approach with other representations of decision-making, direct elicitation of the banker's utility function of money by application of the modified VonNeuman-Morgenstern technique was attempted (Anderson, et. al). This technique involves presenting a decisionmaker with a series of seven 50/50 lotteries. A certainty equivalent for each lottery is determined, in turn. Arbitrary utility values are associated with the extreme outcomes of the initial lottery and, by application of the expected utility theorem, utility values are associated with the designated certainty equivalents. In this manner, the decisionmaker's expected utility function can be elicited. Such a technique is considered "a more rigorous and theoretically satisfactory formulation" than the lexicographic approach described above (Halter and Dean, p. 57).

The two techniques described above were applied to two rural bankers. Both bankers were able to easily rank the important goals in their overall operating plans and to attach satisfactory levels of achievement for each goal. Goal setting appeared to be an important part of their decision-making and, therefore, the lexicographic ordering technique accurately reflected actual decision processes. The goal rankings are described in the next section.

However, when confronted with the modified VonNeuman-Morgenstern technique, neither banker was able to consistently determine the certainty equivalent associated with a 50/50 lottery. Both bankers indicated that such hypothetical lotteries did not accurately reflect their decision-making. They were unable or unwilling to determine a certainty equivalent without more information, i.e., they indicated that factors other than expected return on investment entered into their decision-making as bank presidents. Such a response appears to

provide justification for considering a multiple objective approach to analyze bank decision-making. Although problems with the lexicographic ordering technique exist, it appears to more realistically portray actual decision processes of bankers interviewed in this study. Although the small sample size does not enable generalizations, one can hypothesize that similar results would be obtained from a larger sample of bankers. The observations from this study are consistent with those expressed by Roumasset in comparing the full-optimality (Bernoullian) approach with the behavioralist (lexicographic) approach to decision-making. Behavioral theory "seeks to build a theory of choice which has as its very foundations the process of decision-making," while the full-optimality model "ignores the process of decisionmaking" (Roumasset, p. 35).

In applying the lexicographic tecnhique, each bank president was asked to first list, then order the overall operating goals of her/his bank. In addition, a satisfactory level of achievement for each goal was specified. The unit bank president's goals and satisfactory levels, in decreasing order of importance, were:

Z_1 = Insure depositor's safety, i.e., maintain a loan-to-deposit ratio less than 75%;

Z_2 = Stimulate community growth, i.e., maintain a loan-to-deposit ratio greater than 65%;

Z_3 = Earn a reasonable return on assets, i.e., 1% or greater.

The branch bank president's goals and satisfactory levels were:

Z_1 = Earn a reasonable return on assets, i.e., 1% or greater;

Z_2 = Earn a reasonable return on equity, i.e., 15% or greater;

Z_3 = Achieve a reasonable long term growth rate in earnings, i.e., 10%, five-year compounded rate;

Z_4 = Stimulate community growth, i.e., achieve a loan-to-deposit ratio of 75-80%.

This technique enables comparison of the goal structure of the unit bank president relative to the branch bank president. One important difference is the unit bank's high priority on liquidity. The desired loan-to-deposit ratio (a measure of liquidity) for the unit bank had an upper bound of 75%, while this same ratio for the branch bank had an 80% upper bound. This may reflect the ability of a branch bank to rely on the larger corporate structure to help meet its financing needs. From an economic development perspective, this may indicate an increased ability on the part of branch banks to meet local loan demand if these goal structures are representative of the two populations. However, the unit banker placed the goal of stimulating community growth above that of achieving a given return on assets. It appears that the unit bank may perceive its role in the community as one of actively promoting economic development; yet its ability to do so may be limited by the financial constraints under which it operates. Differences in the goal hierarchies expressed by the bankers in this sample imply potential differences in economic impacts on the communities in which they operate. However, one must be cautious in drawing conclusions from such a small sample. Such potential differences will serve as the basis for future research.

Determination of Optimal Portfolios

Each president's ranking can be translated into a linear programming model (Halter and Dean). The least important goal is maximized, subject to achievement of the satisfactory levels specified for the more important goals.

The lexicographic ordering described above translates into the following maximization problem for the unit bank: max Z_3 subject to $Z_1 \leqq .75$, $Z_2 \geqq .65$, and $Z_i \geqq 0$. For the branch bank, the following maximization problem results: max Z_4 subject to $Z_1 \geqq .01$, $Z_2 \geqq .15$ $Z_3 \geqq .10$, and $Z_i \geqq 0$. The Z_3 goal, long run growth rate in earnings, presents a problem to the present analysis. This is a long run objective, but the analysis deals with only a single period. It does not seem realistic to assume that a 2% increase in earnings is achieved each period in order to meet the 5 year target rate of 10%. Therefore, this long run goal was not considered in the analysis. This suggests that future research might consider a multi-period rather than single-period model.

The full linear programming model for each type bank is summarized in Table 1. The major asset categories available to the banks were included as activities. In addition, two constraints were added to each model: the sum of the assets in each category could not exceed total assets and the sum of loans in each category could not exceed total loanable funds.

The data used in the analysis are from the 1981 financial statements of each bank.[2] Interest rates for 1981 are calculated by applying a simple linear trend to average annual interest rates for the period 1977-1980. Only these years were used in forecasting 1981 rates to avoid the underestimation likely to result from using information prior to 1977, when interest rates began to increase dramatically.

There was no feasible solution to the unit bank problem as originally formulated. Therefore, the least important goal was dropped and the problem was reformulated to: max Z_2 subject to $Z_1 \leqq .75$ and $Z_i \geqq 0$. The optimum activity

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[2] Noninterest income and expense figures for the branch bank are estimated from the 1981 consolidated financial statement of its parent company, a multi-bank holding company. Individual bank income data are not disclosed.

Table 1. Linear Programming Models for Unit and Branch Banks

Activities:

X_1=U.S. Securities	r_1=.139
X_2=Obligations of State/Political Subdivisions	r_2=.0901
X_3=Federal Funds Sold	r_3=.1619
X_4=Real Estate Loans	r_4=.1353
X_5=Commercial and Industrial Loans	r_5=.2528
X_6=Consumer Loans	r_6=.1591
X_7=Cash and due from banks	r_7=.0000

Unit Bank LP ($10 million):

$$\max .139X_1 + .0901X_2 + .1619X_3 + .1353X_4 + .2528X_5 + .1591X_6 + .0000X_7$$

subject to:

$$X_4 + X_5 + X_6 \leq 2.579$$

$$\frac{X_4 + X_5 + X_6}{3.965} \leq .75$$

$$-\frac{X_4 + X_5 + X_6}{3.965} \leq -.65$$

Branch Bank LP ($10 million):

$$\max \frac{X_4 + X_5 + X_6}{4.328}$$

subject to:

$$-(.027X_1 + .018X_2 + .032X_3 + .027X_4 + .050X_5 + .031X_6 + X_7) \leq -.01$$

$$X_4 + X_5 + X_6 \leq 3.275$$

$$X_1 + X_2 + X_3 + X_4 + X_5 + X_6 + X_7 \leq 5.094$$

$$\frac{-(.027X_1 + .018X_2 + .032X_3 + .027X_4 + .050X_5 + .031X_6 + X_7 + NI - B)}{.3310} \leq -.15$$

where B = expenses
NI = noninterest income

levels, as well as optimum value of the objective function are reported in the first column of Table 2. An optimum solution was achieved for the branch bank problem as initially formulated. These results are also presented in the first column of Table 2.

The results of the maximization problem determined by the lexicographic ordering of goals indicate an important failing of this technique. Since asset diversification was not an explicitly stated goal of either bank president, a diversification objective was not incorporated into the model. Yet observed behavior indicates diversification. Comparison of the optimum asset-loan mix with the actual 1981 portfolio selected shows that the model is a poor predictor of actual behavior. In particular, for both banks, the optimal solution had all loans placed in the commercial and industrial loan activity, which earned the highest return. In terms of observed behavior, however, both banks placed substantial amounts of loans in the other two categories as well. If diversification was in fact not a goal of the bank officers, then this may result from additional constraints not reflected in this model. The poor predictive performance does not imply that the lexicographic ordering technique is without value as an analytical tool. Rather, this test indicates that such a technique must be constructed to elicit both a lexicographic ordering of goals and the full set of constraints faced by the decisionmaker. The appropriate programming model is then completely specified by the subjective considerations of the decisionmaker.

In an attempt to incorporate additional constraints into the programming models, the branch bank was recontacted. Inquiries were made to determine operating "rules of thumb" which might be used to determine adequate levels of cash on hand, for example, as well as lack of flexibility in allocating assets

due to decisions in previous periods. There was an evident reluctance to divulge this information. It may be that such "rules of thumb" are not in fact used or that the bank does not wish such information to be known. In any event, comparison of 1980 with 1981 financial statements enabled some admittedly rough additional constraints to be added. They are as follows: $X_4 \geq .85$ (1980 level), $X_5 \geq$ 1980 level, $X_6 \geq$ 1980 level, and $X_7 \geq$ 1980 level. The first constraint requires real estate loans in 1981 to be greater than 85% of 1980 level. This constraint represents the expressed desire of the bankers to sell off their real estate loans in the secondary market. However, these can be sold off only at the rate the market will accept them. A 15% sell off rate is most likely a high estimate for any given year. The final three constraints require 1981 values for commercial and industrial loans, consumer loans, and cash to be greater than the 1980 levels. Again, this represents the stated policy of the bankers to emphasize high interest, short term loans over low interest, long term real estate loans. Cash requirements next year, one might hypothesize, should increase due to inflation and/or potential increases in bank deposits.

The addition of these constraints yields the results in Table 2, column 2. There is greater diversification among loans and some cash is now held to protect the bank's need for liquidity. However, the results still differ from the actual mix chosen (Table 2, column 3). Again, one must point out that without imposing the constraints which are perceived by the decisionmaker as being operative, the lexicographic ordering technique will not be able to accurately reflect the decision-making process of rural bankers.

Implications for Future Research

The lexicographic ordering technique was the most appropriate means of describing actual decision-making processes, as determined by the responses of

rural bankers to both the lexicographic and Bernoullian techniques. However, subsequent empirical application of the programming models determined by such an ordering of goals revealed several important, but by no means insurmountable, problems with the technique. First, elicitation of goal orderings and satisfactory levels of those goals is only one step toward modeling bankers' decision-making behavior. The relevant constraints as perceived and articulated by the decisionmaker must be elicited and incorporated into the model. In this way, one can maximize the least important goal in the decisionmaker's hierarchy, subject to those factors viewed by the decisionmaker as constraints on her/his actions. The value of the lexicographic technique, relative to full optimality techniques, lies in its ability to more accurately describe real world decision-making. Incorporation of relevant constraints should improve its predictive ability.

Second, in the particular empirical application described here, the high degree of regulation in the banking industry at the present time makes it exceedingly difficult to determine over what decisions a bank president has control. Particularly when one wishes to determine a rural bank's role in local community economic development, it is necessary to determine what factors are constraints on a banker's decision-making processes and what areas are discretionary. The lexicographic technique may prove to be helpful in distinguishing between these two components of decision-making.

The limited evaluation of the lexicographic technique provided in this paper suggests its potential usefulness in trying to determine underlying differences in the way unit and branch bankers make decisions. The goal orderings of the two bankers studied were quite different, suggesting possible differential community impacts based on bank structure. The application of the

lexicographic ordering technique to a larger sample of rural bankers has potential to provide important insight into possible economic development implications of structural changes in the banking institution. Further attention to modifying the technique to improve its predictive ability in this application appears to be justified on the basis of this initial exploration .

Table 2. Linear Programming Results compared with Actual Portfolio

	Goal Max	Added Constraints	Actual
Unit Bank			
X_1	1.774	1.426	0.130
X_2	0.000	0.000	0.299
X_3	0.000	0.000	0.295
X_4	0.000	1.621	1.718
X_5	2.579	0.276	0.276
X_6	0.000	6.819	0.683
X_7	0.000	3.480	0.303
Value of Objective Function	0.649	0.649	
Branch Bank			
X_1	1.819	0.000	0.188
X_2	0.000	1.422	0.195
X_3	0.000	0.000	0.129
X_4	0.000	1.524	1.728
X_5	3.275	0.650	0.535
X_6	0.000	1.101	1.130
X_7	0.000	0.397	1.063
Value of Objective Function	0.757	0.757	

References

Anderson, Jock R., John L. Dillon, and Brian Hardaker. Agricultural Decision Analysis. Ames, Iowa: The Iowa State University Press, 1977.

Halter, Albert N. and Gerald W. Dean. Decisions Under Uncertainty. Chicago: South-Western Publishing Co., 1971.

Lin, William, G.W. Dean, and C.V. Moore. "An Empirical Test of Utility vs. Profit Maximization in Agricultural Production." American Journal of Agricultural Economics. Vol. 56. No. 3. August, 1974.

Rhoades, Stephen A., and Donald T. Savage. "The Performance of Small vs. Large Banks: Can the Small Banks Compete?" Bankers Magzine. Forthcoming.

Roumasset, James A. Rice and Risk. New York: North-Holland Publishing Company, 1976.

Shaffer, Ron. "Wisconsin Commercial Banks' Effect on Community Economic Development." Economic Issues 15(November 1977). Department of Agricultural Economics. University of Wisconsin-Madison.

Sullivan, Patrick J. Rural Development and Commercial Bank Holdings of Municipal Bonds. Working Paper No. 7902. Economic Development Division. ESCS. USDA. March 1979.