

## DETERMINANTS OF LENDER RESPONSE TO SHORT-TERM CREDIT NEEDS OF SMALL COMMERCIAL FARMERS

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Credit availability and use have been identified as crucial factors affecting success or failure for many farm operations [1, 2]. The increased level of uncertainty affecting agriculture in the 1970s has intensified the importance of credit use by farmers. Indeed, maintaining financial liquidity often is cited as a strategy to counter increasing farm risks [6, 12]. Farmers view credit as a crucial variable and, as shown by Barry and Baker [3], farmer borrowing patterns can be related to the level of unused credit those farmers maintain.

Use of credit is also an essential strategy for the farmer in achieving goals of profitability and firm growth [8]. This factor is especially important for the young farm operator struggling to establish a successful farming operation [5, 7].

The decision on how much credit is available to the farm operator, however, is influenced by the second participant in the credit decision, the lender and the lending institution. The lender's role is to define the credit capacity of the potential borrower, and to allow the farm operator to use borrowed funds up to that maximum amount. Because of the central role of the agricultural lender in specifying the level of credit availability, more information is needed about the factors that shape the lender's response to requests for agricultural credit. For example, Barry and William [4] show that lender's credit responses to levels of forward contracting can affect production plans and growth potentials for Texas crop producers. Also, Smith and Baker [16] found an inverse relationship between credit availability and debt service requirements for real estate.

An investigation is reported that relates the availability of operating credit to characteristics of the lender as well as to the financial situation of the prospective borrower. Operat-

ing credit is analyzed because of the crucial role of cash flows and short-term liquidity for beginning farmers and farmers operating under conditions of financial stress [15].

### DESCRIPTION OF SURVEY

To investigate lender reactions to requests for operating capital, 33 lenders in east-central Illinois were surveyed during January and February 1977 [10]. These lenders represented 30 commercial banks and three production credit associations in this corn and soybean producing region. At each institution, an agricultural lending officer was asked to evaluate three short-term loan requests. The three situations differed only in terms of the financial attributes of the hypothetical borrower.<sup>1</sup> Characteristics of the three situations are listed in Table 1.<sup>2</sup>

TABLE 1. SELECTED SUMMARY CHARACTERISTICS OF FINANCIAL DATA PRESENTED TO LENDING OFFICERS<sup>a</sup>

Item	Situations		
	1	2	3
Current Assets	44,039	63,569	61,891
Total Assets	192,734	92,214	210,626
Current Liabilities	39,834	31,840	38,946
Total Liabilities	138,834	40,840	122,613
Net Worth	53,900	51,374	88,013
Loan requested	47,980	39,978	41,530
Leverage ratio <sup>b</sup>	2.44	0.795	1.39

<sup>a</sup>All items but leverage ratio are in dollars.

<sup>b</sup>Total liabilities divided by net worth.

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<sup>1</sup>An alternative to analyzing reactions to hypothetical requests would have been to examine actual loan histories. However, factors in addition to the lender's response affect the amounts of funds actually loaned. For example, if a farmer is strongly risk averse one would expect him to attempt to maintain a credit reserve. Use of actual loan histories would not allow one to estimate solely the factors that influence lenders in determining the extent of a farmer's credit capacity.

<sup>2</sup>To interject as much realism as possible into the survey, considerable background material was prepared and was available on request from the interviewer [9]. These data were pretested with selected lenders in the area to ensure that the situation postulated was consistent with actual conditions. One item provided was a detailed biography of the prospective borrower. This biography described the applicant as a young, married farmer with a college education and four years of farming experience. The borrower was said to have a good credit history and had dealt with the institution for the entire time he had farmed. Additionally, production and financial data were available at the lender's request. These included both past and projected balance and cash flow statements.

Because short-term credit is a critical factor for the farmer seeking to establish a successful farm business, a firm size was defined which is consistent with that of a typical entry-level operation in the region. For all three loan situations the farmer was depicted as operating a 400-acre primarily cash grain farm with a small livestock operation to utilize extra labor. In Situations 1 and 3, the farmer had recently purchased 80 of his 400 acres. This purchase contributed to the liquidity problems in these two circumstances. In Situation 2 the entire 400 acres was rented. The tenure arrangement, however, was described as relatively secure.

In each instance, the farmer's current position of financial stress was said to have been precipitated largely by an act of nature. In particular, a severe localized drought, similar to those which actually occurred in Illinois that year, was blamed for reducing crop yields to levels below expected yields for that area. These low yields were cited as a major unforeseen contributor to the cash flow problems of the borrower.

All of the loans were requested for one year and the three loan requests ranked in amount from \$40,000 to \$48,000. Generally the lenders specified that approved loans would be secured by growing crops, but a few lenders also required a lien on farm machinery. The lenders chose to ration credit on a quantity rather than a price basis. The average interest rate was 8.5 percent and the variation in rates among lenders was relatively small. None of the lenders interviewed chose to vary the interest rate required among the three loan situations.

For each of the three situations, the loan request was presented as a minimum amount needed to operate the farm in a normal manner for the coming year. Therefore, the lender was requested to approve the loan for the whole amount or to refuse it entirely. Formulation of the research question in this manner implies special considerations for estimating an explanatory model.

## METHOD

The objective of this analysis is to determine the effect of farmer and lender characteristics on the probability of a lender granting credit to the farmer. A causal model is hypothesized. Because of the way in which lenders were asked to respond to the survey instrument, the observations on the dependent variable of this model can be viewed as dichotomous, i.e., having a value of one if the loan was extended and zero if it was denied. Therefore, ordinary least squares (OLS) would be inappropriate for

this analysis because of the implied heteroskedasticity of the error terms. Moreover, even the use of generalized least squares (GLS) with correction for heteroskedasticity is inappropriate because the predicted value of the dependent variable may still be outside the unit interval between zero and one.

A logit model is used because its underlying assumptions are less restrictive than those of other methods.<sup>3</sup> Additionally it is free of the problems attendant with the use of OLS or GLS. In the logit model it is assumed that the odds of a loan being granted are a log-linear function of the exogenous variables,  $x_i$ , of the form

$$(1) \quad \ln \left( \frac{p}{1-p} \right) = Bx_i$$

where  $p$  is the probability of a loan being granted and  $B$  is a row vector of slope coefficients. If the first element of  $x_i$  is a constant for all  $i$ , the first element of  $B$  is an intercept term. The foregoing expression can be manipulated so that the probability of a loan being granted given a particular level of  $x_i$  is written as

$$(2) \quad P(L | x_i) = 1 / (1 + \exp \{-Bx_i\}).$$

From equation 2 a likelihood function can be formed as shown in [14]. The maximum likelihood estimators have the usual large sample properties of such estimators which, asymptotically, are unbiasedness, efficiency, and normality. For inference on individual coefficients, particularly on whether a coefficient is significantly different from zero, the coefficient divided by its standard error has, asymptotically, a standard normal distribution. More elaborate hypothesis tests on groups of coefficients can be undertaken by using likelihood ratio tests as discussed in [14].

## RESULTS

Lender responses to the three loan situations are given in Table 2. They indicate the importance of the applicant's liquidity position in

TABLE 2. RESPONSES OF LENDERS SURVEYED

	Situations		
	1	2	3
Number of lenders who would have granted loan	19	28	30
Percentage of lenders who would have granted loan	58	85	91

<sup>3</sup>Discriminant analysis, applied in [13], is also a possibility. However, discriminant analysis is rejected because it implies the existence of two populations of lender and borrower situations: one population in which loans are made and another in which loans are refused. A logit model, however, enables one to hypothesize that there is some probability of a loan being made in any given circumstance. Probit analysis is also a potential estimation technique. It is not used because, as noted by Theil [17], the distributional assumptions necessary to validate the probit model are frequently not fulfilled in econometric models.

obtaining an operating loan. For example, the borrowers described in Situations 1 and 2 have net worths which are nearly equal. However, the potential borrower of Situation 1 has a considerably weaker cash flow position than does the applicant of Situation 2. Nearly 45 percent of the lenders surveyed would have refused to make a loan in Situation 1 whereas only 15 percent would not have made a loan in Situation 2.

Another illustration of the importance of liquidity is found by comparing responses for Situations 2 and 3. Although the net worth listed for Situation 3 is 70 percent greater than that for Situation 2, the short-term equity in the latter situation is 38 percent greater than that in the former. The lenders surveyed, however, tended to regard these conditions as nearly equivalent, and 85 to 90 percent of them would have granted the loan requests in each of these two instances.

Although the data in Table 2 illustrate lender reactions to the financial situation of borrowers, an explanatory model of lender response was desired. For the reasons detailed heretofore, logit analysis was selected for further quantitative analysis. In addition to soliciting responses to loan requests, the interviewer obtained information on several characteristics of the lending institution and the lender for use as possible causal factors in determining loan response.

The data set consists of 99 observations on variables which include characteristics of the lending institution and the lender and financial condition of the borrower.<sup>4</sup> Using variables that are theoretically plausible and that have significant explanatory power, one obtains the estimated probability of a loan being made.

$$(3) \quad P(L|x_i) = 1/(1 + \exp\{-(0.735 - 0.206 \\ (0.617) \quad (0.058) \\ LNWC + 1.25 \text{ FARM} + 0.034 \text{ SIZE}\})\}) \\ (0.59) \quad (0.015)$$

where<sup>5</sup>

LNWC = a ratio of the amount of the operating loan requested to the working capital of the farm (working capital = current assets - current liabilities)

FARM = a dummy variable which has a value of 1 if the lending officer had a farm background and a value of 0 if he did not

SIZE = total assets of the lending institution (in millions of dollars).

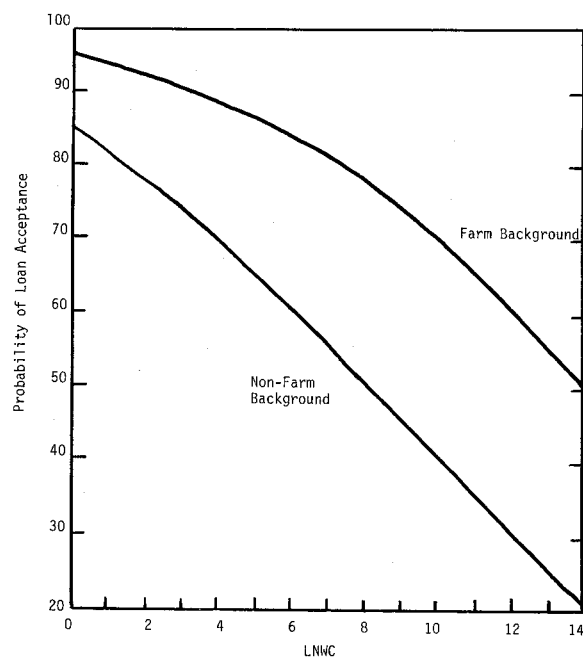
<sup>4</sup>Because ML methods are used, all of the observations are assumed to be independently generated. Because the three situations presented to each bank differ substantially, dependence within the likelihood function is assumed weak enough to be ignored.

<sup>5</sup>The asymptotic standard error for each estimate is given in parentheses below that estimate. To test whether the independent variables as a group have significant explanatory power, a likelihood ratio test is used. The value of the appropriate chi square statistic is 23.78 and, with three degrees of freedom, the null hypothesis of no explanatory power is rejected at the 99 percent level.

The three independent variables all have estimated coefficients that are at least twice their standard errors indicating statistical significance at approximately the 95 percent confidence level.

Figures 1 and 2 illustrate more clearly the relationship estimated in equation (3). In Figure 1, the relationship between the ratio of

FIGURE 1. RELATIONSHIPS BETWEEN THE RATIO OF LOAN REQUESTED TO WORKING CAPITAL AND PROBABILITY OF LOAN ACCEPTANCE



the amount of loan requested to working capital available and the probability of receiving a loan is depicted. For Figure 1 the SIZE variable is set at the mean level for the institutions surveyed, \$28.4 million.

As shown by the lower curve of Figure 1, an applicant with a LNWC ratio of 4 would have a 70 percent chance of receiving a loan if the lender had no farm background. For the conditions specified, that percentage would increase to 90 percent if the lending officer had a farm background. The positive relation for the FARM variable may reflect an increased willingness of the farm-reared lender to analyze loan requests more closely for feasibility instead of being guided by rule of thumb criteria. Alternatively, this relation may originate from a greater sensitivity to farmer

stress conditions, especially if they are due partly to acts of nature. It is interesting that the differential due to this variable widens as the stress position of the applicant worsens (i.e., the value of LNWC increases).

The two curves in the upper part of Figure 2 depict the estimated relationship between the size of the lending institution and the probability of loan acceptance. The LNWC variable was set at 2.0. The bar graph in the lower part of Figure 2 is a frequency distribution of the number of institutions surveyed in each size category [11].

This graph illustrates the strong relationship between size of lending institution and probability of loan acceptance estimated in equation (3).<sup>6</sup> However, a large portion of this advantage can be obtained by working with an institution with at least \$30 million in total assets. For example, the probability of loan acceptance would be approximately 62 percent if the lending institution has \$5 million in total assets (and the loan officer has no farm background). The corresponding probability would increase to almost 80 percent if the institution

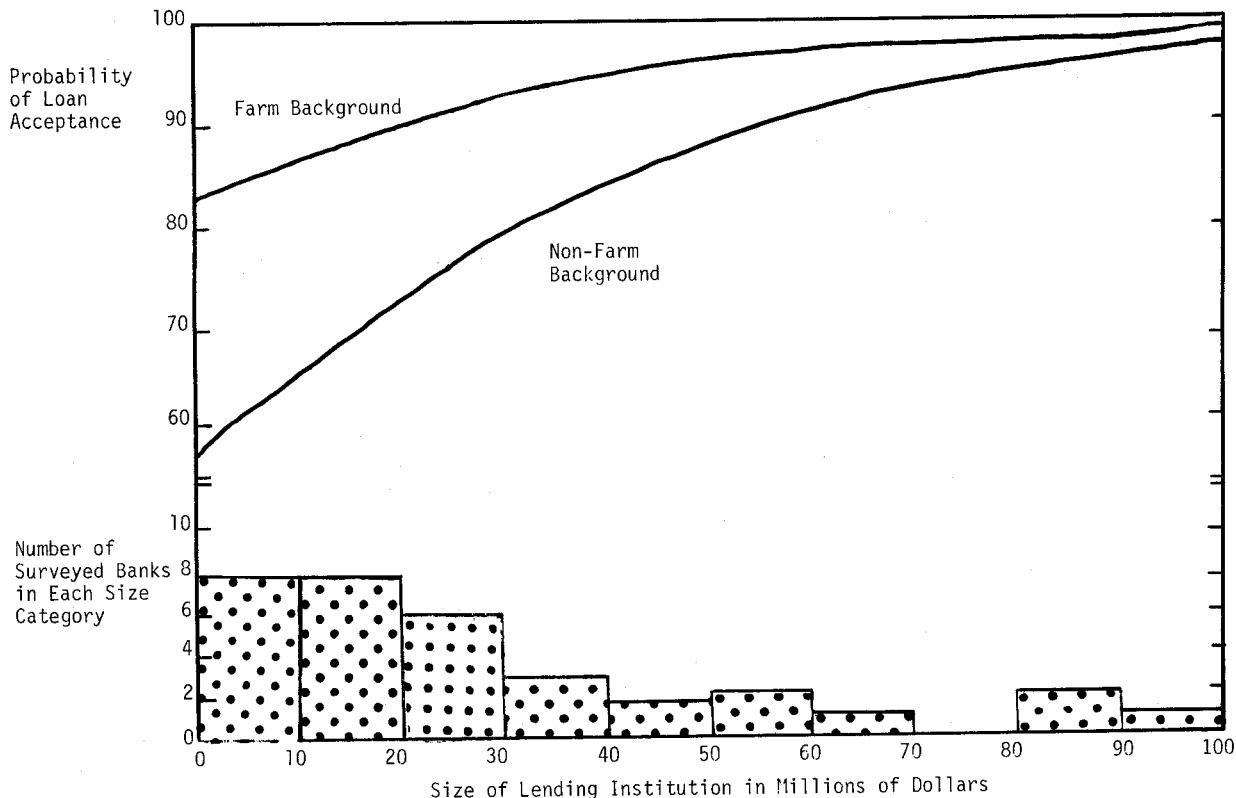
had \$30 million in assets. For an institution with assets of \$55 million, the probability would be about 90 percent. The greater tendency of larger banks to grant loans is consistent with the results of Irwin [9].

As shown in Figure 1, a lending officer with a farm background would be more inclined to make an operating loan for any given size of the lending institution. However, as the size of institution increases the farm background differential rapidly declines. For the institutions surveyed, there is no strong correlation between institution size and whether the lending officer had a farm background. Similarly, for the banks surveyed there is no significant correlation between the lending officer's background and the percentage of that institution's loan which are agricultural.

### SUMMARY

The results of this analysis indicate that credit availability to farmers is a function of

FIGURE 2. RELATIONSHIPS BETWEEN TOTAL ASSETS OF THE LENDING INSTITUTION (SIZE) AND PROBABILITY OF LOAN ACCEPTANCE



<sup>6</sup>One plausible hypothesis for the positive size relationship of equation 3 is that larger loans represent relatively greater risks for smaller than for larger banks. However, a \$40,000 line of credit would not be unusual for a farm operation in this region. Although the loans requested may be relatively sizeable for some of the smaller banks in the survey, no lender indicated that he would not grant a loan in at least one of the loan situations.

more than the farmer's particular financial circumstances. The estimated model shows that the lender with a farm background is significantly more likely to grant a loan. Additionally, the size of a lending institution is related positively to the probability of obtaining a loan. However, because the sample is from a

small geographic area and the survey is restricted to one particular size and type of farm, further research is needed to determine the generality of the results. In particular, a survey which considers an expanded number of critical ratios for the liquidity variable (LNWC) would be useful.

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