AN ANALYSIS OF THE LOAN DELINQUENCY OF MICHIGAN CASH GRAIN FARM BORROWERS

By

June C. Grabemeyer

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INTRODUCTION

1.1 Introduction And Purpose Of The Study

1.1.1 Introduction and Background

The 1970's were characterized by growth in agriculture. There were increases in agricultural exports and prices received by farmers. Cash and feed grain production expanded in response to these price signals. Gross farm income rose from $58.8 billion in 1970 to $167.9 billion in 1981 (Agricultural Statistics, 1984). In Michigan, the value of farmland and buildings grew from $326 per acre in 1970 to a peak of $1,289 per acre in 1981 (Jones and Barnard). Increasing asset values enabled farmers to use unrealized capital gains on assets as collateral for loans. Farm real estate debt in Michigan increased from $667 million in 1970 to $2,058 million in 1981 (Jones and Barnard). Total U.S. farm debt increased from $48,928 million in 1970 to $170,030 million in 1981 (Melichar, 1984-A).

The rationale for the increased use of debt financing in the 1970's were "buy now before the price goes up" and paying off current debt with "cheaper" dollars of the future. Farms could service their debt and continue their growth as long as the assets generated returns that exceeded the cost of servicing the debt on those assets. In 1978, 50 percent of total capital purchases were made with debt financing

compared to only 17 percent of total capital purchases in 1950 (Lins and Duncan).

With the rising use of debt financing, farmers increased their financial risks. Changes in asset values, prices received, and production expenses affect returns to assets. Farmers began to experience problems dealing with the financial risks of debt financing when real interest rates rose and asset values and product prices declined.

Several factors are associated with the end of the 1970's boom period. Changes in monetary policies contributed to the decline of inflation and the increase in real interest rates. The high value of the dollar weakened agricultural export markets. The shift in demand, combined with excellent crop production in recent years excepting 1983, resulted in reduced prices received by farmers. With the decline in prices and profitability, farm asset values began to decrease. The average value per acre of farm real estate declined 18 percent in Michigan from 1981 to 1985 (Jones and Barnard). The loss of equity due to the decline in asset values has been a serious problem for farmers who used leverage during the 1970's for rapid growth.

The high variability of farm incomes along with the high cost of debt servicing obligations has caused cash flow shortages for many farmers. Since 1982 there has been an increase in the number of farm loan delinquencies. Many loans with collateral based on the unrealized capital gains of the 70's are undersecured at current asset values. As farm loan losses have increased, lenders have tightened agricultural credit in response to the increased risk. Changes in the rates and

terms of loans have shifted more risk to the borrower and have increased the cost of debt financing. Many farmers have not been able to make their payments. Several factors can be analyzed to identify the cause of farm loan delinquencies.

1.1.2 Purpose of this Study

The purpose of this study is to analyze the causes of farm loan delinquency in Michigan. Such information should be useful to lenders in the evaluation of loan applications and loan servicing. It also provides guidance to farmers making decisions on the use of debt financing in their operation.

1.2 Objectives Of The Study

Governor Blanchard initiated a Farm Finance Study in 1985 to address the problems of financially stressed farms in Michigan. The first phase of the Governor's study involved a survey of farmers to determine their current financial position. Michigan's farm loan delinquency rate and other indicators of financial stress were determined through this survey.

This analysis is the second phase of the Governor's Study. It involves an in-depth analysis of loan delinquency by collecting information from agricultural lenders. The intent of this study is to investigate the causes of farm loan delinquency and identify the factors that distinguish delinquent from nondelinquent borrowers.

The study focuses on Michigan cash grain farms. Cash grain farms represent a major farm type in the state. Approximately 30 percent of

Michigan's farm income is generated by cash grain farms (Michigan Agricultural Statistics). The specific objectives of this study are to:

1. Identify the characteristics that distinguish delinquent from nondelinquent borrowers.
2. Identify differences in actual and projected farm income that contributed to loan repayment problems.
3. Identify changes in the valuation of loan security and repayment schedules which may have contributed to loan repayment problems.
4. Identify risk management strategies documented in a borrower's file and determine their effectiveness in minimizing loan delinquency.

1.3 Research Approach And Organization

This study involved collecting and analyzing a five year history of loan activity and financial data for a group of Michigan cash grain farms. Information was gathered for the time period of December 1979 to December 1984. Michigan's major types of agricultural lenders were asked to provide detailed information for a limited number of delinquent and nondelinquent borrowers. The study was limited to cash grain farms in order to provide a relatively homogeneous group of borrowers to be included in the analysis. All of the selected farms faced similar prices and weather conditions during the five-year time period. The kind of borrower information recorded by the lenders was evaluated. Discriminant analysis was used to identify borrower characteristics which are associated with loan delinquency.

Chapter Two summarizes selected recent research on loan analysis and loan delinquency. Chapter Three presents the theoretical background on financial analysis and leverage, and discusses the current financial situation. Chapter Four explains the design of the survey, procedures used for selecting the lenders and borrowers for the study, the data collection, the discriminant analysis methodology, and findings. Chapter Five discusses implications of the results and recommendations for future research.

CHAPTER TWO

A SELECTED REVIEW OF LITERATURE

2.1 Introduction

Lenders evaluate and classify loans in order to control the quality of their loan portfolio and minimize loan losses. The evaluation and classification of loans can reduce loan servicing costs when potential problems are promptly identified and appropriate action is taken. Credit risk can be reduced if characteristics of high risk borrowers can be identified and used in determining the allocation of credit.

Credit scoring is a method of evaluating borrowers. Numerous studies have applied discriminant analysis to perform credit scoring. The discriminant equation identifies characteristics which separate borrowers into high and low risk groups. Credit scoring is discussed in the following section. The findings of various studies of measures used for loan evaluation are then presented, followed by a summary of studies utilizing probit and discriminant analysis for credit scoring.

2.2 Credit Scoring

2.2.1 Definition of Credit Scoring

Credit scoring is a process of evaluating loans in order to divide borrowers into groups. Borrowers are categorized by lenders according to their criteria for loan approval or servicing action. Most credit

scoring models separate borrowers into "good" and "bad" groups in which "good" loans are those meeting all the lender's standards and are considered acceptable. The "bad" loans are loans which the lender considers unacceptable or problems loans because they are higher risk. Lenders use financial ratios and nonratio measures to define loan status groups.

2.2.2 Formulation of Credit Scoring Models

A credit scoring model developed with discriminant analysis uses the selected variables in an equation of the form

$Y = a_1 x_1 + a_2 x_2 + \ldots + a_1 x_1$, where:

Y = the composite score used for classifying the borrower

a_1 = the weighting coefficients to be applied to the value for each individual characteristic

x_1 = the individual characteristics used to categorize

Variables are selected for credit scoring on the basis of their ability to classify borrowers. The variables can be ratio and nonratio characteristics that the lender has recorded or can reasonably expect to collect. Borrower values for variables (x_1) are used with the coefficients (a_1) in the equation to calculate the composite score which categorizes the loan.

2.2.3 Use of Credit Scoring Models

Credit scoring is useful to lenders to assure that the quality of their loan portfolio is at acceptable levels for their standards and that losses from nonperforming loans are minimized. Credit scoring helps lenders use their loan servicing efforts more effectively by identifying problem loans. It is also used to identify high risk loan

applicants in order to maintain the quality of the loan portfolio. The lender can then reject applicants or adjust loan rates and terms to compensate for the higher risk.

Credit scoring models have been used in consumer, commercial, and agricultural credit. Recent research studies have developed models suitable for classification of agricultural loans.

2.2.4 Evaluation of Credit Scoring Models

In a credit scoring model, the discriminant equation is tested on all cases in the analysis to determine how accurately it classifies loans. Results of testing a model indicate the percentage of loans correctly classified. While a 100 percent "fool-proof" model is an ideal, all models will misclassify some loans. Cut-off values can be established on composite scores so that the error of misclassifying loans in one group is reduced.

2.3 Summaries Of Credit Scoring Studies

2.3.1 Factors Used for Loan Evaluation

The following studies have identified sets of characteristics used by lenders to evaluate loans. Lenders select the characteristics that are most useful to them in making credit decisions.

Bieber found that a group of 12 state bankers' organizations used a credit scoring system with the following variables:

1) Current ratio.

2) Intermediate ratio.

3) Total debt to equity ratio.

4) Change in net worth.

5) Loan amount to value of security ratio (Bieber).

The weighted score from these five ratios is used as an indicator of credit strength for loan applications.

Stover, Teas, and Gardner collected data to determine criteria used by agricultural creditors in evaluating loan applications. Agricultural loan officers at banks were asked to rank six loan characteristics for a set of loan situations. The research study tested the relative importance of the decision variables for loan requests by designing sets of loan request situations with six variables. The variables were: management ability, market conditions, loan purpose, assurance of repayment, collateral, and loan pricing (rates and terms of the loan). The loan request situations used varying measures of each variable such as speculative to highly productive loan purpose, high to low management ability, favorable to below average market conditions, and various levels of repayment assurance and loan pricing. Management ability was ranked the most important attribute in loan determination. Low management ability was the leading cause of negative loan decisions.

2.3.2 Study by Lufburrow, Barry, and Dixon

Lufburrow, Barry, and Dixon used probit analysis on data from five Production Credit Assocations (PCA) in Illinois. The probit analysis predicts the probability that a borrower will fall into a given classification. The borrowers were classified into three groups of : Class I, Prime (lowest risk); Class II, Base (intermediate risk); and Class III, Premium (highest risk).

Lufburrow, Barry and Dixon found some slight differences in loan credit quality within each loan classification due to credit philosophy differences between individual PCAs. They also found differences in borrower data verification. Less verification was done for the most credit-worthy borrowers. Farm visits were used for occasional verification of collateral values. "The general approach is for the borrower to provide the data which are accepted as valid by the PCAs in their credit analysis." (Lufburrow, et al,1984, p.11). PCAs are generally considered to use uniform methods of loan analysis, credit evaluation, and risk assessment; however, differences may still occur in the completeness of financial data requested and in the relative weights lenders assign to the various credit factors. While these differences are considered minor and are difficult to measure, they may still influence the credit scoring analysis.

The analysis identified five significant factors for determining credit risk. These factors were:

1) Liquidity.

2) Leverage.

3) Collateral.

4) Repayment ability.

5) Repayment history.

2.3.3 Study by Dunn and Frey

Dunn and Frey used discriminant analysis to classify PCA borrowers. They gathered data on cash grain farmers in central Illinois. All the farmers were PCA borrowers who had obtained their loans during 1964 to 1968 and were still borrowers in 1971.

Two groups of borrowers were selected for the study. The PCA's credit examiner determined whether the 1971 loan was an acceptable loan or a problem loan. The acceptable loans were loans that PCA defined as highest in quality ranging down to loans that had significant credit weaknesses. Problem loans were defined as loans which had serious credit weaknesses, but they were considered to be collectable in full. The loans which PCA believed to be "loss" loans were not included in the study. A sample of 99 loans were selected. Of these, 60 were "acceptable" and 39 were "problem" loans. Data were then collected from the original loan application.

The study was developed to determine what information from the original application could be used as predictors of acceptable and problem loans for cash grain farms. The step-wise discriminant procedure was used to determine the significance of variables and the discriminating equation. Dunn and Frey identified 27 characteristics that had been used in other discriminant studies. They selected 6 nonratio and 16 ratio characteristics for their research.

The analysis found four characteristics which were significant at the 95 percent level and were included in the discriminant equation. The debt to asset ratio was the most significant variable. Any applicant with a ratio of more than 0.5 was classified in the problem category by the discriminant equation. The other three characteristics in the order of their significance were the amount of credit life insurance the borrower had, the ratio of amount of note to net cash farm income, and the acres owned. Loans classified in the problem group had greater amounts of credit life insurance. The higher the ratio of

amount of note to net cash farm income, the more likely the loan would remain acceptable in later years. The likelihood of future loan problems increased with acreage owned. The model correctly classified 75 percent of the test loans.

2.3.4 Study by Hardy and Weed

Hardy and Weed's credit scoring model was based on data from 145 acceptable and 75 problem farm loans at Alabama PCA's. The classifications were made by the credit analysts of the Federal Intermediate Credit Bank of New Orleans who examine PCA loans annually. Acceptable loans are those which require normal supervision. Problem loans are loans which are considered weak and require more supervision. This classification was similar to that done in the Dunn and Frey study.

Data were obtained from the borrowers' most recent financial statements. Hardy and Weed selected 15 variables for their research. Three nonratio variables of age, acres owned, and acres rented were used along with 12 financial ratios.

A stepwise discriminant procedure was used to determine the significant variables and discriminating equation. The resulting equation had two ratio variables, the debt to asset ratio and the loan repayment anticipated annually divided by total assets.

One concern in the selection of a research procedure was the problem of misclassification of loans. Hardy and Weed adjusted their model to limit the misclassification of problem loans. Their resulting equation classified 93.5 percent of the problem loans correctly while only 44.8 percent of the acceptable loans were correctly classified.

2.3.5 Study by Johnson and Hagan

This study was done using information gathered from three PCA's in central and northwestern Missouri (Johnson and Hagan). Data were collected from the most recent financial statements of 204 acceptable and 68 problem loans which had been classified by the credit analysts of the Federal Intermediate Credit Bank of St. Louis. Three variables were identified as significant. The first was a repayment index which is the amount of the loan actually repaid each year plus the value of marketable crops and market livestock not sold during the year expressed as a percentage of the amount expected to be repaid. The other two variables were the current ratio (current assets to current liabilities) and the debt to asset ratio.

The resulting equation correctly classified 61.6 percent of the loans. Johnson and Hagan reported that the PCA desired a model which would correctly classify 99 percent of problem loans. The correct classification of PCA problem loans would reduce the staff hours needed for loan examination and classification, thereby allowing more time and attention for the problem loans. The discriminant equations were not able to meet the level of performance that was desired.

2.3.6 Study by Altman

Altman's study applied discriminant analysis to test the quality of ratio analysis as an analytical technique. The study used 66 case corporations. One-half the group (33 cases) had filed bankruptcy in 1946 to 1965. Altman selected five financial ratios which were measures of liquidity, profitability, productivity, solvency, and capital

turnover. The analysis classified the corporations as bankrupt or nonbankrupt.

Altman used the discriminant equation on ratio variables for each year up to 5 years prior to bankruptcy. The equation which contained ratios from 2 years prior to bankruptcy correctly classified 79 percent of sample firms. The equation was a less accurate forecaster when using ratios more than 3 years prior to bankruptcy. The largest change in ratios and the ability of the equation to correctly classify firms occured between the second and third year before bankruptcy.

Altman found companies which eventually go bankrupt underestimate their financial plight. He concluded that discriminant models are useful as predictors and ratios used with discriminant analysis have a greater statistical significance than trend ratio comparisons.

2.4 Critique Of Previous Studies

2.4.1 Development of Models

The purpose of the studies was to develop a model which would evaluate the repayment ability of borrowers. In order to develop such a model the classification groups must be clearly defined, and reliable and consistent data must be collected.

Most credit evaluations have been based on the personal observations and subjective judgements of loan officers. Lenders generally accept the data provided by the borrower as valid. Some verification of data may be done by the loan officer during the credit evaluation process. Overestimation of assets values means that the

farmer is more leveraged than the lender believes. This might not be noticed until a problem such as delinquency occurs.

The loan classifications for the four studies involving PCA loans used the PCA's loan classification criteria. PCAs have more than two loan classification categories. However, for each study the loan categories were combined into two groups and the "loss" loan group was excluded. The definitions of "acceptable" and "problem" for loans may include some subjective judgement by the credit examiner. The differences in the credit philosophy of each PCA's management was identified by Lufburrow, Barry, and Dixon as a problem which affects the credit scoring model. The studies done by Dunn and Frey, Johnson and Hagan, and Hardy and Weed used loans classified by the Federal Intermediate Credit Bank credit examiners. The classification of loans by the credit examiners would be more consistent than classification done by individual PCAs where differences in credit philosophy would cause more variance in classification of loans.

None of the studies reported the criteria used by PCA examiners to classify their loans. PCA does not usually disclose their classification guidelines. The characteristics identified as significant in the studies are expected since they are measures which lenders use to evaluate loans. Thus, it is highly likely that these variables were also used by the PCA credit examiner to classify the loans. Given the research design used, the actual objective of the PCA studies is to determine the classification procedure used by the credit examiners.

2.4.2 Results of Studies

The significant characteristics from the agricultural models are summarized in Table 2.1. Each study found financial ratios that were significant variables. Dunn and Frey found two nonratio variables which were significant. All the models (Table 2.1) used some measure of leverage. The debt to asset ratio was significant in discriminating between problem and acceptable loans (Dunn and Frey, Johnson and Hagan, and Hardy and Weed). Liquidity measured by the current ratio was significant in two of the four agricultural loan studies. The other significant characteristics were ratios for collateral and repayment ability.

One of the nonratio significant variables was the amount of credit life insurance on the applicant (Dunn and Frey, 1976). The results showed greater amounts of credit life insurance required for problem loans. Dunn and Frey reported that this finding reflects the tendency of highly leveraged borrowers to obtain more insurance to cover their debt. While this may be true, it may also be an indication of the lender's desire to reduce risk of problem borrowers. Credit life insurance can be required by the loan officer as part of the loan terms. The PCAs sell credit life insurance as a service to their borrowers. Since the PCA receives a part of the premiums and would have the loan paid by the insurance in the event of the death of the borrower, it would seem reasonable for the loan officer to encourage or require higher risk borrowers to insure their debt. It appears that credit life insurance may not be a valuable discriminator if PCA's

TABLE 2.1

SIGNIFICANT CHARACTERISTICS FROM OTHER STUDIES

Significant Characteristics for Discriminating Between Acceptable and Unacceptable Agricultural Loans, as reported in major studies (1)

Characteristic	Research Study (2)			
	D&F	J&H	H&W	L,B,&D
Debt to asset ratio	x	x	x	
Debt to equity ratio				x
Amount of credit life insurance on applicant	x			
Amount of note as a proportion of net cash farm income	x			
Number of acres owned	x			
One year repayment index (3)		x		
Current assets to current debts ratio		x		x
Loan repayment anticipated annually divided by total assets			x	
PCA collateral to total PCA line of credit				x
Repayment ability (4)				x
Repayment history (5)				x

(1) Some studies analyzed application data and some used the most recent financial statement information.
(2) D&F, Dunn and Frey; J&H, Johnson and Hagan; H&W, Hardy and Weed; L,B,&D, Lufburrow, Barry, and Dixon.
(3) The amount of the loan actually repaid each year plus the value of marketable crops and market livestock not sold during the year expressed as a percentage of the amount expected to be repaid. This index was computed for the current year only.
(4) Projected net cash flow plus projected grain inventory divided by total PCA line of credit.
(5) Average of loan principal repaid divided by principal due over the past three years.

management requires coverage after the loan has been identified as a problem loan.

Dunn and Frey reported that the amount of loan to net cash farm income ratio varied inversely with the likelihood of loan problems in their resulting equation. The higher this ratio is, the more debt commitment the borrower has; thus, it appears that the impact of this variable is the opposite of what would be expected. Dunn and Frey noted that borrowers whose rate of return was greater than the interest cost on the borrowed capital, would grow faster with the borrowed capital. This makes the borrower more likely to have an acceptable loan in the future. Borrowers who were judged as good credit risks were able to obtain more credit that those who weren't. Thus, the ratio is a result of the use of leverage rather than a predictor. Their study was based on loan data collected between 1964 and 1971. The relationship between returns and interest costs between 1964 to 1971 influenced the effectiveness of this variable as a prediction tool for loan classification; the relationship between returns and interest rates has since changed.

The ability of a model to correctly classify loans in each loan class separately can be adjusted by changing the cut-off discriminant value. The cut-off value is the value of the discriminant score used to separate loans into groups. The error of misclassifying a problem loan was viewed as more serious than that of misclassifying an acceptable loan. Cut-off values for problem loans were adjusted to reduce this error by Hardy and Weed. There is a trade-off in classification because as the percentage of problem loans correctly classified increases, the

percentage of acceptable loans correctly classified decreases. Alternatively, Altman suggested that the composite scores could be cut off for both groups such that a gray area is created between the groups which limits misclassification of both groups. Loans in this "indeterminate" group would be subject to the same review as loans in the "problem" category.

2.5 Summary

Use of credit scoring and evaluation models reduces lenders' credit risk and servicing costs. These models do not replace credit examiners, but they do reduce subjective judgement in loan classification. These models can be applied to information from applications to identify future problem loans.

Research using discriminant analysis has shown that significant characteristics can be identified which will classify borrowers into groups. The discriminant technique is useful because several characteristics can be used simultaneously to classify borrowers.

CHAPTER THREE

THEORETICAL BACKGROUND AND CURRENT SITUATION

3.1 Introduction

In this chapter the fundamental concepts of financial analysis with ratio and nonratio measures of performance are presented. The chapter also discusses the principle of leverage, leverage and risk, lender leverage limits, leverage and liquidity, and determining the maximum leverage a farm can service. The current farm financial situation is evaluated by presenting the motivations for leveraging in the 1970's compared to the ability to service leverage in recent years (1980-84).

3.2 Fundamental Concepts Of Financial Analysis

Financial analysis of the farm firm provides information on its financial strengths and weaknesses. The analysis of ratio and nonratio characteristics is the basis for decisions on the use of leverage in the firm and the evaluation of the performance and financial position of the firm. The analysis also provides measures with which to determine growth and progress toward the goals set by management.

3.2.1 Financial Ratios

Financial ratios are used to measure the financial position and profitability of the farm firm. These measures are used by lenders to

evaluate loan applicants and by farmers for financial planning. The formulas for the ratios discussed in this section are in Appendix A.

Balance sheet (or net worth statement) ratios measure the liquidity and solvency of the farm. These ratios show the position of the farm at a point in time. Liquidity of an asset relates to the ability of converting an asset to cash without sacrificing the asset's value. Liquidity ratios compare these values of assets to debts. Liquidity is commonly measured with the current and intermediate ratios. Solvency ratios measure the degree of leverage of the firm. Solvency deals with the farm's ability to meet the total debt obligations. Trends in the capital structure are monitored with one of the solvency measures. Solvency is measured with the debt to equity, debt to asset, and asset to equity ratios.

Income statement ratios measure the performance of the business. The gross ratio and operating ratio are used for analysis of the business. The gross ratio measures the proportion of income relative to expenses. The operating ratios measures the proportion of income that is used for operating expenses. The interest to expense ratio measures the proportion of operating expenses attributed to interest paid on borrowed funds. The interest to net farm income ratio measures the proportion of net farm income that is used for interest payments on borrowed funds. These ratios help the farmer monitor the relationship between the income and expenses of the business.

Profitability of the business can be measured in several ways. Profitability can be shown through the average rate of returns to assets or the average rate of returns to equity. The turnover ratio measures

the turnover of assets. The turnover ratio shows the opportunity to produce profits, provided the profit margins are positive. These measures come from both the balance sheet and income statement. These measures indicate the efficiency with which capital is being employed in the firm.

Other ratios used to measure the performance of the farm firm are production oriented such as yield per acre, crop costs per acre, value of production per acre, and machinery costs per acre. These ratios determine the efficiency of resource use and the production ability of the management.

Trend analysis shows the change in financial ratios over time. The trends in ratios are useful for determining the effects of leverage use and the ability of the farm firm to meet cash flow demands for debt repayment. Ratios are also used to compare a farm's financial position with that of other similar farms.

3.2.2 Nonratio Measures of Financial Analysis

Nonratio information is also useful for examining the financial position and growth of the farm. Comparisons of the net worth from year to year show the trend of equity growth. The income statement is calculated on an accrual basis. Net farm income from the income statement can be compared from year to year to measure the profits of the farm. The returns to unpaid operator's labor and management and returns to capital can be calculated from net farm income. Trends in these returns as well as trends in receipts and expenses are used to compare the farm business performance over time.

The cash flow statement shows the inflow and outflow of funds and the seasonal patterns of net cash flows. This statement also includes the flows for off-farm uses. The monitoring of cash flows and the use of projected cash flow statements is necessary to determine credit needs and repayment ability.

3.3 The Theory Of Leverage And Financial Risk

3.3.1 The Principle of Leverage

Leverage is the use of borrowed capital along with equity (owned capital) in order to control more assets in the operation of the business. Leverage ratios measure the proportion of borrowed to owned capital in the operation. The larger these ratios are, the greater is the degree of leverage.

Using leverage enables the farm to grow through the earnings from assets purchased with borrowed funds. The incentives for growth are production cost efficiencies achieved with economies of size and increased income generating capacity.

The rate of growth equation can be used to explain how leverage affects equity growth. This equation (Barry, Hopkin, Baker) is expressed as: $g = [r(A/E) - i(D/E)]\, k$ where:

g = growth rate of equity

r = average net rate of return before taxes

A/E = assets to equity ratio

i = average nominal interest rate

D/E = leverage measured by debt to equity ratio

k = $(1-t)(1-c)$

Where:

t = average rate of income taxes and

c = average rate of withdrawal for family living and off-farm flows

The k variable represents the proportion of earnings that remain in the business after income taxes and consumption or off-farm withdrawals. Without leverage the rate of growth is the average net rate of return (r) times k. The net rate of returns to assets (r) is a measure of the returns earned by all assets. It is measured in nominal, before tax terms. The average nominal interest rate (i) is the rate of interest that is charged on debt.

The relationship between the leverage level, rate of return, and interest rates affects the growth rate of equity. Leverage affects the growth rate by the factor, k(r-i); thus, the difference between r and i impacts the amount of change in equity growth. Table 3.1 illustrates the changes in growth rate for different leverage levels as the relationship between r and i changes.

When r is greater than i, leverage use has a positive effect on equity growth (Situation 1, Table 3.1). In this situation, the growth rate (g) increases as leverage increases; thus, the use of debt financing accelerates the farm's equity growth. At a debt to equity ratio of 1.0, the growth rate is 8.8 percent compared to a growth rate of 6.4 percent without any debt financing.

As the rate of returns declines relative to interest rates, so does the growth rate. When r is less than i, the growth rate declines with increases in leverage. The comparison of Situations 1 and 2 (Table 3.1) shows that when the rate of return is cut in half, the rate of growth is

TABLE 3.1

PRINCIPLE OF INCREASING RISK THROUGH LEVERAGE

Rate of equity growth (a)	Debt to Equity Ratio			
	0	0.5	1.0	2.0
Situation 1: r = .16 and i = .10	6.4%	7.6%	8.8%	11.2%
Situation 2: r = .08 and i = .10	3.2%	2.8%	2.4%	1.6%
Situation 3: r = .08 and i = .15	3.2%	1.6%	0.4%	-2.4%

(a) Using the growth equation:
$g = [(r)(A/E) - (i)(D/E)]\ k$
where $k = (1-t)(1-c)$ and assume that $t = .20$ and $c = .50$,
then $k = .40$.

reduced by more than half for the leveraged firm and by half for the unleveraged firm.

As interest rates increase relative to the rate of return, the rate of growth can decline and may even become negative. In Situations 2 and 3 (Table 3.1) the cost of debt exceeds the rate of return. In Situation 3, the growth rate is negative when the debt to equity ratio rises to 2.0. This situation illustrates how the use of debt financing can adversely affect a firm's equity.

3.3.2 Risk and Leverage

The activities in the farming environment are characterized by risk and uncertainty. "Risks occur as unanticipated variations in farm production and in commodity and resource prices, uncertainties about personnel performance, technological change, and changes in the legal environment. These business risks combine with financial risks, attributed to borrowing and leasing, to bring strong challenges in risk management for farmers and their lenders." (Barry, et al, p.5). Future events and decision outcomes facing a farm manager are uncertain. The farm manager identifies possible outcomes and judges their likelihood of occurring in the decision making process. The planning horizon for debt financing decisions may be short term or long term time frames. The decision to use debt financing has risk associated with it. These uncertainties will affect a farm firm's equity growth rate.

The rate of return (r) will vary with changes in production costs and crop revenues. When interest rates are at variable terms, i will also vary. As illustrated previously, their expected rates of returns and interest are used to determine the expected rate of growth.

The standard deviation is a measure of the amount of variability, or risk, in an expected value. The standard deviations of r, (d_r), and of i, (d_i), are used to determine the standard deviation of g, (d_g). The standard deviation of g shows the relative financial risk of the expected growth rates. The standard deviation of growth (Barry, et al, p.125) is expressed as:

$$d_g = \sqrt{[d_r^2(A/E)^2 + d_i^2(D/E)^2]\, k^2}$$

The standard deviation of g is used with the expected growth rate to determine the range of values that g could have. The larger the standard deviation, the larger range of values possible for g. The standard deviation of g is not linearly determined; that is, financial risk increases disproportionately with increased leverage and larger deviations in r and i. Farm firms must assess this risk as well as the potential benefits from the use of leverage.

3.3.3 Limits to Leverage Use

Lenders limit the maximum amount of debt farm firms can incur. Lenders use the farmer's credit worthiness, financial position, loan purpose, and type and amount of security for the loan to analyze applications and to determine loan limits.

Credit worthiness is based on the lender's judgement of the farmer's management ability, experience, and past credit history. This subjective judgement is usually based on office and farm visits. The lender considers production practices, character and experience of the farmer, and loan repayment history.

The financial position and future plans are analyzed to determine the impact of the proposed changes if the loan were made. A projected

cash flow statement is used to determine repayment ability. The impacts of the loan on the farm's debt to equity position and production ability are determined.

The loan purpose and type of security must be acceptable to the lender. The loan must be for the farm business to be considered an agricultural loan. Lenders' criteria for acceptable loan purposes vary according to the structure of the lending institution and their portfolio management. The loan purpose is also used in loan pricing. Higher risk purposes may require adjustments in the interest rates and terms to reflect the increased repayment risk. The type of security offered has to be compatible with the loan purpose and repayment period.

An appraisal is made of the security offered to determine the fair market value of the security. Lenders assess the value of security in terms of expected sale value of the property in the event of default. A loan limit is set as a percentage of appraisal value. The loan to appraised value ratio is set by the lender based on the type of collateral and the costs of liquidation in the event of default. Lenders incur costs for legal fees, loss of interest on the loan balance while in the collection and liquidation process, unpaid property taxes on real estate, maintenance, and disposal of the property. These costs are estimated on the basis of past experience and future projections. An additional deduction may be included to allow for changes in asset values or repayment risk associated with the loan. Lenders will have a lower loan to appraised value percentage on specialized facilities to compensate for the limited number of potential buyers or the extra time it would take to market the security.

Asset values affect the amount of debt that can be obtained. Increasing values allow for expansion through borrowing on unrealized capital gains. Lenders assess the asset value and the repayment ability when determining debt limits.

3.3.4 Land Values

Land is a major asset for most farm firms. Land can be valued by using a comparable sales method. This is based on recent sales of similar tracts of land and provides an estimate of the current market value of the land.

Land can also be valued using the capitalization approach. This method values the property by estimating the perpetual series of returns to land under average production and price conditions. "The basic valuation approach is to estimate an asset's current market value by capitalizing its flow of expected future earnings at an appropriate interest (or capitalization) rate" (Barry, et al, p.250). Land values are determined by using the asset's real earnings and real capitalization rates (value = asset's real earnings/real capitalization rate). The asset's real earnings are the dollars earned in one period and the real capitalization rate is the real interest rate (nominal market interest rate less anticipated inflation rate).

Adjustments are made to the land valuation formula to allow for expected changes in land values due to increases in the general inflation rate and real growth in returns to land. The real growth rate in land returns is the difference between the nominal rate and the inflation rate. Real growth in land returns is primarily attributable to increased productivity in land and changes in demand conditions for

outputs. The total returns to land is equal to the inflationary capital gain plus the real current returns plus the real capital gains. The use of the total returns in determining land values allows farm land to be priced relative to its recent pattern of returns.

3.3.5 Liquidity and Leverage

The need for liquidity increases as leverage rises. Liquidity is needed to meet debt servicing commitments as they come due. Liquidity is also needed to provide reserves to meet cash flow needs when unpredictable fluctuations due to variable prices, yields, or expenses occur. Liquidity is also needed to meet unexpected expenses caused by hazards, such as fire or severe storm damage. As debt levels increase, liquidity is reduced. Decreases in liquidity occur as cash is used for downpayments on purchases and borrowing capacity is exhausted. Liquidity is also reduced by the increase in future debt payment obligations. Decreased liquidity means more risk of cash flow shortfalls.

Cash flow analysis is used to monitor a firm's cash position and determine its repayment ability. As leverage levels increase, changes in interest rates or returns have a greater effect on repayment ability. Increases in interest rates mean a larger portion of income is used for loan servicing. When returns are not sufficient to make the loan payments, there are cash flow shortfalls.

Capital gains and the expectation of future capital gains encourages the ownership of land and the use of leverage. When growth expectations are capitalized into the price of land, current returns may be inadequate to meet debt servicing requirements. With a highly

leveraged land purchase, net farm income may not generate sufficient returns to meet debt repayment requirements. However, such a purchase can possibly be financed if there are earnings from other assets, financial reserves, or nonfarm income to make the payments. Lenders may also be willing to provide debt financing based on the unrealized capital gains.

3.3.6 Determining the Maximum Amount of Firm Leverage

The maximum leverage a farm can support is limited by the factors that affect repayment ability. The rate of return to assets, the flexibility of loan terms, and interest rates all affect repayment ability.

A study to identify the maximum feasible debt ratio (MFDR) that could be safely carried by a farmer was conducted (Hanson and Thompson). The MFDR (a debt/asset ratio) was determined by the debt repayment capacity in a low return year. The cash flow ability was based on estimates of the cash flow rates of return (ROR) the assets would earn annually. Estimates of cash income, consumption, taxes, debt servicing demands on cash income, and adjustments for inventory changes were used to determine the annual ROR. Their study analyzed information from southern Minnesota farms. The data for the study came from farm records for 1966-75 and were separated into 9 farm types with three farm sizes for each type.

The RORs for the low return year were used to determine MFDR for each farm type at three farm sizes. The rates of return for each farm type were estimated with a multiple linear regression model. The sum of the weighted enterprise returns was equated with the total farm ROR

annually. MFDRs were determined for each farm type and size for the low return or "critical" year.

Coefficients of variability of income were calculated for each farm type (coefficient of variability = standard error around the linear trend divided by the mean). These coefficients showed the relative range of deviation about the average income in the ten year time period. The larger the coefficient of variability, the greater the relative difference between actual income and income during a low return year. Thus, MFDRs decreased as the coefficient of variability increased.

The MFDRs differed substantially by farm type and size. The results of the model showed cash grain farms had lower MFDRs than most of the other farm types. When cash grain was mixed with another enterprise having a higher MFDR farm type, the MFDR for the mixed enterprise farm type was higher than that of the cash grain enterprise alone. While larger farms had larger MFDRs, the ability to defer debt principal affected debt capacity more than farm size.

The ability to defer principal payments also affected the debt capacity. Two payment plans were analyzed in the study. One plan required payment of all principal and interest as scheduled and the other allowed a two-year deferral on nonreal estate principal payments. Results showed the deferral allowed farms to handle a larger MFDR. The MFDRs for cash grain farms is shown on Table 3.2.

A second study analyzed MFDRs with deferrals of 1, 2, or 3 years compared to no deferral on nonreal estate principal payments (Thompson and Hanson). The study found that flexibility of loan repayment terms

TABLE 3.2

MAXIMUM FEASIBLE DEBT RATIOS

Cash Grain Farms By Farm Size

	Small	Medium	Large
No Deferral of Loan Payments Allowed	0.098	0.228	0.330
Two-Year Deferral of Nonreal Estate Loan Payments Allowed	0.147	0.282	0.376

Source: Hanson and Thompson

becomes more important as total debt servicing commitments increase with higher leverage.

The impact of interest rate changes on MFDRs was analyzed (Thompson and Hanson). Interest rate changes of 1 and 2 percentage points above and below the average historical levels were used. The interest rate changes were analyzed with the two year deferral of nonreal estate principal repayment plan. With a two-year deferral, increasing the interest rate by two points above the historical rate decreased the MFDR for cash grain farms from 0.282 to 0.256, while a similar decrease raised the MFDR to 0.312. These were based on a 5-year and 20-year maturities on intermediate loans and mortgages respectively. Extending the maturities to 7 and 40 years appeared to neutralize the effect of 2 percent increases in interest rates. Thompson and Hanson found that interest rate increases had a greater effect on the repayment ability of highly leveraged farms than that of low leverage farms. They concluded that "Interest rate changes of 1 to 2 percentage points above average historical rates did not appear to lower MFDRs more than a few percentage points. However, an increase in interest rates of about 4 percentage points would appear to reduce MFDRs by 10 to 15 percentage points for farm types that could otherwise support large debt loads."(Thompson and Hanson,p.43).

A study by Grabemeyer and Nott analyzed the impact changes in interest rates had on cash flows (Grabemeyer and Nott). The study analyzed 3 percent changes in interest rates and 10 percent changes in debt/asset ratios for various farm types. Data from Michigan Telfarm averages were used to create a benchmark farm for each farm type.

Changes in net cash flows resulting from interest rate increases were analyzed for short-term debt only, short and intermediate term debt, and all debt.

Since long-term debt tends to have lower interest rates than short-term and intermediate debt, the net cash flow changed less when debts were structured with a larger proportion of long-term debt. Their results showed that net cash flows changed from positive to negative as debt to asset ratios increased. The results also indicated that increasing debt to asset ratios by 10 percent had a greater impact on net cash flow than a 3 percent change in interest rates.

These studies have shown the maximum amount of leverage is affected by loan terms and the ability to defer payments in low return years. Changes in interest rates and farm income affect the level of debt that can be supported. The results of these studies demonstrate the financial risk faced with variable interest rate financing and leverage.

3.4 The Current Situation

3.4.1 The Use of Financial Leverage

Farm loan delinquency rates have been increasing recently (Hepp and Hardesty). Loan delinquency is evidence of cash flow shortfalls. The recent difficulties are related to the debt levels, rate of returns to assets, interest rates, and other loan terms.

Farm debt levels increased from $48,928 million in 1970 to $131,652 million in 1979 (Melichar,1984-A). Michigan farm real estate debt was $.67 million in 1970, $1.65 million in 1979, and $2.5 million in 1984 (Agricultural Statistics, 1980 and 1984). The use of debt financing for

real estate purchases increased dramatically during this time period. In 1945 only 44 percent of farmland transfers were credit-financed compared to 78 percent of transfers credit-financed in 1970. By 1979, credit financing was used for 90 percent of farmland transfers (USDA,1985-A). In 1945 the debt to purchase price ratio was 57 percent compared to 73 percent in 1970 and 79 percent in 1979 (USDA,1985-A).

Several factors contributed to the motivations to use leverage. In addition to increasing farm land values, rates of return and interest rates were favorable for the use of leverage. The rate of return to farm assets between 1970-79 ranged from a low of 1.2 percent in 1970 to an 18.4 percent high in 1973. The average rate for 1970-79 was 8.8 percent (Melichar, 1984-A). The average annual rate of interest rose from 6.4 percent in 1970 to 8.7 percent in 1979 (Melichar, 1984-A). With interest rates less than the rate of return, the use of leverage accelerated equity growth rates. Also with low to negative real interest rates, the debt would be paid back with "cheaper" dollars. The nominal interest rate adjusted for inflation equals the real interest rate. Real interest rates in 1970, 1975, and 1979 for PCA, FLB, and commerical banks were reported by Penson, Klinefeller, and Lins as follows:

	% real interest rates		
	1970	1975	1979
PCA	2.9	-0.2	-1.4
Commercial Bank	2.1	-0.3	-0.4
FLB	2.6	-0.4	-2.7

Source: Penson, et al, p.222.

The use of leverage in the 1970's allowed farms to increase their equity at a low real cost of debt.

A nationwide survey by the U.S.D.A. found 196,512 farms with debt to asset ratios of 70 percent and over; 50,599 of these farms were technically insolvent with debt to asset ratios over 100 percent (USDA, 1985-C). Farms in larger sales classes had the highest proportion of debt to asset ratios over 40 percent. As of January 1, 1985, farms with debt to asset ratios over 70 percent owed 29 percent of total farm debt and 32.9 percent of debt was owed by farms with debt to asset ratios of 40-70 percent (USDA, 1985-C). One third of U.S. farms are family-size farms with sales of $50,000 to $500,000 per year. There are 93,000 of these farms with debt to asset ratios ratios of 70 percent or more; they hold 20.4 percent of the total farm debt (Harrington). These figures show that a minority of highly leveraged operators hold the majority of farm debt and many of these operators are in the family-size group.

3.4.2 Recent Ability to Service Farm Debt

The changes in income, returns, and interest rates from 1980-84 have affected the ability of farmers to meet their debt servicing commitments. U.S. net farm income (based on 1967 dollars) averaged $8.3 billion per year from 1980-83 compared to an average of $15.3 billion per year from 1970-79 (Agricultural Statistics, 1984). Recent rates of return to assets have been low, ranging from 0.3 percent to -6.4 percent between 1980 and 1984 with an average of -3.4 percent per year for the 5 year period (Melichar,1984-A). Average annual interest rates for 1980-84 were 10.4 percent (Melichar, 1984-A). With interest rates greater than returns, real farm equity growth from 1980-83 was -5.3 percent

(Melichar, 1984-B). Interest paid as a percentage of net farm income increased from 64.2 percent in 1981 to 116 percent (projected) for 1985 (USDA, 1985-B). The projection for 1985 indicates interest payments are greater than net farm income. Cash flow problems occur with the decline in net farm income and the rate of returns. As of January, 1985, 50.4 percent of farms had negative cash flows (USDA, 1986).

When capital gains expectations are capitalized into land prices, current returns from land may be inadequate to meet debt servicing requirements for highly leveraged land purchases. Michigan farmers have experienced such problems. A survey of Michigan farmers found that farmers who purchased land between 1978 and 1981 had the highest loan delinquency rates (Hardesty and Hepp).

3.4.3 Asset Values and Leverage

Farm real estate values increased 171 percent in Michigan between 1973 and 1981 (USDA,1985-A). These capital gains were used as collateral for increased debt by many farmers.

Between 1981 and 1985, farm real estate values per acre in Michigan dropped 23 percent compared to 19 percent decrease nationwide (USDA, 1985-A). Total U.S. asset values were $1,089.8 billion in 1981 and dropped to $1,022.4 billion by 1985 (USDA, 1985-B). As asset values decline, the ability to refinance existing debt diminishes.

The ratio of debt to purchase price for credit-financed transfers ranged from 76-78 percent between 1980 and 1985 (USDA, 1985-A). This level of credit-financing on land purchases leaves little room for refinancing in the first few years after purchase.

3.4.4 Loan Delinquency

When a farm firm is not able to meet its debt servicing commitment, it is declared delinquent. Farm loan delinquency rates have been reported since 1982. Nationwide, delinquency rates increased from 3.9 percent in 1982 to 5.3 percent in 1985 (Table 3.3). Delinquency rates in Michigan have increased from 1982 to 1984 (Table 3.4). The most complete record of the delinquency rates at commercial banks was reported by Melichar, (1984-C). Delinquent farm loans as a percentage of farm loans outstanding increased from 5.5 percent in 1982 to 7.6 percent in 1984. In Michigan, 3.8 percent of farm loans were past due 30 days or more in 1984. These increases are not very large. One reason that the delinquency rates have not shown large increases is that lenders have restructured, refinanced, or liquidated loans. Table 3.3 indicates that the percentage of farm borrowers that were discontinued by the bank, borrowed up to their limit, went out of business, and in bankruptcy increased between 1982 and 1985; these farms were off the delinquency lists, but are still in financial trouble.

The number of loans rescheduled, consolidated, and reamortized by FmHA increased from 12,689 in 1982 to 30,204 in 1984 (Table 3.5). Since FmHA borrowers may have several loans under different classifications of farmer program loans, the number of delinquent borrowers is less than the number of delinquent loans. It appears that FmHA has kept delinquency rates from increasing by refinanciang loans with servicing actions. Even with increases in loan servicing actions, the number of FmHA delinquent borrowers rose from 66,470 in 1982 to 80,985 in 1984 (Table 3.5).

TABLE 3.3

INDICES OF FINANCIAL STRESS

Commercial Bank Loans to U.S. Agriculture

	percentages			
	1982	1983	1984	1985
Delinquent more than 30 days (by loan value)	3.9	3.7	4.5	5.3
Borrowers discontinued by bank	3.3	2.9	3.4	4.5
Farms loan up to practical limit	31.9	28.1	32.8	36.7
Farms in bank's area who went out of business	2.2	2.3	3.6	4.8
Farms in bank's are who went through bankruptcy	.75	1.1	2.6	3.8

Source: USDA, 1986, p.20.
Data from American Bankers Association Mid-Year Farm Credit Survey, 1982, 1983, 1984, and 1985.

TABLE 3.4

DELINQUENCY RATES FOR VARIOUS MICHIGAN LENDERS

	% Of Borrowers Delinquent On December 31			% Of Loan Volume Delinquent On December 31		
	1982	1983	1984	1982	1983	1984
Production Credit Association	2.0	1.8	2.2	2.2	2.0	2.7
Federal Land Bank	4.4	3.0	3.7	.3	.2	.8
Commercial Banks (Farm Nonreal Estate	----	----	----	2.6	3.1	3.8
Farmers Home Administration	26	26	26	----	----	----

Source: Hepp and Hardesty.

TABLE 3.5

FARMERS HOME ADMINSTRATION FARMER PROGRAM LOANS
(All U.S.)

	1982	1983	1984
Number of borrowers	270,209	271,099	273,197
Number of delinquent borrowers	66,470	77,111	80,985
% delinquent loans	24.6	28.4	29.6
Number that left farming	8,277	7,529	6,713
Number of acceleration letters sent out	4,314	3,630	2,954
Loans rescheduled, consolidated, and reamortized	12,689	30,804	30,204

Source: Farm Credit Administration (FCA), 1985, p.33.

3.5 Summary

Financial ratios and nonratio measures are used in the analysis of the farm business. These factors are used to determine the financial position and profitability of the farm firm. These factors also determine the amount of leverage to use, the ability to repay debts, and the efficiency with which capital is being employed in the firm.

Leverage can be useful to accelerate the growth of equity when the rate of return exceeds the cost of debt. The actual rate of growth is determined by the rate of return, interest rates, leverage, off-farm uses of farm returns, and tax rates.

As leverage increases, liquidity risks rise. The current increase in farm loan delinquency, liquidation, and bankruptcy rates can be traced to the increased use of leverage in the 1970's and the subsequent adverse changes in returns to farming and interest rates in the early 1980's. In the following chapter, the factors contributing to farm loan delinquencies will be examined quantitatively.

CHAPTER FOUR

RESEARCH METHODOLOGY, ANALYSIS, AND RESULTS

4.1 Introduction

This study analyzed data from delinquent and nondelinquent farm borrowers in order to explain some possible causes of loan delinquency among Michigan farmers. Financial histories of farm borrowers were obtained from lenders' records. Discriminant analysis was applied to determine the factors which distinguished delinquent from nondelinquent borrowers. This chapter discusses the design of the data collection effort, lender response to the data requested, analysis of the data, and results of the discriminant analysis.

4.2 Design Of The Analysis

The analysis was designed to identify characteristics and management practices that distinguish delinquent and nondelinquent agricultural borrowers. Characteristics pertaining to farm size, business arrangement, financial position, performance, and risk management strategies were identified and included on the data gathering form. Agricultural lenders were asked to provide this data over a five-year time period from their borrowers' records. Data were collected from loan applications, farm plans, and financial statements of delinquent and nondelinquent cash grain farm borrowers. The cover

letter, selection criteria, and data gathering form are in Appendix B. This section describes the lender selection, borrower selection, and design of the data gathering form.

4.2.1 Lender Selection

Borrower histories were collected from four major types of agricultural lenders: Farmers Home Adminstration (FmHA), Production Credit Associations (PCA), Federal Land Bank Associations (FLB), and commercial banks. The commercial banks selected were those which were active in agricultural lending between 1979 to 1984.

The number of borrowers selected from each type of lender was proportionate to their share of Michigan agricultural borrowers. The proportion of total farm borrowers serviced by each of the major lenders are approximately: commercial banks-14 percent, PCA-11 percent, FLB-29 percent, and FmHA-6 percent (U.S.D.A., 1982). These approximate proportions do not equal 100 percent because some borrowers have loans from life insurance companies, individuals, and others. Borrowers were not selected by lenders' proportion of loan volume or number of loans because real estate loans would have substantially greater volume than nonreal estate loans and borrowers could have several loans with one lender.

4.2.2 Borrower Selection

The study was restricted to cash grain farms. These farms typically produce corn, soybeans, and wheat for sale. Cash grain farms were selected because of their importance in resources controlled and income generated in Michigan. Livestock based farms were not studied because of the confounding interactions between the livestock and crop

enterprises. Lenders were requested to identify farms where cash grain farming was considered the main income generating enterprise.

The four counties selected for study are representative of typical Michigan cash grain production areas where farms are faced with similar production and marketing situations. These counties are Calhoun, Clinton, Eaton, and Lenawee (Figure 4.1).

The borrowers selected were intended to be in similar financial situations on December 1979. All borrowers selected were to be solvent and have nondelinquent loans at the beginning of the study period. The study was intended to be limited to borrowers with debt to asset ratios of 0.50 or less on December 1979. Borrowers were required to have operated 300 or more acres in 1984. This criterion was used to limit the sample to full-time farmers. The selection criteria (Appendix B) specified that on December 1984 one-half of the borrowers were to be delinquent and one-half were to be nondelinquent. The nondelinquent borrowers were those who had repaid loans as scheduled and the delinquent borrowers were those who were 90 days or more delinquent on scheduled payments as of December 1984.

The number of borrowers selected was limited due to the detailed nature of the information requested. However, the number of borrowers in the analysis had to be large enough to test the statistical significance of the results. Assuming that the observations are normally distributed, it was determined that at least 50 cases were needed to test the results of the study at the significance level of 0.05 (or the 95 percent confidence probability level). The total number of borrowers to be included in this study was set at 72 to allow for

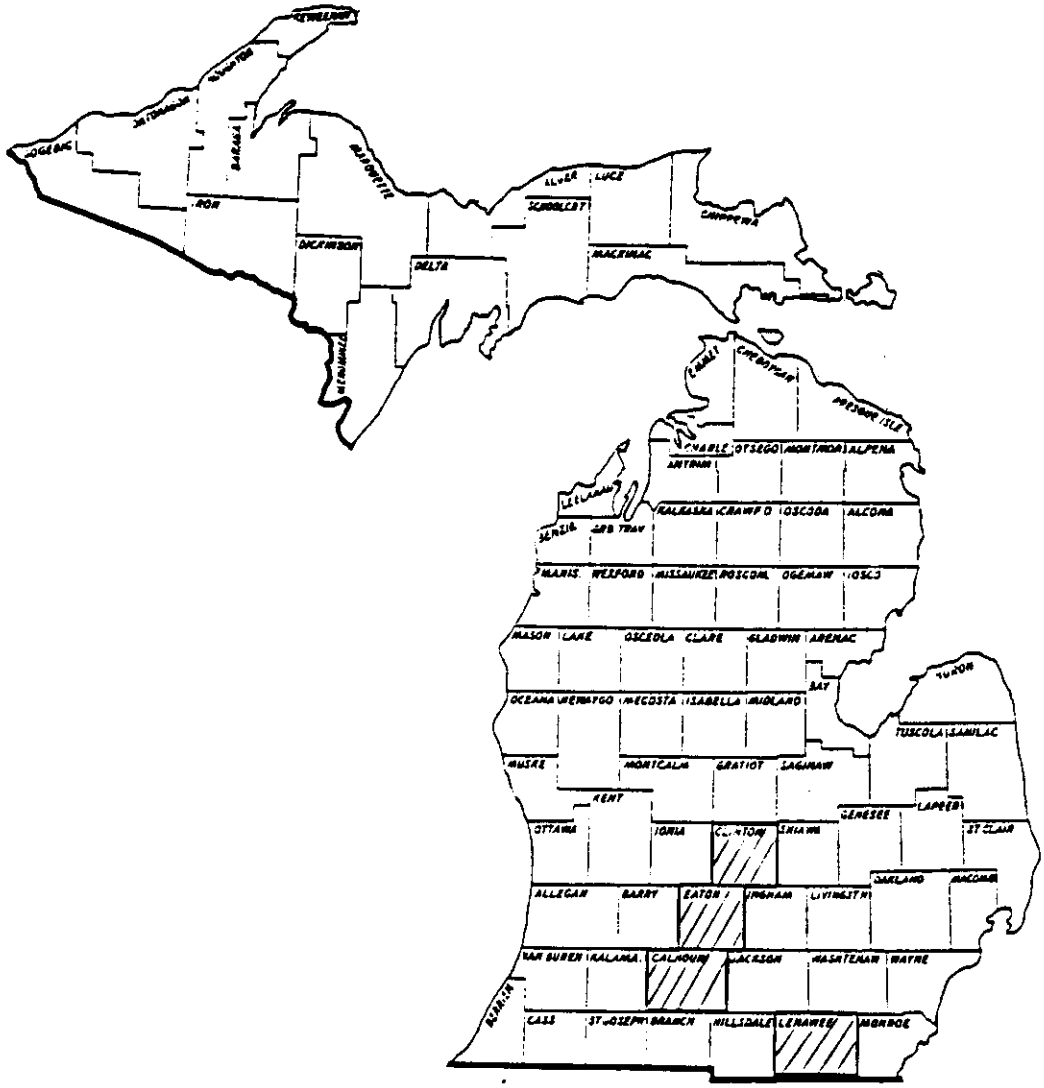

FIGURE 4.1. LOCATION OF COUNTIES SELECTED FOR THE STUDY

data collection problems, such as cases which did not meet all the selection criteria.

4.2.3 Design of Data Gathering Form

The data gathering form was organized in six sections to collect descriptive data on farm identification, characteristics of size and structure, financial condition, debt servicing, production efficiencies, and risk management strategies. The data gathering form (Appendix B) recorded five years of loan history and financial information for each borrower.

The first section concerned identification of the type of lender, farm location, type of loan, and loan status. This information was used to classify the borrower by loan status for the analysis. The additional data on the type of loan were used to sort and identify borrowers.

The farm characteristics section concerned the business arrangement and personal characteristics of the primary operator, the farm size, and major changes due to expansions or liquidations. Operator's age, off-farm income, acres operated, acres owned, and purchases or liquidations of assets were requested in order to compare differences in age, off-farm income, and growth management strategies between delinquent and nondelinquent borrowers.

Balance sheet and income statement information, including income and expense projections, were recorded in the third section. These two financial statements provided data for measurement and comparison of the leverage, solvency, liquidity, capital turnover, and profitability. This information was collected in order to determine if the standard

financial ratios of delinquent and nondelinquent borrowers differed. The projected income and expenses were requested in order to determine if differences between actual and projected performance contributed to loan delinquency.

The fourth section concerned loan information and loan servicing. This included new borrowing, payments scheduled and payments made, interest rates, as well as appraisal information. Loan history and loan servicing information were requested to ascertain if loan activity and the lenders' servicing actions could have affected borrowers' delinquency status on December 1984. The amount and purpose of new loans made, along with dollars refinanced and reamortized, were used to determine the change in debt levels and debt structure for the two loan status groups. Payments scheduled and made were requested for determining differences in the portion of income used for debt servicing. Changes in interest rates charged by lenders and lenders' valuation of security were requested to determine their impact on loan delinquency. The frequency of lender contacts with delinquent and nondelinquent borrowers were compared to determine the amount of additional loan servicing contacts for delinquent borrowers.

Section five requested data on projected and actual crop acreage and yields. This information was collected in order to compare the production anticipated with the actual production performance. A history of participation in government programs was also collected in this section. Farmers participate in government programs by setting aside a required acreage in order to receive price and income supports which reduce the financial risk associated with adverse changes in grain

prices. The acres set-aside were collected to indicate the amount of participation in government programs.

The sixth section related to the use of six other risk management strategies. Forward contracting of crop sales and hedging are marketing tools used to limit income risk due to adverse changes in prices. Crop insurance is used to reduce the risk of losses due to crop failures. Farmers can select from a combination of three price and three yield levels for crop insurance depending on the level of financial risk they want to take in the event of a crop failure. Soil testing is a management strategy to control input expenses by determining the desired amounts of fertilizer to use. Forward contracting of inputs is used to stabilize expenses. Credit life insurance is used to reduce financial risk on debt by providing payment of the debt in the event of death. This assures that farm assets would not have to be liquidated to pay creditors. Data related to risk management strategies were requested to determine if these strategies would affect loan delinquency.

4.2.4 Pretesting of Data Gathering Form

Pretesting of the data gathering form allowed for detection of data collection problems that could arise from lenders misunderstanding what data were being requested or having difficulty in completing the forms. The pretest and revisions to the data gathering form were necessary to assure that the most consistent data set could be obtained. Also, the easier the form is to complete, the more likely it will be completed and returned to the researcher.

After the pretesting, the data gathering form was modified to make several sections easier to complete. Some changes were made in the

section on loan information and loan servicing to allow room for data when the borrower had several loans with the lender. The changes also allowed for clarification in terms of loan purpose by separating loans made to restructure debt from loans for new purchases. This allowed for comparison of new loans and debt restructuring for the two loan status groups. Changes in the yields and acreage section were made to separate acreage data to show set-aside acreage as an indicator of participation in government programs. Additional space was provided for comments. Appendix C shows the preliminary data gathering form (before pretesting); the final data gathering form is included in Appendix B.

4.3 Response To The Study

4.3.1 Lender Response to the Study

The PCA, FLB, and FmHA offices and 15 commercial banks which serve the four counties selected were contacted to participate in the study. All the PCA, FLB, and FmHA offices submitted data. Seven banks participated in the study. Three banks submitted data. An additional four banks commented on their agricultural lending criteria. Eight banks did not participate due to a lack of borrowers which fit the selection criteria or a lack of interest in the study.

Many of the commercial banks did not have borrowers with a five year history or borrowers who were delinquent beyond 90 days. Banks do not tend to carry delinquent accounts beyond 90 days. Bank loan officers commented that their interest rates were relatively high during 1980 to 1981, causing some borrowers to seek other credit sources.

Thus, financial information for the requested number of borrowers could not be obtained from the commercial banks.

FLBs and FmHA had some difficulty selecting borrowers with two or more years of loan history. Because FLB is a long-term lender, annual financial data were not collected unless there was some loan servicing activity or additional lending. FmHA borrowers who did not obtain operating loans did not have annual financial data. Finding data on nondelinquent borrowers was also a problem. The only information available on many nondelinquent FmHA and FLB borrowers concerned payments scheduled and collected.

Some lenders had difficulty locating borrowers with a debt to asset ratio of 0.5 or less on December 1979. Because FmHA is the lender of last resort, FmHA had the most difficulty with this criterion. PCAs also had difficulty in identifying borrowers to meet this criterion. PCAs had several borrowers they considered as not financially in trouble on December 1979 even though their debt to asset ratios were greater than 0.5. The lenders were instructed to identify borrowers who came as close as possible to meeting the criteria.

Financial information for the requested number of farm borrowers could not be obtained due to a lack of permission from FLB borrowers to release information. Both PCA and FLB loan officers expressed concern that public relations between the borrowers and lenders were strained due to interest rate increases and negative publicity regarding the financial condition of the Farm Credit System. This made it difficult to obtain borrowers who would participate in the study.

4.3.2 Data Set

Data forms on 57 borrowers were completed. Of those 57, six could not be used because they were not cash grain farms. There were 51 borrowers who met all of the criteria except the 0.5 debt to asset ratio maximum on December 1979. In order to retain a reasonable sample size, this ratio was increased to 0.69. This produced a sample of 17 nondelinquent and 21 delinquent borrowers.

4.3.3 Data Collection Problems

There were many instances of incomplete data in the borrower records which were collected. All lenders had some years when financial data were not collected. Lenders did not collect borrower information unless needed for a new loan or for loan servicing. The real estate loans had less loan activity, as real estate is not purchased or refinanced as often as machinery or production inputs. Nonreal estate loan records also had some missing data for the years when there was no loan activity. Borrowers who obtained operating loans each year had the most complete data.

It was expected that FmHA would have the most complete records as FmHA requests annual data from each borrower for year-end analysis. Not all borrowers comply with the request; thus FmHA had borrowers with missing records. This was most common where the borrower was nondelinquent and did not obtain annual operating loans. Some FmHA files had been transferred from office to office due to county assignment changes. The transfers along with changes in office personnel may have had some effect on the follow-up and collection of borrowers' records.

The data on lender contacts (phone calls, visits, and letters) were estimated by most lenders. FmHA includes a record of office visits, phone calls, and farm visits along with copies of letters in their loan files. Other lenders keep copies of letters and records of notes on some farm visits or other lender contacts. Because many lenders do not record in detail the office visits or phone calls, the number of contacts with the borrower during the year had to be estimated. Lenders did keep records of contacts for adverse action.

Most appraisals on security were updated only when needed for further lending, subordinations of liens, other loan servicing, or liquidation actions; thus, annual asset valuations were infrequent. The delinquent borrowers had more recently updated appraisals as lenders determined values for decisions on further servicing actions.

Data concerning acreage and yields were most frequently missing. Most PCAs, FLBs, and commercial banks did not collect this detailed information on crop production. Very little data were available on the amount of acreage in government set-aside. PCA and FmHA had the most complete records on acreages and yields for borrowers who were obtaining operating loans. Many borrowers had projected data for the year the loan was obtained, but did not have actual data recorded or projections for subsequent years.

Most lenders could not respond to the questions about the risk management strategies used by borrowers. When lenders did not know the type of risk management strategies used, their records did not have the crop, quantity, or price data pertaining to the strategy.

4.3.4 Lender Comments on Loan Criteria

In addition to completing the data gathering forms, lenders were asked to comment on their own process in evaluating loan applications. Of particular interest was the type of data used in loan application decisions. The interviews with lenders were conducted on the phone and in person.

All the lenders used a combination of factors in making their credit decision. Management ability, collateral, and repayment ability were consistently identified as important factors. Collateral and repayment ability were determined from application information. Management ability was measured on a more subjective basis. FLB and PCA ranked their borrowers in terms of management ability with a "man" factor: of 1 to 5.

Lenders used varying subjective measures to determine management ability. Most of these measures were expressed in some form of character judgement about the borrower. These subjective measures, along with a comparison of the farm's production to that of other similar farms, were used to determine an acceptable level of management ability for borrowers. Terms such as "good operator", "good farmer", and "good management" were used by lenders in describing management ability. Management ability appears to be an illusive term without a clear consensus of opinion on a quantifiable measure of what lenders consider an acceptable level of management ability.

Lenders obtained financial information on their borrowers through balance sheets, income statements (usually asking for past federal income tax Schedule F forms), and projected cash flow statements. The

verification of information among lenders differed according to the amount and type of loan, the previous experience with the borrower, and the lender's credit policies. Three of the commercial banks used outside appraisal services to evaluate collateral for loans. Four of the banks had changed their lending criteria over the past few years and felt that their most recent records provided better information for analyzing the borrower's financial position. Three bank loan officers said, "borrowing on your signature" was a thing of the past and farmers were expected to prepare financial statements for applications. Both PCA and FLB used application information and information from a farm visit to make loan decisions.

4.4 Analysis Of The Data

4.4.1 Discriminant Analysis

Discriminant analysis is a statistical method of distinguishing between two or more groups. The discriminant technique was selected because borrowers were members of two mutually exclusive groups: delinquent and nondelinquent borrowers. With the discriminant technique an entire profile of characteristics can be used to classify group membership.

The discriminant technique is used to determine which variables best "discriminate" between groups. Given measurements of selected variables, the resulting discriminant function is of the form:

$$D = d_1 z_1 + d_2 z_2 + \ldots + d_p z_p$$

where D is the discriminant score, the d's are the weighting coefficients, and the z's are the standardized values of the p

discriminating variables used in analysis (Nie, et al). The discriminant score is computed for each case. The group centroid is computed by averaging the scores for the cases within a particular group. Comparison of group centroids indicates how far apart the groups are. The discriminant method assumes that the independent variables have a probability distribution which is multivariate normal and the population covariance matrices are equal for each group.

The dividing point between groups is generally the midpoint between the group centroids. Cases are classified into groups according to this cut-off score (or dividing point between groups). The discriminant score cut-off point can be adjusted to limit misclassification errors to assure that the more serious type of misclassification error can be reduced; however, this leads to increased misclassification error of the other group. Also, two cut-off scores can be selected to identify a middle group ("zone of ambiguity") between the two groups. This zone provides a method for limiting misclassification errors by creating a middle range of unclassified cases.

4.4.2 Discriminant Method Used

The Mahalanobis stepwise method was used to identify the explanatory variables. With a stepwise method, the independent variables are selected for entry to the equation on the basis of their discriminating power. The Mahalanobis (Mahal) method includes variables on the basis of the maximized squared difference between subgroup means. The more separation between group centroids, the larger the F ratio. The F ratio is the ratio of distance between means to the spread within the distributions.

At each step in the stepwise procedure the inclusion of a variable was based on its "F to enter." "F to enter" is a partial F ratio which is "the likelihood ratio of equality on the test variable over all the groups, given the distribution produced by the variables already entered" (Nie, et al, p.453). The "F to enter" is a test for statistical significance of centroid separation added by the variable being tested above and beyond the separation produced by other variables already entered. At each step variables already included are tested, so variables can be added or removed based on their ability to separate groups. A minimum partial F ratio value of 1.0 (associated with a significance level of 0.50) was used to test for entering and removing variables. This minimum partial F value for the "F to enter" and "F to remove" was selected to provide for an acceptable level of group separation with the limited number of cases in the analysis. The tolerance level is checked for each variable before it is tested for selection. The tolerance level is set to limit rounding errors that may occur while discriminant coefficients are being computed. The minimum tolerance level of 0.001 was used.

4.4.3 Variables Selected for Analysis

Variables selected for the discriminant analysis in this study were measures of liquidity, solvency, profitability, leverage, farm investment and disinvestments, and risk management stategies used. Both ratio and nonratio variables were used in the analysis. Variables which were found to be significant discriminating variables in previous studies (Table 2.1) were included in this analysis.

A preliminary analysis of the 25 variables (Appendix D) considered was done by cross-tabulating the data. The cross-tabulations created tables of the values for the categorical variables for the delinquent and nondelinquent borrowers. These tables were used to compare the values for each variable for delinquent and nondelinquent borrowers. Visual comparisons were used to identify variables which showed differences between the two groups. This preliminary analysis also identified the number of borrowers with observed values for the variables being considered.

The preliminary analysis identified 15 variables that did not show differences between delinquent and nondelinquent borrowers. The variables of age, off-farm income, acres owned, acres operated, and major purchases or liquidations were among the variables which the visual comparisons showed no differences in the distribution of values for the two groups. While the survey conducted by Hepp and Hardesty found that expansions in the 1970's contributed to repayment problems, this study didn't find expansions or liquidations between 1980 to 1984 as distinguishing characteristics between delinquent and nondelinquent borrowers. The amount of off-farm income for 1984 did not differ for the two borrower groups. However, it is likely that borrowers who began experiencing repayment problems from 1980 to 1983 could have sought off-farm employment by 1984. The off-farm income may have kept them from being delinquent in 1984.

For some variables there was a lack of data available for them to be used as a characteristic to separate the two borrower groups. There were insufficient data on the variables for the risk management

strategies used and the variables on the projected and actual production for the farm.

In the selection of variables in the discriminant analysis the correlation matrix was used to measure the strength of the relationship between two variables. Because one variable may vary in relationship to another variable, the correlation matrix was used to identify and eliminate highly correlated variables. Variables with correlations of 0.25 or less were acceptable. Low values in the correlation matrix indicate that each variable provides additional information which may be useful for separating the groups.

There were 10 variables that did show differences between the two groups. These variables were:

1) Change in debt to asset ratio from 1980 to 1984
2) Turnover ratio (gross income to total assets) in 1980
3) Change in acres operated from 1980 to 1984
4) Total major purchases for 1980 and 1981
5) Interest paid to acres operated in 1980
6) Debt to asset ratio in 1980
7) Total loan payment made to net farm income in 1980
8) Total payment made to total assets in 1980
9) Net farm income in 1980
10) Change in value of loan security from 1980 to 1984. Discriminant analysis was then used to identify which variables had the ability to separate the borrower groups.

4.5 Description Of Results

Data were analyzed with SPSS, Statistical Package for Social Sciences (Nie,et al and Hull and Nie). The most recent release of SPSS (SPSS-6000, Version 9.0) was run on the Cyber 750 mainframe computer at Michigan State University. This program was selected because it provided the analytical procedures for cross-tabulation and discriminant analysis needed to satisfy the objectives of this study.

4.5.1 Results Regarding the First Objective

Objective one was to identify the characteristics that distinguish delinquent from nondelinquent borrowers. The discriminant technique was applied to the ten variables. Because the discriminant technique only includes cases which have data for all the variables in the analysis, the high incidence of missing data in borrowers' records affected the number of cases in the analysis. The number of cases included in the analysis was because of the desire for statistically significant results. Because there were numerous instances of missing data for the cases in the study, it was not feasible to analyze all ten variables at the same time. Various combinations of four variables were analyzed.

In the discriminant analysis the nondelinquent borrowers were coded with zeros and the delinquent borrowers were coded with ones. In the resulting discriminant equations, positive coefficients for variables would indicate that the variables contributed to loan delinquency.

The discriminant technique was applied to the turnover ratio in 1980, the interest paid to acres operated ratio in 1980, the debt to asset ratio in 1980, and net farm income in 1980. There were 17 borrowers for whom data were available for all four variables. The

analysis identified three variables which distinguished between the delinquent and nondelinquent borrowers. The following discriminant equation was determined:

$$D = 0.75603\ Z_1 + 0.60944\ Z_2 - 0.59647\ Z_3$$

where: D = Classification score

Z_1 = Debt to asset ratio in 1980

Z_2 = Turnover ratio in 1980

Z_3 = Net farm income in 1980

In an effort to have more borrowers included in the analysis and minimize the effects of missing data, another analysis was done using only the three significant variables. This resulted in the following equation:

$$D = 0.84316\ Z_1 + 0.61015\ Z_2 - 0.52455\ Z_3$$

Of the 38 borrowers in the data set, 18 had values for the three variables that were tested in the final analysis. The addition of one more borrower had very little impact on the coefficients for the three variables, but was selected as the equation used for scoring the borrowers because it was based on a larger number of borrowers. After the discriminant equation was determined, it was used to compare predicted group membership with the actual group membership. The equation correctly classified 82 percent of the grouped cases. Eighty-two percent of nondelinquent borrowers and 81 percent of delinquent borrowers were correctly classified by the equation.

Since normalized values of the variables are used in the discriminant equation, the estimated coefficients measure the relative strength of the discriminating ability of the variables. The signs on

the coefficients show the direction of the relationship between the variable and the group classification. The sum of each coefficient times the individual borrower's value of the discriminant variable is the discriminant score. Borrowers with discriminant scores larger than -0.17 would be classified into the delinquent group, while those with scores smaller than that would be classified into the nondelinquent group.

The positive signs on the debt to asset and turnover ratios indicate that larger values for these ratios would contribute to a classification of the borrower into the delinquent group. It was expected that as the debt to asset ratio (leverage) increased the more likely a borrower would be delinquent. The coefficient for the debt to asset ratio variable indicates a strong relationship between the degree of leverage and loan delinquency. The turnover ratio is a measure of how efficiently capital is used in the business. It was expected that this ratio would be inversely related to loan delinquency; the resulting positive coefficient was not expected. However, the turnover ratio is affected by asset values and gross farm income. Lower asset values increase the turnover ratio; thus, this variable could be affected by the valuation of assets in 1980. The negative sign on the net farm income coefficient indicates it is inversely related to loan delinquency. Thus, the smaller net farm income is the more likely a borrower would be delinquent. The relationship between net farm income and loan delinquency was as expected.

The average discriminant score of the borrowers in each group is the group mean or centroid. The group centroids were -0.93 for the

nondelinquent borrowers and 0.59 for the delinquent borrowers. The group centroids and the distribution of the borrowers in each group are shown on Figure 4.2. The distribution of each of the groups (Figure 4.2) is nearly evenly distributed about the group mean. Figure 4.2 also shows the combined group scores.

Some misclassification exists due to the closeness of the group centroids. Most of the misclassification occurs in the area between the group centroids. The misclassification of borrowers is of particular concern when classification errors would be costly. Classifying a delinquent borrower as nondelinquent could result in loan losses. A copy of the complete computer output for the discriminant equation is included in Appendix E.

In addition to the graphic comparison, statistical tests can be applied to evaluate the strength of the discriminant equation. Wilks' lambda was calculated for the equation. The Wilks' lambda is the ratio of the within sum of squares divided by the total sum of squares for the discriminant scores of the borrowers. This ratio ranges between zero and one. The larger the Wilks' lambda, the better the equation explains separation between groups with the discriminating information (Nie, et al). The Wilks' lambda for the resulting equation was 0.618. This indicates the discriminanting equation's strength in separating the two loan groups.

The equation compares well with those in other studies. The equation correctly classifies more borrowers than those of Dunn and Frey's (75 percent), and Johnson and Hagan's (61.6 percent). Hardy and Weed's equation had a higher classification of problem loans at 93.5

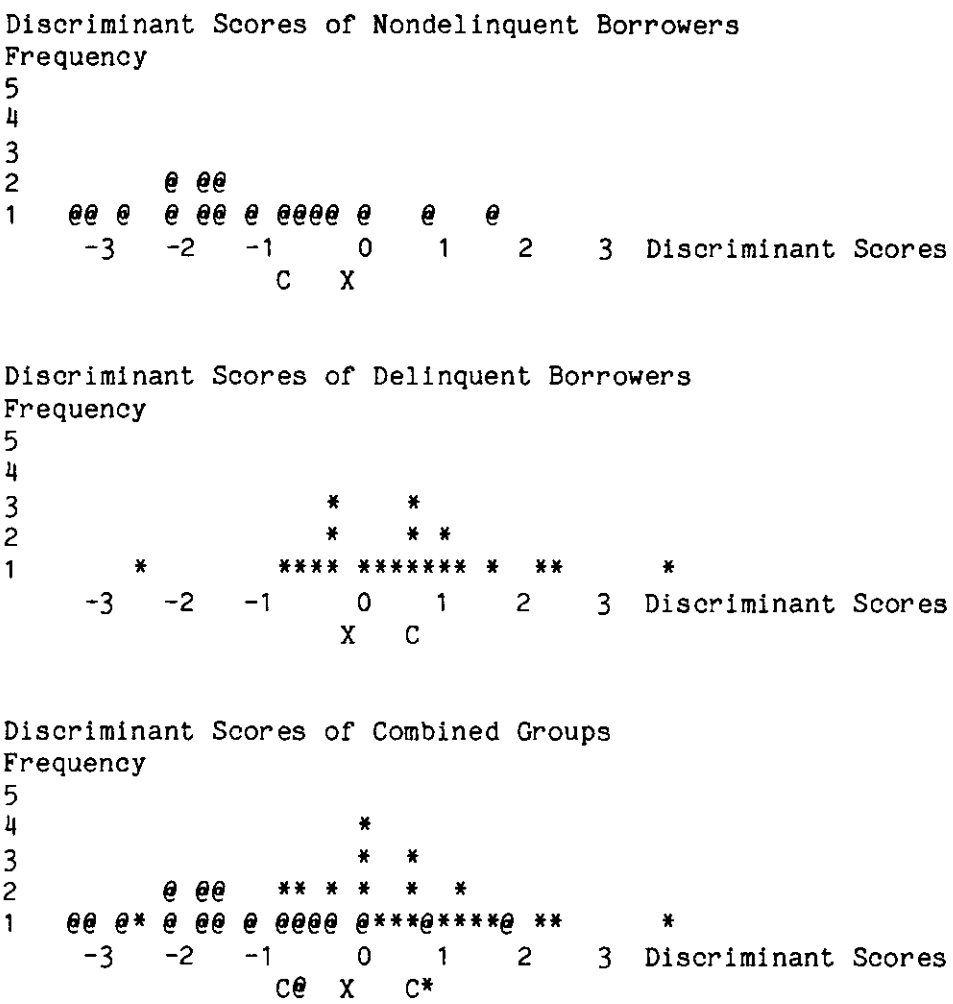

FIGURE 4.2. DISTRIBUTION OF DISCRIMINANT SCORES #
(As Stacked Histogram)

\# The equation tested on each actual classified case in the study by using the group means for the variables were the actual value was missing. Thus, all 38 cases are included in the discriminant scores.
C= Group Centroid
@= Nondelinquent
*= Delinquent
X= Cut off point between groups is equal distance between the group centroids

percent (Hardy and Weed,1980). This was made possible by adjusting the cut-off score, which then classified only 44.8 percent of acceptable loans correctly. The acceptability of this study's equation depends on the amount of misclassification that can be tolerated in use of the model as a predictor for the potential of delinquency. The costs of misclassification errors are important in evaluating what is an acceptable level of correct loan classification.

4.5.2 Misclassification by the Discriminant Equation

The misclassification of borrowers by the equation is partly caused by data problems. Because the study included borrowers from different types of lenders and borrowers who had real estate and nonreal estate loans, it was difficult to show separation in the groups. It appears that there are differences in the loan standards of the various lenders. It also appears that lenders may have weighted some variables differently in their loan decision depending on the type of collateral for the loan. Real estate lenders may consider different factors than nonreal estate lenders. These differences make it difficult to determine a scoring model when data from a mix of lenders and loan types are used. There appears to be a diversity in the borrower's financial condition and the data collected by lenders.

Loan performance standards also differed with the mixed lenders. The differences in the loan standards meant that some lenders refinanced or reamortized loans. These servicing actions rolled payments due back into loan balances so that borrowers who were unable to make payments were not delinquent. Borrowers from lenders which did not have loan

standards which allowed this restructuring of debts and were not able to make their payments were delinquent on their accounts.

The lenders' practices in recording borrowers' data caused data problems for this study. The study requested in depth borrower data in order to determine the causes of farm loan delinquency. The completed data gathering forms showed many instances of missing data. Lenders did not record all the financial data on all their borrowers. It appears that lenders increased their review of the borrower's situation as the borrowers began to experience financial difficulties. It also appears that lenders may have influenced borrowers valuation of their balance sheets. A more conservative valuation of assets for higher risk borrowers relative to more solvent borrowers would result in less consistent data from balance sheets.

The lenders selected borrowers for the study who had the most complete records. Borrowers with the most individual data had obtained new loans or had received loan servicing in the five year time period of the study. Thus, the data collection procedures for this study produced a bias towards borrowers who were experiencing financial difficulties throughout the five year period. The nondelinquent borrowers in the study were probably in worse financial condition than nondelinquent borrowers who were not in the study because lenders had the least data available on the latter group. The delinquent and nondelinquent borrowers in this study probably are not as different as they could have been if lenders had collected more complete information annually on all of their nondelinquent borrowers.

4.5.3 Results Regarding the Second Objective

The second objective of the study was to identify differences in actual and projected farm income that contributed to loan delinquency. Actual minus projected gross farm income was compared for each of the five years. The ability to accurately project income is important because scheduled debt repayment depends on the actual income received. Table 4.1 shows the number of borrowers in each group by categories of actual less projected gross farm income.

Annual differences between actual and projected gross farm income ranged from -$318,481 to $125,327. The large negative difference between actual and projected would indicate serious overestimation of income. Borrowers who based debt repayment on such overestimated income projections would experience cash shortfalls and lack of debt repayment ability. Delinquent borrowers were more likely to seriously overestimate their gross farm incomes than nondelinquent borrowers (Table 4.1).

The amount of projected income that was planned for debt servicing was compared for both loan status groups. The payment scheduled to projected gross income ratios for all five years averaged 33 percent for nondelinquent borrowers and 43 percent for delinquent borrowers. In each of the five years, the average ratio for delinquent borrowers was equal to or greater than the average ratio for nondelinquent borrowers. In 1984, the average portion of projected income scheduled for debt repayment was 53 percent for delinquent borrowers compared to 34 percent for nondelinquent borrowers. This indicates that a greater portion of income is allocated to debt repayment by delinquent borrowers

TABLE 4.1

COMPARISON OF PROJECTED AND ACTUAL GROSS FARM INCOME

Overestimation of Gross Farm Income
(Projected Greater Than Actual)

	Number of Observations	
	Nondelinquent Borrowers	Delinquent Borrowers
0 to 25%	9	11
26 to 50%	5	13
Over 50%	0	7
Total Observations	14	31

Underestimation of Gross Farm Income
(Actual Greater Than Projected)

	Number of Observations	
	Nondelinquent Borrowers	Delinquent Borrowers
0 to 25%	7	8
26 to 50%	3	4
Over 50%	0	2
Total Observations	10	14

and shows that the delinquent borrowers have lower liquidity than the nondelinquent borrowers.

The ratios of actual payments made to actual gross income for both loan status groups were also compared for all five years. For the nondelinquent borrowers, the five year average was 33 percent of actual gross income used for debt repayment. The average for the delinquent borrowers was higher at 39 percent. In each of the five years, the delinquent borrowers' average proportion of income used for debt payments was equal to or greater than the average for nondelinquents. Delinquent borrowers have less liquidity than nondelinquent borrowers. There would be a greater potential for repayment problems when the borrower has lower liquidity.

4.5.4 Results Regarding the Third Objective

The third objective concerned changes in valuation of loan security and repayment schedules which may have contributed to loan delinquency. The changes in the appraised values were compared for the five year period. The payments scheduled and payments made were also compared.

Comparisons of changes in security valuation were difficult to make due to the limited data available. Lenders did not reappraise assets unless there was a new loan or loan servicing action. It appeared that after a borrower became delinquent, an evaluation of security was made in determining alternatives for loan servicing.

There were many incidences of reamortized, refinanced, consolidated, and rescheduled loans. This debt restructuring was possible where there was sufficient collateral for the debts. These

actions increase the leverage for the borrower, and allow the borrower to continue the farming operation in the short run. Reamortization and rescheduling of loans can lower the annual payments by extending the time period of the loan and thus, ease cash flow stress. Reamortization and refinancing can reduce liquidity as accrued interest is added to the principal to become the new principal balance after the loan servicing action is completed. Nondelinquent borrowers had 19 loans compared to 55 loans of delinquent borrowers which were reamortized, refinanced, rescheduled, or consolidated in the five year time period of this study. It appears these loan actions may have delayed delinquency or may have helped borrowers to avoid delinquency.

There was no evidence from the data available that these changes in repayment schedules altered the payments in such a way as to contribute to loan delinquency. These alterations did not appear to be changes in the "rules of the game" in terms of adverse impacts on the borrower's loan repayment schedule.

4.5.5 Results Regarding the Fourth Objective

The fourth objective was to identify risk management strategies documented in the loan file and determine their effectiveness in minimizing loan delinquency.

The responses to six risk management strategies questions were intended to be used in the analysis. However, these strategies could not be analyzed because of a lack of data (Table 4.2). Lenders tended not to collect specific data on if and how their borrowers use risk management strategies.

TABLE 4.2

RISK MANAGEMENT STRATEGIES
(As Reported By Lenders)

	Number of Responses					
	Nondelinquent			Delinquent		
and refinancing can reduce liquidity as accrued interest is added to the principal to become the new principal balance after the loan servicing action is completed. Nondelinquent borrowers had 19 loans compared to						
Hedging	3	3	8	6	4	10
Crop Insurance	2	3	9	5	4	11
Credit Life Insurance	7	2	8	6	8	6
Soil Tests	6	0	8	5	1	14
Forward Contract Inputs	3	2	9	0	7	13

4.5.6 Other Results

The source of the borrowers' balance sheet information was requested. There appears to be differences in the methods used by lenders to gather information from borrowers and lenders may influence how borrowers report their asset values. Borrowers tend to complete their financial records according to the requests and expectations of their lenders. Thus, a balance sheet completed from borrower's records could reflect the lender's standards for acceptable asset values. Only three borrowers had balance sheets based on the lenders' valuation. PCA and FLB each had two borrowers where a combination of lender's and borrower's valuation were used. Only one nondelinquent borrower had data from a combination of lender and borrower valuation. The response to this question indicates that most lenders obtained balance sheet information from the borrowers which was considered satisfactory and no further revisions of values were requested by the lender.

Lenders may make other adjustments in regard to the balance sheet values instead of completing a balance sheet with their evaluation. One bank loan officer said the bank accepted the balance sheet from the applicant and adjusted the amount of the loan or loan terms based on the bank's appraisal of security values. This approach constrains borrowers to a lower leverage position.

Debt to asset ratios increased for both groups during the time period of the study. The average debt to asset for delinquent and nondelinquent borrowers in 1980 were 45 percent and 38 percent, respectively. The difference in the average debt to asset ratio for the two groups, as well as the difference in the distribution of debt to

assets in 1980 (Table 4.3), indicates that the two groups were not as similar at the beginning of the study time period as desired. In 1980, a larger number of delinquent borrowers were in the 41 to 70 percent debt to asset categories. In 1984, there were no delinquent borrowers with debt to asset ratios of 40 percent or less. Most of the delinquent borrowers had debt to asset values between 71 to 100 percent with an average of 78 percent. The average debt to asset ratio had also increased to 56 percent for the nondelinquent borrowers. In 1984, debt to asset ratio values for nondelinquent borrowers ranged from 10 percent to 181 percent and from 41 percent to 140 percent for delinquent borrowers. There were two delinquent and two nondelinquent borrowers who had debt to asset ratios over 100 percent in 1984. One of the nondelinquent borrowers had a debt to asset of 181 percent, suggesting that the financial leverage level is not the only factor determining loan delinquency. While the leverage levels for both groups increased, the deterioration was greater for the delinquent borrowers than for the nondelinquent borrowers.

The number of contacts for nonadverse action between the lender and borrower is presented in Table 4.4. Comparing the number of lender contacts with delinquent and with nondelinquent borrowers was used to measure the difference in time spent with borrowers in the two loan status groups. Communications between lender and borrower are important for assuring that the credit needs of the farmer are met. The contacts also impose costs on the lenders for time spent with borrowers in order to lower loan losses.

TABLE 4.3

COMPARISON OF 1980 AND 1984 DEBT TO ASSET RATIOS

Debt To Asset Ratios	1980 Number of Borrowers Nondelinquent	Delinquent
0 to 20%	3	2
21 to 30%	4	1
31 to 40%	4	4
41 to 50%	3	6
51 to 60%	0	5
61 to 70%	3	3
71 to 80%	0	0
81 to 90%	0	0
91 to 100%	0	0
Over 100%	0	0
Total Number of Borrowers	17	21
Average Debt to Asset Ratio	37%	45%
Range of Ratios for the Group	7 to 68%	18 to 69%

Debt to Asset Ratios	1984 Number of Borrowers Nondelinquent	Delinquent
0 to 20%	2	0
21 to 30%	3	0
31 to 40%	1	0
41 to 50%	3	2
51 to 60%	2	3
61 to 70%	2	2
71 to 80%	2	4
81 to 90%	0	6
91 to 100%	0	2
Over 100%	2	2
Total Number of Borrowers	17	21
Average Debt to Asset Ratio	56%	78%
Range of Ratios for the Group	10 to 181%	41 to 140%

TABLE 4.4

ANNUAL NUMBER OF LENDER CONTACTS WITH BORROWERS FOR NONADVERSE ACTION

Status	Year				
	1980	1981	1982	1983	1984
Nondelinquent	2.5	2.0	2.6	2.5	3.7
Delinquent	2.4	3.8	3.8	4.4	5.8

The contacts for adverse action increased from a total of 5 in 1981 to 20 in 1984 and averaged 1.1 per delinquent borrower in 1984. Lenders appear to spend more time servicing the accounts of borrowers as the borrower's financial position deteriorated. The increase in loan servicing time indicates that lenders could be assisted by the use of scoring models to identify problem or delinquent borrowers and thereby anticipate and plan for servicing time needs.

4.6 Summary

The study was designed to collect the financial data that could be used to distinguish between delinquent and nondelinquent borrowers. Lenders were provided with selection criteria to identify a group of borrowers with similar financial situations on December 1979. The desired number of cases was not obtained because of lack of lender participation and lack of borrowers who satisfied the selection criteria. In addition, some of the data requested were not recorded in the lenders' records. Lenders did provide insights as to the type of information and borrower characteristics they analyze in making a loan determination.

The discriminant technique was applied to the data. A discriminant equation was obtained with three variables: debt to asset ratio in 1980, turnover ratio in 1980, and net farm income in 1980. Borrowers with larger debt to asset and turnover ratios are more likely to become delinquent than borrowers with lower ratios. Net farm income has an inverse effect on delinquency. The larger the net farm income the less

likely a borrower would be delinquent. The discriminant equation correctly classified 82 percent of the loans.

Analysis of other factors indicated that delinquent borrowers had larger overestimates of farm revenues and proportions of income allocated to debt servicing than nondelinquent borrowers. These differences would affect repayment ability with variations in actual net income. Comparisons of changes in security values and risk strategies used could not be analyzed due to the lack of data. The amount of loan restructuring through servicing actions did show a larger number of delinquent borrowers had had loans refinanced, reamortized, consolidated, and rescheduled. These actions appeared to have delayed delinquency and contributed to increased leverage levels. These practices also decreased liquidity and increased the borrower's financial risk.

Other results indicate that lenders spend more time in communication with delinquent borrowers. Lenders also tend to accept the borrower's valuation for balance sheet information but may make their own adjustments which are not recorded in the loan file.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the conclusions based on the analysis conducted for this study. The first part of this chapter discusses the conclusions regarding the analytical results of the discriminant analysis, the discriminant equation, and other results in the study. The second part of this chapter discusses the implications for present and future lending practices. The last section of this chapter presents recommendations for future research.

5.2 Conclusions

5.2.1 Conclusions Regarding the Discriminant Results

The discriminant analysis identified three variables which distinguish delinquent from nondelinquent borrowers. The debt to asset ratio was the strongest indicator in the discriminant equation. The other two variables were the turnover ratio and net farm income. These three measures are typical of the measures used to monitor a firm's financial position. The results of this study confirm that these measures are reliable indicators for determining the farm firm's likelihood for loan delinquency problems.

The coefficients for the debt to asset ratio and the net farm income variable had signs in the discriminant equation that supported the expectations that loan delinquency is directly related to the degree of leverage and inversely related to the level of net farm income. The sign of the turnover ratio coefficient in the discriminant equation was not as expected. It was expected that delinquent borrowers would use their asset less efficiently and would have smaller turnover ratios than nondelinquent borrowers. The results showed that the larger the turnover ratio, the more likely the borrower would be delinquent.

It is possible that the turnover ratio variable is not as reliable an indicator of loan delinquency due to the differences in lenders' record keeping practices. Lenders may tend to influence borrower information through greater scrutiny of the records for higher leveraged borrowers who are considered a greater credit risk. This increased level of scrutiny could result in more conservative estimates of asset values which would explain the higher turnover ratios for delinquent borrowers. If this is the case, high leverage levels or other factors which increase credit risk caused the increased turnover ratios, rather than turnover ratios being an indicator of loan delinquency.

A second possible reason for the unexpected direction of the coefficient for the turnover ratio as an indicator of loan delinquency is that delinquent borrowers may have had larger turnover ratios in 1980 because they had lower asset values. Borrowers with less land or older equipment and machinery in 1980 would have been in weaker asset positions. Borrowers who were not able to maintain or improve their machinery or equipment would have a deteriorating asset base which would

add to their financial stress as older farm equipment requires more expense and results in lower production efficiency due to untimely breakdowns.

It is difficult to confirm the reasons for the unexpected results of the sign on the turnover ratio coefficient because the data on the age, condition, and type of assets were not gathered. It appears that there may be factors about the asset base or lender influence on how borrowers value assets that are not discernible by the data available. The asset value part of the ratio was identified as the probable reason for this result because it appeared that the situation of prices received and gross farm income were similar for both groups in 1980.

5.2.2 Conclusions Regarding Results of Discriminant Equation

The discriminant equation compares well with the credit scoring models of other studies. The equation correctly classifies 82 percent of borrowers. The equation could make two types of misclassification errors. One would be classification of a nondelinquent borrower as delinquent. The other error would be classification of a delinquent borrower as nondelinquent. The latter would be considered a more serious error as lenders wish to avoid loan losses on delinquent borrowers. The equation did misclassify 18 percent of the borrowers in each group. This was due to the closeness of the group centroids.

Data problems caused some of this lack of separation between the groups. Data problems were caused by the diversity in the financial condition of borrowers at the beginning of the study and by the use of data from a mix of lenders. Elimination of data problems could result

in an equation which would correctly classify a larger percentage of the borrowers' studied.

The discriminant equation could be improved by separating the analysis of borrowers by type of lender. Differences in loan performance standards of the four types of lenders caused some similarities between delinquent and nondelinquent borrowers. FmHA, as the lender of last resort, had borrowers who were in considerably worse financial positions than the borrowers of other lenders. In order to become a FmHA borrower, the farmer must not be able to obtain credit from other lenders; thus, FmHA borrowers' financial conditions are below the minimum acceptable levels of other lenders. Some of FmHA's nondelinquent borrowers had values for the variables which were similar to those of other lenders' delinquent borrowers. The use of data from a mix of lenders made it more difficult to separate the loan groups. Better results could be expected by analysis of borrowers from one type of lender.

The type of loan that a borrower is delinquent on may be an indicator of differing degrees of financial stress. Borrowers who cannot make all loan payments would have to prioritize their payments if they have loans with several lenders. A borrower's loan repayment decisions may be influenced by the loan type and the lender's loan servicing policies (the squeaky wheel gets the grease). It is possible that borrowers tend to place a higher priority on their real estate loan payment than on their nonreal estate payment. Thus, it is possible to have borrowers who are delinquent on nonreal estate debt and nondelinquent on real estate debt. Due to priorities for loan payment,

there could be borrowers who are delinquent on their nonreal debt who would be in better financial condition than borrowers who were reported as nondelinquent on their real estate debt.

Lenders' servicing policies would also have an impact on a borrower's decision of which payments to make. Since FmHA's policy was to not liquidate delinquent borrowers unless another lender started foreclosure, FmHA borrowers who couldn't make all their payments would be more likely to pay other creditors before they paid FmHA. It is possible that some borrowers in this study were delinquent with one lender and nondelinquent with another lender. The data gathered from a mix of loan types and lenders did not identify the status of borrowers' accounts with other lenders. Thus, it was not possible to ascertain if borrowers were delinquent or nondelinquent with all or some of their creditors.

Management ability is defined in terms of production, marketing, and financial performance. This study attempted to reflect management ability by using variables measuring these three factors. Financial performance variables were the significant variables in the discriminant equation. The other variables were not significant due to the lack of adequate data for analysis. It appears that lenders include a "character of the borrower" factor to describe the credit worthiness and honesty of the borrower along with the other three factors of management ability. It is difficult to find a quantitative measure for the borrower's character, but such a measure could improve the discriminant equation and be a more reliable predictor of loan performance than the very subjective measures that lenders appear to have been using.

5.2.3 Conclusions Regarding Other Results

The results indicated that delinquent borrowers had a greater tendency to overestimate their gross income, relative to nondelinquent borrowers. The delinquent borrowers also had a larger proportion of their projected and actual income allocated to debt servicing. This indicates that before they became delinquent, delinquent borrowers were exposed to greater financial risk than nondelinquent borrowers.

Delinquent borrowers had a larger number of loan servicing actions through refinancing, reamortization, rescheduling, and consolidation of loans. This "rolling over" of debt increased financial stress for these borrowers as leverage increased and liquidity was reduced. Refinancing a line of credit by rolling payments and principal into the next year can hide financial problems in the short run. Such actions can delay loan delinquency, but do not deal with the causes of the financial management problem that generated the need for refinancing.

It was presumed that risk management strategies could be used as an indicator of the management practices that the farm operator uses to reduce financial risk. There were indequate data regarding risk management strategies to include them in the discriminant analysis. These data were not collected by lenders during the time period of this study, even though the use of these strategies could reduce income and repayment uncertainties.

5.3 Implications

Credit scoring models are useful as predictors of loan delinquency. These models have been used mostly by lenders to reduce

credit risk by anticipating problem loans. The discriminant equation is useful as a predictive tool because the discriminant score is based on a combination of variables. Results of credit scoring models can be used by lenders to evaluate present borrowers and to determine credit risks of loan applicants. Credit risk for lenders is the risk of losses when the loans do not generate sufficient income to cover the costs of lending. Credit scoring models are also useful to farmers in prediction of potential repayment problems.

One way lenders can handle credit risks is through the use of loan pricing. Loan pricing is setting the loan terms to reflect the credit risk. The amount of the loan, due date, and interest rate are adjusted in accordance with the credit risk. Lenders can use credit scoring to identify loans with potential for losses and price them according to their credit risk level. Loan pricing through the use of varying interest rates allows the lender to charge the higher risk borrowers a higher interest rate to reflect the increased risk for loan losses.

It appears that lenders tended to collect only financial performance data and only collected borrower's data as needed for new loans or loan servicing. This pattern of data collection makes it difficult to develop credit scoring models for agricultural lending. A systematic collection of borrowers' data and updated appraisals on loan security would result in a data base suitable for development of improved credit scoring models.

5.4 Recommendations For Future Research

5.4.1 Recommendations for Additional Study

Additional studies should utilize more restrictive selection criteria to ensure that borrowers are more similar financially at the beginning of the study. The separation of borrowers by lender and by loan type would also provide more uniform groups for analysis. This type of study would require obtaining a larger number of borrowers for analysis. Separate analysis of FmHA borrowers should be done because their lending activities involve working with borrowers who cannot obtain credit from other lenders.

5.4.2 Development of a Management Ability Measure

Lenders appear to place fairly heavy weighting on the subjective judgement of the creditworthiness and character of the borrower in their analysis of management ability. It would be desirable to find a method to measure this character aspect of management ability. Use of such a variable may improve credit scoring models and eliminate some of the subjective judgement in loan decisions.

A survey could be developed to identify attitude variables which reflect a borrower's credit character. A survey approach was used successfully by Awh and Waters to calculate non-ratio variables on attitudes of credit card holders for their discriminant model (Awh and Waters,1974).

Finally, more data regarding marketing strategies and production performance could be used with financial performance variables to develop more reliable measures of management ability than the subjective judgement of lenders.

5.5 Summary

The results of this study and other credit scoring models are useful for lenders in evaluating loan applications, and determining loan servicing actions. Future use of credit scoring can help lenders price loans in terms of calculated credit risks. Farm borrowers may find scoring models useful for identifying potential repayment problems.

Future research is needed to develop a more accurate discriminant equation. This can be accomplished by designing the study to eliminate some of the data problems experienced in this study and better collection of records by lenders. Also additional research could develop nonobjective measures for management ability.

The results of this study indicate that higher leveraged borrowers with low net farm incomes are at greater risk for loan repayment problems. Lower net farm incomes in recent years have added to financial stress. The increased "rolling over" of debt in recent years has delayed loan delinquency. Borrowers who refinanced their loans postponed addressing this liquidity problem and are at greater risk for loan delinquency in future years.

The results indicate that farm loan delinquency will continue to be a problem for Michigan cash grain farmers. Loan delinquency may increase as farm borrowers approach lenders' loan limits and can no longer refinance debts. Without elimination of the problem which generated the need for the loan servicing, the restructuring of debts will only provide short term solutions for some borrowers.

APPENDICES

APPENDIX A

FORMULAS FOR FINANCIAL RATIOS

FORMULAS FOR FINANCIAL RATIOS

I. Balance Sheet Ratios

A. Current Ratio	= current assets / current debts
B. Intermediate Ratio	= current + intermediate assets / current + intermediate debts
C. Net Capital Ratio	= total assets / total debt
D. Debt/Equity Ratio	= total debt / equity
E. Debt/Asset Ratio	= total debt / total assets
F. Equity/Asset Ratio	= equity / total assets

II. Income Statement Ratios

A. Operating Ratio	= total operating expenses / gross income
B. Gross Ratio	= total expenses / gross income
C. Interest/Expense Ratio	= annual interest paid / total operating expenses
D. Interest/Income Ratio	= annual interest paid / net farm income

III. Other Ratios

A. Average Capital Investment	= average of beginning and ending total assets
B. Turnover Ratio	= gross income / total assets
C. Percent Return To Assets (ROA)	= $\frac{R}{A}$ X 100%

WHERE:

R = Return To Assets	= cost of debt + dollars return to equity
A = Total Assets	= debts + equity
(COD) Cost Of Debt	= Annual interest paid / average annual debt
(ROE) Returns To Equity	= dollars return to equity / net worth

WHERE:

Dollar Return To Equity	= Net farm income - charge for unpaid family labor - charge for operator's labor and management

Sources: Barry, et al, Nelson, et al, and Harsh, et al

APPENDIX B

SELECTION CRITERIA

SELECTION CRITERIA

This study was restricted to cash grain farms in Southern lower Michigan. Four counties were selected: Calhoun, Clinton, Eaton, and Lenawee. These counties are representative of typical Michigan cash grain production areas where farms are faced with similar production and marketing situations. This gives a homogeneous group of borrowers to study. The number of borrowers selected from each lender is displayed below. The distribution is approximately proportionate to each lender's share of Michigan agricultural borrowers.

Lender	NUMBER OF BORROWERS			
	Calhoun	Clinton	Eaton	Lenawee
Farmers Home Adminstration	2	2	2	2
Federal Land Bank	8	8	8	8
Production Credit Associations	4	4	4	4
Commercial Banks	4	4	4	4
TOTAL	18	18	18	18

The following criteria were used in selection of borrowers to be studied:

1. Acreage: Farms which operated 300 or more acres during 1984.

2. Loan Activity: Borrowers who have had active loan accounts between December 1979 and December 1984.

3. Financial Status on December 1979:
   A) Borrower was current or less than 90 days delinquent. Borrowers who have made formal lender approved payment arrangements for delinquent accounts will be considered current.
   B) Debt/Asset ratio was .5 or less.

4. Financial Status on December 1984:
   A) 1/2 of the borrowers selected are to be current or less than 90 days delinquent.
   B) 1/2 of the borrowers selected are to be delinquent more than 90 days.

MICHIGAN STATE UNIVERSITY

DEPARTMENT OF AGRICULTURAL ECONOMICS
AGRICULTURE HALL

EAST LANSING · MICHIGAN · 48824-1039

Dear

In order to effectively address Michigan's current farm financial situation, Governor Blanchard has initiated a Farm Finance Study. Michigan State University is responsible for analyzing farm loan delinquencies as a part of this effort.

Your assistance in this project is needed. This study is designed to supplement the findings of the recent farmer survey with an in-depth analysis of the causes of farm loan delinquency. To perform the study, a financial history and operator characteristics are needed for a small group of delinquent and nondelinquent farm borrowers.

Enclosed are the project objectives and selection criteria that will be used to identify the study group, and a copy of the data gathering forms. The confidentiality of the information will be stringently protected; no names will be recorded and the analysis will be based on aggregated data for all borrowers.

Dr. Gerald Schwab and Dr. Sermin Hardesty, from the Department of Agricultural Economics, are directing this project. June Grabemeyer, a graduate student, will be responsible for data gathering and analysis. She will be contacting you shortly to ascertain your role in this project.

Results of this research will be provided to you. Your participation in the project would be greatly appreciated.

Sincerely,

Larry J. Connor, Chairman
Agricultural Economics

Timothy R. Taylor, Chairman
Agricultural Banking Committee
Michigan Bankers Association

/lp
Enc.

I. IDENTIFICATION

Lender: _____

Farm Location(County): _____

Loan Type: ___Real Estate ___Nonreal Estate ___Both

Loan Status As of December 1984: ___Nondelinquent ___Delinquent

II. FARM CHARACTERISTICS

Business Arrangement: ___Sole Proprietorship ___Partnership ___Corporation

Primary Operator: _____Marital Status _____Age ____Dependents

1984 Family Living Expenses $_____

1984 Nonfarm Income $_____

Source _____

Farm Size:	December 1979	December 1984
Acres Operated	_____	_____
Acres Owned	_____	_____
Acres Rented Cash	_____	_____
Acres Rented On Shares	_____	_____
Acres Tiled	_____	_____

Terms of Rented Acres _____

Tiling recommended for soils in that area? ___Yes ___No

Major Changes: (Circle **P** for Purchased OR **L** for Liquidation)

December 1979 To December 1984:

Real Estate	P / L	Year _____	Acres _____	$_____
	P / L	_____	_____	_____
	P / L	_____	_____	_____
	P / L	_____	_____	_____
	P / L	_____	_____	_____
Machinery &	P / L	Year _____	Item _____	$_____
Equipment	P / L	_____	_____	_____
	P / L	_____	_____	_____
	P / L	_____	_____	_____
	P / L	_____	_____	_____
Buildings &	P / L	Year ____	Item _____	$_____
Improvements	P / L	____	_____	_____
	P / L	____	_____	_____
	P / L	____	_____	_____
	P / L	____	_____	_____

III. FINANCIAL DATA

Farm Income And Expenses
(Income Statement And Schedule F)

ITEM	1980	1981	1982	1983	1984
GROSS FARM INCOME					
A. Total Projected					
B. Total Actual					
C. Actual:					
1) Corn					
2) Soybeans					
3) Wheat					
4) Other Crops					
5) Government					
6) Other					
CASH OPERATING EXPENSES					
A. Total Projected					
B. Total Actual					
C. Actual:					
1) Interest Paid					
2) Machine Lease Payment					
DEPRECIATION					
NET FARM INCOME ACTUAL					
From Schedule F					

Balance Sheet
(Market Values - Lender's Valuation If Available)

ITEM	1980	1981	1982	1983	1984
DEBTS					
A. Current					
B. Intermediate					
C. Long-Term					
ASSETS					
A. Current					
B. Intermediate					
C. Long-Term					
NET WORTH					

VALUES ABOVE ARE:

___Lender's Valuation
___Applicant's Records
___Other (indicate source) _____

IV. LOAN INFORMATION AND LOAN SERVICING
(With This Lender)

ITEM	1980	1981	1982	1983	1984
	—$/Number Of Years To Pay—				
NEW LOANS					
A. Dollars Of New Loans:					
1) Operating	/	/	/	/	/
2) Machinery Replacement	/	/	/	/	/
3) Machinery Expansion	/	/	/	/	/
4) Buildings Repair	/	/	/	/	/
5) Buildings New	/	/	/	/	/
6) Real Estate	/	/	/	/	/
7) Consolidation Or Other	/	/	/	/	/
B. ($) Refinanced	/	/	/	/	/
C. ($) Reamortized	/	/	/	/	/
ALL LOANS					
A. Av. An. Interest Rate(%)					
B. Total Payments Sch.($)					
C. Total Payments Made($)					
D. Loan Bal. End Of Year($)					
E. Charged Off($)					
F. Lender's Valuation Of Security($)					
LENDER CONTACTS (phone calls, visits, letters)					
A. Total (No.)					
B. For Adverse Action (No.)					
NO. REAPPRAISAL OR UPDATED APPRAISALS					

V. ACRES AND YIELDS

ITEM		1980	1981	1982	1983	1984
CORN:						
Acres	Planted					
Yield-	Actual					
	Projected					
SOYBEANS:						
Acres	Planted					
Yield-	Actual					
	Projected					
WHEAT:						
Acres	Planted					
Yield-	Actual					
	Projected					
DRY BEANS:						
Acres	Planted					
Yield-	Actual					
	Projected					
OTHER:						
_____						
Acres	Planted					
Yield-	Actual					
	Projected					
_____						
Acres	Planted					
Yield-	Actual					
	Projected					
SET-ASIDE:						
Acres						

VI. RISK MANAGEMENT

A. FORWARD CONTRACTING? ___Yes ___No ___Unknown

_____Crop	_____Year	_____Quantity	_____Price
_____Crop	_____Year	_____Quantity	_____Price
_____Crop	_____Year	_____Quantity	_____Price
_____Crop	_____Year	_____Quantity	_____Price
_____Crop	_____Year	_____Quantity	_____Price
_____Crop	_____Year	_____Quantity	_____Price

B. HEDGING? ___Yes ___No ___Unknown

_____Crop	_____Year	_____Quantity	_____Price
_____Crop	_____Year	_____Quantity	_____Price
_____Crop	_____Year	_____Quantity	_____Price
_____Crop	_____Year	_____Quantity	_____Price
_____Crop	_____Year	_____Quantity	_____Price
_____Crop	_____Year	_____Quantity	_____Price

C. CROP INSURANCE? ___Yes ___No ___Unknown

1980		1981		1982		1983		1984	
Crop	Acres	Crop	Acres	Crop	Acres	Crop	Acres	Crop	Acres

D. CREDIT LIFE INSURANCE ON LOANS? ___Yes ___No ___Unknown
_____All Loans Insured _____Real Estate Only _____Nonreal Estate Only

E. SOIL TESTS? ___Yes ___No ___Unknown

F. INPUT PURCHASES FORWARD CONTRACTED? ___Yes ___No ___Unknown

G. OTHER RISK MANAGEMENT STRATEGIES:

H. COMMENTS:

APPENDIX C

PRELIMINARY DATA GATHERING FORM

PAGE 1
I. IDENTIFICATION
Lender FMHA=1 PCA=2 FLBA=3 COMM BK=4
Farm Location (county CALHOUN=1 CLINTON=2 EATON=3 LENAWEE=4
Loan type: REAL ESTATE=1 NONREAL ESTATE=2 BOTH=3
Loan status as of Dec 84: NONDELINQUENT=0 DELINQUENT=1

II. FARM CHARACTERISTICS
Business Arrangement:
1.sole proprietorship 2.partnership 3.corporation
Primary Operator: MARITAL STATUS MARRIED=1 SINGLE=2 AGE__dependents__
1984 annual family living expenses $_____
1984 Non-Farm Income $_____
source NO SOURCE=0 FARMER=1 SPOUSE=2 BOTH=3 OTHER=4

Farm Size:	December 1979	December 1984
Acres Operated		
Acres Owned	_____	_____
Acres Rented Cash	_____	_____
Acres Rented on Shares	_____	_____
Acres Tiled	_____	_____
	_____	_____

Terms of rented acres 1/3:2/3=1 50/50=2 $<50=3 $50-75=4 $>75=5
OTHER&UNKNOWN=6
Tiling recommended for soils in that area? yes=1 no=0

Major Purchases or Expansions: Dec. 1979 to Dec. 1984

Real Estate :
NONE=0 P=1 L=2 year_____ acres_____ $_____

	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____

Machinery and Equipment:
TRACTOR=1
COMBINE=2
TILLAGE&PLANTING=3
OTHER HARVEST=4
OTHER & UNKNOWN=5

year	item	$
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Buildings and Improvements:
TILING=1
NEW BUILDING=2
GRAINBINS & DRYERS=3
BUILDING IMPRO & REPAIR=4
OTHER & UNKNOWN=5

year	item	$
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Page 2

III. FINANCIAL DATA:

A. Farm Income and Expenses: Income Statement and Schedule F

	1980	1981	1982	1983	1984
1.Gross Farm Income:					
a. total projected					
b. actual					
1.corn					
2.soybeans					
3.wheat					
4.other crops					
5.government					
6.other					
7.total actual					
2.Cash Oper Expenses:					
a. total projected					
b. actual					
1. interest paid					
2. mach. lease pmt					
3.total actual					
3. Depreciation					
4. Net Farm Income actual (from Sch F)					

Page 3
III. FINANCIAL DATA:
B. Balance Sheet: Market Values (Lender's valuation if available)

	1980	1981	1982	1983	1984
1.Debts: current					
intermediate					
long term					
2.Assets: current					
intermediate					
long term					
3.Net Worth					

4. Values above are: (circle appropriate answer)
1) Lender's valuation
2) Applicant's Records
3) other (indicate source)

IV. YIELDS: (bu/acre)

		CORN	SOYBEANS	WHEAT	DRY BEANS		
1980	projected						
	actual						
1981	projected						
	actual						
1982	projected						
	actual						
1983	projected						
	actual						
1984	projected						
	actual						

PAGE 4

V. LOAN INFORMATION and LOAN SERVICING (with this lender)

	1980	1981	1982	1983	1984
1. New Loans					
a. Number of new loans:					
1. operating'					
2. Machinery replacement					
3. Machinery expansion					
4. Buildings repair					
5. Buildings new					
6. Real Estate					
b. # years to pay					
c. new financing $					
2. $ refinanced					
3. $ reamortized					
4. All Loans:					
a. Ave Ann Interest Rate					
b. Total payments sch					
c. Total payments made					
d. Loan balance end of year					
5. Lender's Value of Security					
6. Lender contacts:					
a. total					
b. for adverse action					
7. Number reappraisal or updated appraisals					

Page 5
VI.RISK MANAGEMENT (circle appropriate answer)
A. Forward Contracting ? 1.yes 2.no 3.unknown

year	crop	quantity contracted	price

B. Hedging ? 1.yes 2.no 3.unknown

year	crop	quantity hedged	price

C. Government Program Participation? 1.yes 2.no 3.unknown

	acres set aside			
crop	1980	1981	1982	1984
corn				
wheat				
soybeans				

D. Crop Insurance? 1.yes 2.no 3.unknown

1980		1981		1982		1983		1984	
crop	acres	crop	acres	crop	acres	crop	acres	crop	acres

E. Credit Life Insurance on loans? 1.yes 2.no 3.unknown
1.all loans insured 2.R.E. only 3.non-R.E. only
F. Soil Tests ? 1.yes 2.no 3.unknown
G. Input purchases forward contracted ? 1.yes 2.no 3.unknown
H. Other risk management strategies:

I. Comments:

APPENDIX D

VARIABLES TESTED IN PRELIMINARY ANALYSIS

25 VARIABLES TESTED IN PRELIMINARY ANALYSIS

Debt to asset ratio for each of the years 1980 to 1984.

Change in debt to asset ratio between 1980 and 1984.

Change in networth between 1980 and 1984.

Current plus intermediate debt divided by total debt 1980.

Interest paid divided by total expenses for each year 1980 to 1984.

Interest paid divided by gross income for 1980.

Loan balance divided by gross income for each year 1980 to 1984.

Loan balance divided by net farm income for 1980.

Acres owned in 1980 and in 1984.

Acres operated in 1980 and 1984.

Debt repayment made divided by total assets for each year 1980 to 1984.

Gross income divided by total assets for each year 1980 to 1984.

Total of major purchases and expansions for all years.

Total of major purchases and expansions 1980 plus 1981.

Total interest paid divided by acres operated for 1980.

Total debt repayment made divided by net farm income for 1980.

Net farm income for each year 1980 to 1984.

Change in value of loan security between 1980 and 1984.

Off-farm income for 1984.

Debt to equity ratio for each year 1980 to 1984.

Total dollars refinanced and reamortized for all years.

Cash operating expenses divided by gross income for each year 1980 to 1984.

Total gross income for each year 1980 to 1984.

Borrower's age.

Risk Stategies:

- Forward contracting
- Hedging
- Crop insurance
- Credit life insurance on loans
- Soil tests
- Input purchases forward contracted

APPENDIX E

DISCRIMINANT ANALYSIS

00102500 CM REQUIRED FOR DISCRIMINANT CLASSIFICATION

OPTION - 2
INCLUDE CASES WITH MISSING DATA DURING CLASSIFICATION

OPTION - 5
PRINT CLASSIFICATION RESULTS TABLE

OPTION - 7
PRINT A SINGLE PLOT OF CASES

- D I S C R I M I N A N T A N A L Y S I S -

ON GROUPS DEFINED BY VAR4 LOAN STATUS

38 (UNWEIGHTED) CASES WERE PROCESSED.
20 OF THESE WERE EXCLUDED FROM THE ANALYSIS.
0 HAD MISSING OR OUT-OF-RANGE GROUP CODES.
20 HAD AT LEAST ONE MISSING DISCRIMINATING VARIABLE.
0 HAD BOTH.
18 (UNWEIGHTED) CASES WILL BE USED IN THE ANALYSIS.

NUMBER OF CASES BY GROUP

VAR4	NUMBER OF CASES UNWEIGHTED	WEIGHTED	LABEL
0	7	7.0	NONDELINQUENT
1	11	11.0	DELINQUENT
TOTAL	18	18.0	

GROUP MEANS

VAR4	DA	CAPITAL1	NFI
0	.46558	.25506	46966.28571
1	.60817	.32985	18519.18182
TOTAL	.55272	.30078	29581.94444

GROUP STANDARD DEVIATIONS

VAR4	DA	CAPITAL1	NFI
0	.12488	.16547	39920.66101
1	.13582	.15920	49140.58783
TOTAL	.14653	.16118	46760.76027

POOLED WITHIN-GROUPS CORRELATION MATRIX

	DA	CAPITAL1	NFI
DA	1.00000		
CAPITAL1	-.22932	1.00000	
NFI	-.01639	.21389	1.00000

CORRELATIONS WHICH CANNOT BE COMPUTED ARE PRINTED AS 99.0.

- -

WILKS LAMBDA (U-STATISTIC) AND UNIVARIATE F-RATIO
WITH 1 AND 16 DEGREES OF FREEDOM

VARIABLE	WILKS LAMBDA	F	SIGNIFICANCE
DA	.76173	5.005	.0399
CAPITAL1	.94583	.9164	.3527
NFI	.90687	1.643	.2182

D I S C R I M I N A N T A N A L Y S I S

ON GROUPS DEFINED BY VAR8 LOAN STATUS

ANALYSIS NUMBER 1

STEPWISE VARIABLE SELECTION

SELECTION RULE= MAXIMIZE MINIMUM MAHALANOBIS DISTANCE (D SQUARED) BETWEEN GROUPS

MAXIMUM NUMBER OF STEPS	6
MINIMUM TOLERANCE LEVEL	.00100
MINIMUM F TO ENTER	1.0000
MAXIMUM F TO REMOVE	1.0000

CANONICAL DISCRIMINANT FUNCTIONS

MAXIMUM NUMBER OF FUNCTIONS	1
MINIMUM CUMULATIVE PERCENT OF VARIANCE	100.00
MAXIMUM SIGNIFICANCE OF WILKS LAMBDA	1.0000

PRIOR PROBABILITY FOR EACH GROUP IS .50000

---------- VARIABLES NOT IN THE ANALYSIS AFTER STEP 0 ----------

VARIABLE	TOLERANCE	MINIMUM TOLERANCE	F TO ENTER	D SQUARED	BETWEEN GROUPS	
DA	1.0000000	1.0000000	5.0049	1.16997	0	1
CAPITAL1	1.0000000	1.0000000	.9164			
VFI	1.0000000	1.0000000	1.6437	.38409	0	1

AT STEP 1, DA WAS INCLUDED IN THE ANALYSIS.

		DEGREES OF FREEDOM		SIGNIF.	BETWEEN GROUPS	
WILKS LAMBDA	.7617280	1	1	16.0		
EQUIVALENT F	5.004873		1	16.0	.0399	
MINIMUM D SQUARED	1.169970				1	2
EQUIVALENT F	5.004873		1	16.0	.0399	

---------- VARIABLES IN THE ANALYSIS AFTER STEP 1 ----------

VARIABLE	TOLERANCE	F TO REMOVE	D SQUARED	BETWEEN GROUPS
DA	1.0000000	5.0049		

---------- VARIABLES NOT IN THE ANALYSIS AFTER STEP 1 ----------

VARIABLE	TOLERANCE	MINIMUM TOLERANCE	F TO ENTER	D SQUARED	BETWEEN GROUPS	
CAPITAL1	.9474138	.9474138	1.6295	1.70339	0	1
VFI	.9997314	.9997314	1.1075	1.53250	0	1

```
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AT STEP   2. CAPITAL1 WAS INCLUDED IN THE ANALYSIS.

                                  DEGREES OF FREEDOM   SIGNIF.  BETWEEN GROUPS
WILKS  LAMBDA        .6870966      2    1       16.0
EQUIVALENT F         3.415654           2       15.0    .0599

MINIMUM D SQUARED    1.703391                                      1      2
EQUIVALENT F         3.415654           2       15.0    .0599

---------------- VARIABLES IN THE ANALYSIS AFTER STEP   2 ----------------

VARIABLE   TOLERANCE  F TO REMOVE   D SQUARED   BETWEEN GROUPS

DA         .9474138     5.6486
CAPITAL1   .9474138     1.6295

-------------- VARIABLES NOT IN THE ANALYSIS AFTER STEP   2 --------------
                       MINIMUM
VARIABLE   TOLERANCE  TOLERANCE   F TO ENTER   D SQUARED   BETWEEN GROUPS

NFI        .9531248   .9032461      1.5573     2.30892       0     1

* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

AT STEP   3. NFI      WAS INCLUDED IN THE ANALYSIS.

                                  DEGREES OF FREEDOM   SIGNIF.  BETWEEN GROUPS
WILKS  LAMBDA        .6183044      3    1       16.0
EQUIVALENT F         2.880807           3       14.0    .0734

MINIMUM D SQUARED    2.308921                                      1      2
EQUIVALENT F         2.880807           3       14.0    .0734

---------------- VARIABLES IN THE ANALYSIS AFTER STEP   3 ----------------

VARIABLE   TOLERANCE  F TO REMOVE   D SQUARED   BETWEEN GROUPS

DA         .9462959     4.8379
CAPITAL1   .9032461     2.0615
NFI        .9531248     1.5573

F LEVEL OF TOLERANCE OR VIN INSUFFICIENT FOR FURTHER COMPUTATION.
```

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SUMMARY TABLE

STEP	ACTION ENTERED	ACTION REMOVED	VARS IN	WILKS LAMBDA	SIG.	MINIMUM D SQUARED	SIG.	BETWEEN GROUPS	LABEL
1	DA		1	.761728	.0399	1.16997	.0399	0 1	
2	CAPITAL1		2	.697027	.0599	1.70319	.0599	0 1	
3	NFI		3	.618308	.0734	2.30852	.0734	0 1	GROSS INCOME TO ASSET RATIO

CANONICAL DISCRIMINANT FUNCTIONS

FUNCTION	EIGENVALUE	PERCENT OF VARIANCE	CUMULATIVE PERCENT	CANONICAL CORRELATION	AFTER FUNCTION	WILKS LAMBDA	CHI-SQUARED	D.F.	SIGNICANCE
1*	.61732	100.00	100.00	.6178119	0	.6183084	6.9711	3	.0728

* MARKS THE 1 FUNCTION(S) TO BE USED IN THE REMAINING ANALYSIS.

STANDARDIZED CANONICAL DISCRIMINANT FUNCTION COEFFICIENTS

	FUNC 1
DA	.84316
CAPITAL1	.51015
NFI	-.52455

CANONICAL DISCRIMINANT FUNCTIONS EVALUATED AT GROUP MEANS (GROUP CENTROIDS)

GROUP	FUNC 1
0	-.92859
1	.59092

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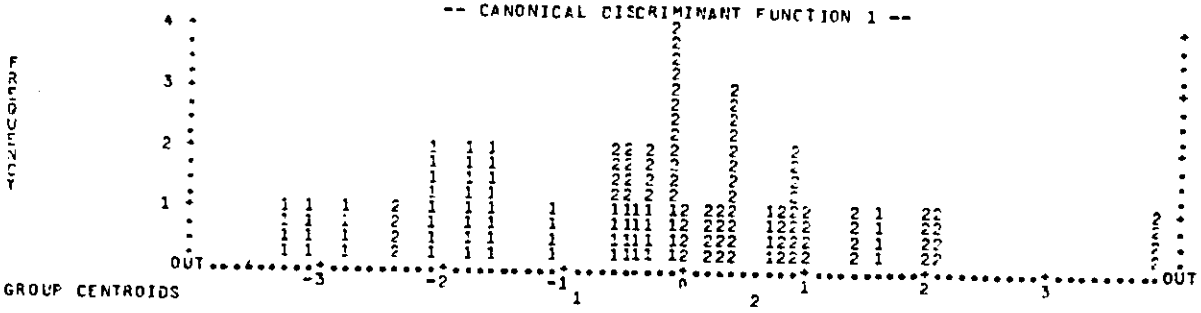
SYMBOLS USED IN PLOTS

SYMBOL	GROUP	LABEL
1	0	NONDELINQUENT
2	1	DELINQUENT

ALL-GROUPS STACKED HISTOGRAM

-- CANONICAL DISCRIMINANT FUNCTION 1 --



GROUP CENTROIDS

CLASSIFICATION RESULTS -

ACTUAL GROUP	NO. OF CASES	PREDICTED GROUP MEMBERSHIP 0	1
GROUP 0 NONDELINQUENT	17	14 82.4	3 17.6
GROUP 1 DELINQUENT	21	4 19.0	17 81.0

PERCENT OF GROUPED CASES CORRECTLY CLASSIFIED = 81.58

CLASSIFICATION PROCESSING SUMMARY

38 CASES WERE PROCESSED.
38 CASES WERE USED FOR PRINTED OUTPUT.

CPU TIME REQUIRED.. .287 SECONDS

* FINISH

TOTAL CPU TIME USED.. 1.444 SECONDS

RUN COMPLETED

NUMBER OF CONTROL CARDS READ 85
NUMBER OF ERRORS DETECTED 3

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