DETERMINANTS OF RESTRUCTURED FARM LOAN PERFORMANCE

Glenn Pederson, Ananth Rao, and Michael Boehlje

Abstract

A probabilistic model is applied to cross-sectional data to identify determinants of post-restructure performance of Federal Land Bank loans. The results indicate that restructured loans were sensitive to factors that determine the debt repayment burden and the repayment ability of the restructured farm operations. Loan performance is found to be relatively more sensitive to the levels of the post-restructure interest rate and cash farm income than to the financial structure and leverage position of the restructured farm. The relationships between the post-restructure interest rate, cash farm income level, and the probability of loan performance are illustrated.

Key words: restructured farm loans, performance, Federal Land Bank

The Farm Credit Banks of St. Paul (FCB), like many other Farm Credit District banks, experienced a significant deterioration in loan quality during 1983-1986. Unrestructured, nonaccrual loan volume stood at $1,328 million in the Seventh District by the end of 1986. That represented about 16.9 percent of gross loan volume. Federal Land Bank (FLB) loans accounted for 84.7 percent of the total nonaccruing farm loan volume at the FCB. In addition, FLB delinquencies were reported to be 6.1 percent of accruing FLB loan volume ($4.69 billion) on December 31, 1986.[1] Uncertainty about farm real estate values, the continuing deterioration of loan collateral values, and the build-up of acquired property inventories through deedback and foreclosure further compounded the FCB's problems. The bank was also projecting that it would be forced to continue moving a large number of loans to nonaccrual status during 1987.

The FCB developed its strategy for managing the nonaccrual loan problem during the latter part of 1986. The emphasis of the recovery plan was to negotiate loan restructuring arrangements that would maximize the economic benefits to the bank while attempting to control the overall credit risk and legal exposure. Rapid restructuring of nonaccrual loans was a major element of the overall plan to stop the deterioration of bank equity capital and ensure bank survival.

One of the key issues of restructuring is the uncertain future performance of loans that are restructured for viability.[2] Early estimates by FCB internal auditors and special credit personnel indicated the existence of widely disparate opinions about the percentage of restructured loans that were expected to perform. It is not uncommon to find such differing opinions on viability of restructured farm operations and it raises the two research questions underlying this paper. First, what are the major determinants of restructured farm loan performance in the short run? Second, can estimates of the probabilities of nonperformance be derived and used to evaluate and guide the restructuring process? The corresponding objective of this paper was to conduct an *ex post* analysis to identify those determinants and evaluate their influence on the short-run, post-restructure performance of loans at the FCB. The focus on short-run loan performance gives high priority to identifying situations where restructuring efforts would be inadequate to significantly improve the likelihood of repayment. For example, restructuring of a borrower's debt obligations may provide only minor financial relief such that income in the next year is inadequate to make the new debt payments. With this information the FCB could redirect its efforts to restructure more extensively, or monitor

[1] Delinquent loans include those with payments over 30 days past due. Nonaccruals are typically loans that stop accruing interest after they are 90 days past due. Delinquencies of the FLB and nonaccruals of the FCB are distinct categories of loan volume.

[2] The FCB defines viable farm units as those which generate sufficient income on an annual basis to pay all operating, family living, and interest expenses and maintain capital replacement. A viable unit generally has a good net worth position.

Glenn Pederson is an Associate Professor, Ananth Rao is a Graduate Research Assistant, and Michael Boehlje is a Professor in the Department of Agricultural and Applied Economics at the University of Minnesota. The authors wish to thank Journal reviewers for their comments on an earlier draft. This study was funded in part by cooperative USDA ERS ARED Research Grant No. 58-3AEN-8-00046, and also appears as Minnesota Experiment Station Publication No. 18488.

those loans more closely, or explore various nonrestructure alternatives.

Analysis of the determinants of restructured loan performance at the microeconomic level is important for several reasons. First, the viability of a restructured loan is important to the survivability of farming operations that have participated in a loan restructuring program. For example, since the restructured interest rate may affect farm cash flow and profitability, it is important for the lender to know if the post-restructure interest rate significantly influences the performance of individual loans and the loan portfolio. Second, identification and quantification of the factors that lead to successful loan restructuring would be useful in guiding future borrower-lender negotiations involved in loan restructuring.

METHOD OF ANALYSIS

The dependent variable in an analysis of loan performance is binary (i.e., the scheduled payment on the loan is or is not made). Gessner et al. have analyzed the theoretical and empirical aspects of estimating models with binary dependent variables. They observe that each of the classification techniques (e.g., linear discriminant analysis, binary probit, ordinary least squares (OLS), and quadratic discriminant analysis) has a set of underlying assumptions that must not be violated by the data. Linear discriminant analysis (LDA) can be used to model binary variables, but one must assume that the predictor variables are distributed multi-variate normal, which frequently does not hold for measures such as financial ratios. LDA has the additional disadvantage that the probabilities of events must be constrained to the interval (0,1). Although there are no multivariate distributional assumptions for the predictors underlying logit and probit analysis, strict error term distributional assumptions underlie both techniques (Maddala). The logit model requires the assumption of a skewed Weibull or Gumbel distribution of the error term, as compared to the symmetric normal distribution for probit and OLS. Due to the closed form structure, logit is preferred to probit for analytical convenience.

Recent studies have used probit or logit methods to analyze the problem of classifying borrowers as good or poor credit risks. Lufburrow et al. used probit regression in their analysis of Production Credit Association loans. Fiske et al. employed logistic regression to model factors influencing currentness of debt payment among Ohio farmers. Mortensen et al. and Miller and LaDue used logistic regression to predict probability of loan default of farmers in North Dakota and New York, respectively. In contrast with these previous studies, this paper extends the probabilistic model to the problem of analyzing the performance of restructured, nonaccrual borrowers.

In binomial logit analysis, it is assumed that there is an underlying response variable Y^*_i defined by the regression relationship

(1) $Y^*_i = \beta^T X_i + u_i$

where X_i are the independent variables, u is the error term, β is the vector of coefficients, and T indicates the transpose. In practice, Y^*_i is unobservable. Used in its place is the dummy variable Y, defined by

(2) Y = 1 if the restructured loan does not perform (i.e., if $Y^*_i > 0$)

= 0 if the restructured loan does perform (i.e., if $Y^*_i \leq 0$).

In this formulation $\beta^T X_i$ is $E(Y^*_i \mid X_i)$.

From equations (1) and (2),

(3) $\text{Prob}(Y_i = 1) = P_1$

$= \text{Prob}(u_i > -\beta^T X_i)$

$= 1 - F(-\beta^T X_i)$

where F is the cumulative distribution for u. In this case the observed values of Y are the realizations of a binomial process with probabilities given by equation (3), which vary from trial to trial (depending on the X_i). Hence, the likelihood function is

$$(4)\quad L = \prod_{y_i = 0} F(-\beta^T X_i) * \prod_{y_i = 1} [1 - F(\beta^T X_i)]$$

Since the cumulative distribution of u_i is assumed to be logistic, it follows that

$$F(-\beta^T X_i) = \frac{\exp(-\beta^T X_i)}{1 + \exp(-\beta^T X_i)} = \frac{1}{1 + \exp(\beta^T X_i)}.$$

Therefore, $1 - F(-\beta^T X_i) = P_1$

$$(5)\quad = \frac{\exp(\beta^T X_i)}{[1 + \exp(\beta^T X_i)]}.$$

In this case, there is a closed-form expression for F (because it does not involve explicit integrals) and P_1 can be computed. Rearrangement of equation (3) gives

$$(6)\quad \text{Ln}\left[\frac{P_1}{(1 - P_1)}\right] = (\beta^T X_i).$$

The dependent variable in this application of the regression equation is simply the logarithm of the odds that the restructured loan will not perform.[3] A restructured loan is not performing if the borrower failed to make interest and/or scheduled principal payments under the terms of the restructure arrangement. One of the advantages of the logistic approach is that an estimate for the critical point of explanatory variable i can be derived by solving the model with $\beta^T X_i=0$ and all other variables at their mean values. The critical point for variable i is the value at which this variable has the greatest impact on the conditional probability of nonperformance.

DATA

Stratified random sampling was used to select FLB borrower credit files in southern Minnesota based on business-view principal of the borrower accounts. The business-view principal refers to the FCB's book value of the loan and includes outstanding principal and accrued interest. FCB employees and persons contracted to the FCB collected information from individual credit files of borrowers for several years prior to debt resolution (1984-1986), the year debt was restructured (1987), and the year following the restructuring action (1988). Individual case data were collected from a total of 85 restructured borrower files. Three general categories of variables were identified for analysis: financial, nonfinancial, and restructure variables. Summary statistics for some of the identified variables are reported in Table 1. Since parameter estimates were found to be sensitive to missing values, only the 44 cases with complete information were used in the analysis.[4]

Financial Variables

Financial variables were expressed in relative index form. These indices were computed as the 1988 (post-restructure) values divided by the corresponding geometric means of the 1984-1987 (pre-restructure) values. For example, the debt/asset index (DA) is equal to the debt/asset ratio in 1988 divided by the geometric mean of the debt/asset ratio during 1984-1987. This index measure approach was used to measure the influence of changes in these financial variables from the pre-restructure period to the post-restructure period on the likelihood of post-restructure loan performance. An index value greater than 1.0 indicates that an increase occurred in the financial measure during 1988 compared with the mean of the previous years. Although numerous financial variables were computed, only those that were significant predictors of loan performance are reviewed here.

Several measures of the change in farm earnings were identified as potential predictors of loan performance: the rate of return on farm assets (ROA), gross cash farm income (GCFI), net cash farm income, and net farm income (accrual). The ROA measure (net cash farm income plus interest paid divided by total assets) is easily converted to an index of profit performance. However, the ROA index is a function of changes in both farm earnings and asset values. Land values had fallen sharply during 1982-1987 (Schwab and Raup) which would tend to raise ROA measures in the pre-restructure period even though farm earnings may have deteriorated. The rise in land values during 1988 would have the opposite effect on ROA. Additionally, the FLB had previously used benchmark farms to gauge changing land values. These benchmarks may not

Table 1. Descriptive Statistics for Predictors of Post-Restructure Performance

Variable	Mean	Standard Deviation	Median	Interquartile Range 25th Percentile	Interquartile Range 75th Percentile	Minimum	Maximum
DA (index)[a]	.85	.22	.83	.78	.98	.33	1.31
DSI (index)[b]	1.04	.22	.99	.93	1.08	.69	1.78
GCFI (index)[c]	1.05	.27	1.05	1.0	1.1	.22	1.78
INT (%)[d]	9.18	1.10	9.	8.	9.76	8.00	12.75

[a] Debt to asset index
[b] Debt structure index
[c] Gross cash farm income
[d] Post-restructure interest rate

[3] The "odds" that the restructured loan would not perform relates to the ratio of the probability that the loan would not perform to the probability that the loan would perform.

[4] The use of only complete case data does not introduce bias into the empirical analysis. Summary statistics for the complete and incomplete cases were compared on all variables where data was available and found to be nearly identical.

have accurately reflected changes in the land values of individual farms. In 1987, appraisals were done by the FCB to establish more accurate asset values as part of the restructuring effort. Since changing farm earnings and asset values are combined into a single ROA index measure, interpretation of the effect on loan performance becomes difficult. Consequently, the ROA index was rejected in favor of separate indicators of farm earnings and asset values.

Gross cash farm income (GCFI) was found to be the measure of farm earnings which was the best predictor of loan performance. In addition, the GCFI captures the effect of changes in economic conditions on farm financial performance during the post-restructure period. While GCFI is an annual measure, the GCFI index reported in Table 1 is expressed as the ratio of the 1988 (post-restructure) cash income to the mean of the 1984-1987 cash income series. The mean GCFI index value (1.05) indicates that there was a 5 percent increase in the average level of cash incomes during 1988, even though that was a drought year. An increase in the GCFI index is expected to result in a greater capacity to repay debt in the post-restructure period. According to the interquartile range statistics, about 75 percent of the restructured farms experienced the same level or higher gross cash farm income during 1988 when compared with the mean of the pre-restructure years.

Debt/asset (DA) ratios were computed (as total farm liabilities divided by total farm assets) and the ratios were converted to index measures. The DA index measure of changes in financial leverage position is also affected by changes in asset values. In this instance, however, these changes do not create an interpretation problem. Prior to 1987, the decline in asset values would tend to raise the pre-restructure leverage position if debt was not paid off at a commensurate rate. Restructuring typically involved a debt reduction, and the DA ratio would have decreased. The mean DA index should be less than 1.0 and indicate a lower leverage position in the post-restructure period. The implication of this lower debt burden is that the probability of loan repayment is improved. The sample mean DA index was estimated to be 0.85, which implies a 15 percent average reduction occurred in the relative debt load of restructured operators. Similarly, the 75th percentile statistic is 0.98. This indicates that about three-fourths of the sample borrowers were in post-restructure debt positions which had been reduced by 2 percent or more from the debt/asset positions they carried prior to restructuring.

A deficiency of the DA index is that it does not indicate if the maturity of debt has been significantly altered by restructuring. The debt structure index (DSI) is a measure of the relationship between noncurrent liabilities and noncurrent assets (Mazzocco).[5] Computationally,

$$DSI = [(TL-CL)/TL] / [(TA-CA)/TA]$$

where TL is total liabilities, CL is current liabilities, TA is total assets and CA is current assets. The DSI is an indicator of potential liquidity problems arising from the combined effects of financial leverage and differences between the timing of maturities of liabilities and the rates at which noncurrent assets contribute to cash flow.[6] The DSI index was computed by dividing the post-restructure DSI by the mean pre-restructure DSI. The result is a relative index measure which exceeds 1.0 when the financial structure of the farm business has been altered toward proportionately greater long-term liabilities through debt restructuring. The mean DSI index is 1.04 and the estimated standard deviation is 0.22. The 4 percent increase in the average DSI value is expected to increase the ability of the average farm to make repayment on the restructured loan.

Restructure Variables

Loan restructuring is a process during which lenders may consider a number of additional financial parameters of the problem. The factors which must be considered in the restructure versus foreclosure decision are now dictated under the 1987 Agricultural Credit Act. Since the St. Paul-FCB conducted most of its 1987 restructuring activity prior to passage of the 1987 Act, we identified restructure variables that were logically related to the performance of these loans. Three of those variables were the loan penetration ratio (FLB debt/net realizable value of assets held by the FLB as collateral) expressed as an index measure, the dollar amount of borrower FLB debt (outstanding principal plus accrued interest)

[5]Note that the ratio of noncurrent liabilities to noncurrent assets is the product of the DA ratio and the debt structure index, i.e., (TL-CL)/(TA-CA) = DA * DSI. Both the overall leverage position of the borrower and the relative maturities of assets and liabilities are captured in the DSI ratio.

[6]To illustrate, consider two firms, each with a DSI of one, and identical values of total assets. Assume, firm A has a DA ratio of 0.3, while firm B has a DA ratio of 0.9. If all other factors are equal, firm B will require annually three times more cash than firm A to reduce term debt. Firm B's likelihood of experiencing liquidity problems is magnified by its financial leverage.

after restructuring, and the post-restructure interest rate (in percent). Neither the loan penetration ratio nor the amount of outstanding debt were found to be strongly related to loan performance and are not discussed further.

The post-restructure interest rate (INT) is the contractual interest rate charged by the FLB after restructuring the loan. The average interest rate on restructured loans in the sample was 9.18 percent. These post-restructure interest rates ranged from 8.0 to 12.75 percent. Comparison of these rates with rates on accruing FLB loans indicated that significant rate reductions frequently occurred on restructured loans. The restructure interest rate was typically set as a 3-year fixed rate. At the end of the fixed-rate contract the interest rate is to be renegotiated with the FLB. Consequently, loans that were restructured in early 1987 were due for an interest rate review/adjustment beginning in early 1990. It is expected that a lower post-restructure interest rate increases the probability that the borrower would perform on the loan.

Nonfinancial Variables

Initially, numerous characteristics of the borrower and the borrower's business were considered as potential determinants of ability or willingness to repay the restructured loan. However, the theoretical justification for including them in the model was not strong. The fact that they were not important predictors was borne out by the lack of significant statistical relationships with the loan performance variable and problems of intercorrelation between those variables. The following variables were considered: the farmer's age, how long the farmer had been borrowing from the FLB, the size of farm (total assets), annual nonfarm income, a dummy variable for cooperativeness of the borrower with the FLB in seeking a compromise on the debt, the FLB's assessment of the borrower's business management ability, and the value of the borrower's land assets in 1988 divided by the value in 1987.

LOAN NONPERFORMANCE ANALYSIS

Multi-collinearity among the variables was analyzed using the method of singular value decomposition (Belsley, Kuh, and Welsch).[7] The procedure revealed that significant collinearity existed among variables in the initial data set. One acceptable method of correcting the multi-collinearity problem is to omit one of the collinear variables (Kennedy, p. 151). The premise behind this approach is that the true coefficient of the dropped variable would be zero because of a high degree of linear dependence. In such a case, the estimated coefficients would not be seriously biased by dropping the redundant variable, and the efficiency of the parameter estimates improves. A trade-off necessarily occurs between gain in efficiency and acceptable levels of bias in the estimates. While multi-collinearity would not result in biased estimates, greater efficiency was the preferred outcome in the restructure analysis due to the study's focus on significant predictors of nonperformance. Restructured borrower cases were pooled for a single analysis and LIMDEP software was used for model estimation. The criteria for choosing the appropriate model were the pseudo-R^2 statistic, the log-likelihood ratio, the Chi-square statistic, asymptotic-t values, and correct prediction percentages.

Estimated parameters of the restructured-performing (RP) equation were normalized to zero for the purpose of interpretation. The restructured-nonperforming (RNP) model coefficients are the probabilities that restructured loans would not perform relative to the outcome that those loans would perform. Results in Table 2 indicate the variables that were found to be significant in explaining why restructured loans did not perform. Nonfinancial variables were not significant and were excluded from the final model. The post-restructure interest rate (INT) was the most highly significant predictor of nonperformance and the coefficient has the expected positive sign. The higher the interest rate, the higher

Table 2. Restructured Loan Nonperformance Model Results with RP as the Base

Variable	Estimated Coefficient	T-statistic	Significance Level
INT (%)[a]	1.11435	2.14	0.0321
DSI (index)[b]	-8.49685	-1.64	0.1004
GCFI (index)[c]	-6.12892	-1.84	0.0656
DA (index)[d]	3.17294	1.45	0.1472
Log Likelihood ratio		=	17.904
Chi-squared significance level (3)		=	.00046
Pseudo-R^2		=	.47

[a] Post-restructure interest rate.
[b] Debt structure index.
[c] Gross cash farm income.
[d] Debt/asset ratio.

[7] SVD is a procedure for diagnosing the presence of multi-collinearity among the independent variables. The procedure uses two criteria: a singular value with a high condition index (30 or above) associated with a high variable decomposition proportion (0.5 or above) for two or more estimated regression coefficients. These two criteria jointly indicated which variables are exhibiting near dependency. Those variables were dropped from the analysis.

are the odds that the restructured loan would not perform.

The DSI index variable carried the expected negative sign and the coefficient is significant at the 10 percent level. The higher the DSI index, the lower the odds that restructured loans would not perform. The general interpretation of this model result is made in two parts. First, a higher DSI ratio reflects an improvement in farm financial structure (other factors held constant). Similarly, a higher DSI index (DSI post-restructure ratio/DSI pre-restructure ratio) also reflects an improvement in farm financial structure. More specifically, a higher DSI ratio indicates that the proportion of long-term liabilities in the capital structure is higher, while a higher DSI index indicates that the post-restructure proportion of long-term liabilities in the capital structure has increased relative to the pre-restructure proportion. Second, the consequence of an increase in the DSI index was a reduction in the likelihood of a future liquidity problem. Debt maturities were restructured so that the demands on farm cash flow are proportionately lower and more consistent with the level of cash flows generated by fixed farm assets. The higher DSI index can be achieved through an increase in the noncurrent liabilities/noncurrent assets ratio, or through a reduction of the total liabilities/total assets ratio, or through a combination of these financial structure adjustments.

The accounting definition of the DSI measure indicates that the DSI and DA variables are inversely related. However, the actual extent of that inverse relationship depended on the degree of statistical correlation found in the sample farm data set. The correlation coefficient between the DSI and DA index variables was found to be low (-0.19). Hence, to isolate the differential effects of long-term liquidity and financial structure, the DA variable was also included in the model. This improved the overall significance of the variables and separated the effects of debt structure from leverage on loan nonperformance. The DA index variable has the expected positive sign but is not highly significant. The higher the debt/asset index, the higher the probability that the loan will not perform.

As expected, the gross cash farm income (GCFI) index had a negative sign in the model. The higher the level of gross cash farm income in the post-restructure period, the lower the probability that the borrower would default. An improvement in a borrower's post-restructure gross cash farm income situation was interpreted as an increase in the debt repayment capacity of the borrower's farm business. The coefficient on the GCFI index variable was significant at about the 7 percent level.

A total of 36 cases was used to estimate the equation (of which 28 cases were performing loans and 8 were nonperforming loans). When applied to the data set, the estimated equation correctly classified 93 percent of restructured loans in the restructured performing loan (RP) category. The model also correctly identified 75 percent of the nonperforming restructured loans (RNP). Total correct classification of loans was 89 percent. The model was validated using a 15 percent holdout sample (8 cases).

Parameter estimates performed reasonably well in the holdout sample with a total correct classification of 71 percent. The model was also evaluated by computing the probabilities of nonperformance at the mean values of the variables. The probability that the average restructured loan would not perform was estimated to be 9 percent. This fell in the 5-10 percent range of nonperformance anticipated by FCB credit personnel.

Marginal Probabilities

The probability of nonperformance at different levels of the interest rate and gross cash farm income index are illustrated in Figures 1 and 2. In Figure 1 the post-restructure interest rate (INT) is varied as the DSI, DA, and GCFI indices are held at their mean values. When the interest rate is raised from the mean (9.18) percent to 10.28 percent (one standard deviation higher) the probability of nonperformance rises from 9 percent to over 25 percent. This increase in nonperformance is significant but reflects the rate of response in a relatively flat section of the cumulative probability curve. Since the relationship is nonlinear, larger increases in the interest rate imply proportionately larger increases in the rate of default. The corresponding effects of improvements in farm income on loan performance are illustrated in Figure 2 by varying the GCFI index while holding INT, DSI, and DA at their mean values. When the GCFI index is set at 0.78 (one standard deviation below its mean) the probability that the restructured loan would not perform increases from about 9 percent to over 33 percent.

The impact of a change in any one of the independent variables on the conditional probability of nonperformance can be assessed using marginal analysis. However, it is to be noted that the marginal effect is not constant because of the logistic distribution of the error term. The marginal effect is calculated at the overall mean values of the other independent variables. The marginal effect is the change in the conditional probability of nonperformance associated with a one percent change in the independent variable away from its mean, holding

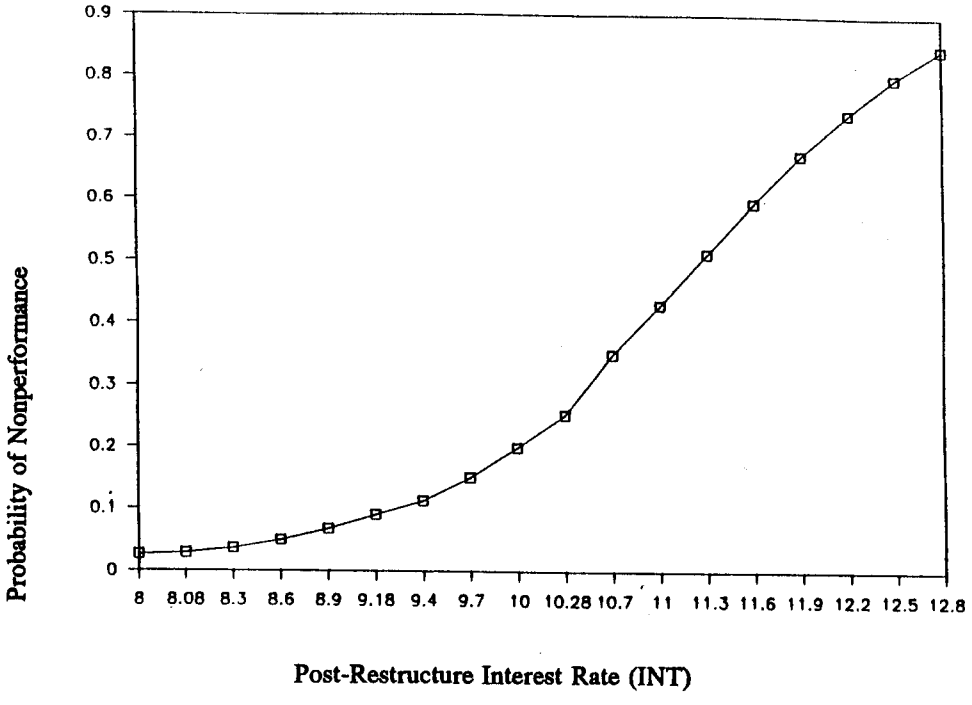

Figure 1. Effect of Post-Restructure Interest Rate on Loan Nonperformance

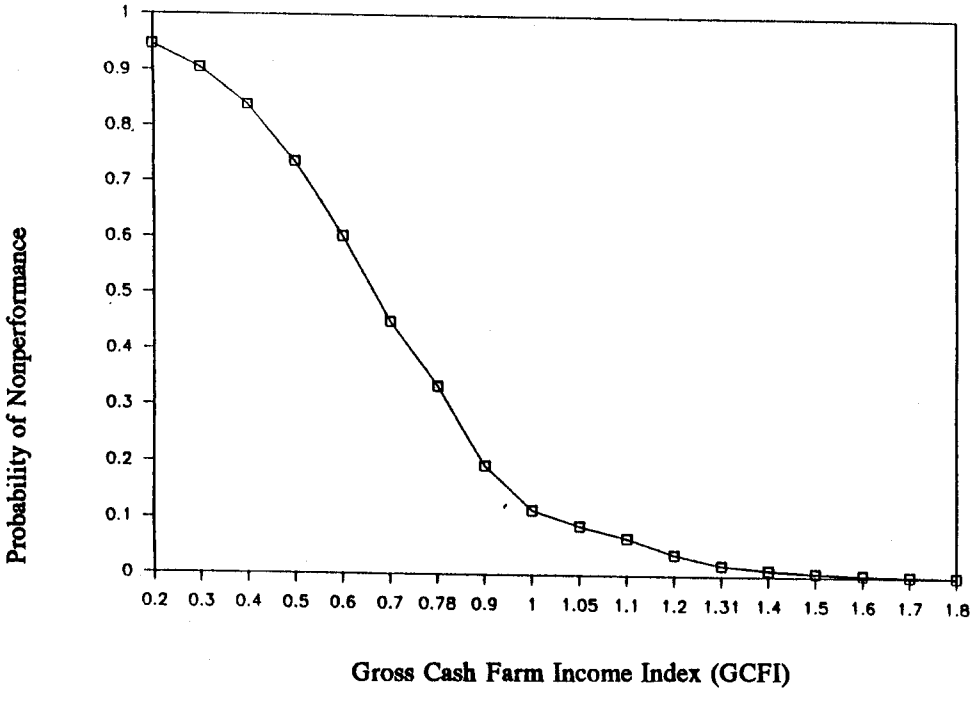

Figure 2. Effect of Gross Cash Farm Income on Loan Nonperformance

the remaining independent variables at their mean values. The results are presented in Table 3.

The post-restructure interest rate had the largest marginal effect on the conditional probability of nonperformance. The marginal effect was 0.87. A one percent upward adjustment in the post-restructure interest rate from its mean (9.18 percent) to 9.27 percent is associated with a 0.87 percent increase in the conditional probability of nonperformance of restructured loans. The analogous effect could be shown for a decrease in the interest rate. A similar interpretation applies to the DSI index except that a 1.0 percent increase (decrease) in the DSI index reduces (increases) the conditional probability of nonperformance by 0.7 percent. The GCFI index and the DA index variables have correspondingly smaller influences on the probability of nonperformance, as suggested by their smaller marginal coefficients.

Table 3. Marginal Effects, Means and Critical Points for the Independent Variables

Independent Variable	Marginal Effect	Mean	Critical Point
INT (%)[a]	0.87	9.18	11.25
DSI (index)[b]	-0.70	1.04	0.76
GCFI (index)[c]	-0.52	1.05	0.66
DA (index)[d]	0.22	.85	1.58

[a] Post-restructure interest rate.
[b] Debt structure index.
[c] Gross cash farm income.
[d] Debt/asset ratio.

Critical Point Analysis

A critical point on the logistic curve is the location at which changes in the probability of nonperformance are the greatest (i.e., slope is the steepest). As one moves away from this point, the probability that restructured loans would not perform changes less dramatically. This value is estimated by solving the model in Table 2 with $\beta^T X_i = 0$ for the value of the i-th variable (in Equation 6) while holding all other variables at their mean values.

The critical value of INT is 11.25 percent. At that interest rate level the conditional probability of nonperformance is 50 percent. This is illustrated in Figure 1. As the post-restructure interest rate approaches 11.25 percent, the interest rate achieves its maximum impact on the probability of nonperformance. Similar critical values are reported in Table 3 for the other variables in the model. These critical points represent values of individual variables at which FCS restructuring actions would achieve the largest effect in controlling performance of the post-restructure loan portfolio.

Two characteristics of these critical points are notable. First, when all four variables are jointly set at their critical values they define an extremely high percentage of nonperformance. This high level of nonperformance can readily be seen by comparing the critical point values with the mean statistics in Table 3. A loan characterized by all four critical points would carry a higher-than-average post-restructure interest rate, a lower-than-average debt structure index, a significantly greater financial leverage position than the average, and a sharply lower-than-average level of gross cash farm income. Based on signs of the estimated coefficients in Table 2, each of these critical point variations from the sample means contributes to a higher rate of nonperformance. Clearly, the FCB could improve overall loan performance by managing the restructure process to avoid positioning borrowers at levels of the determinants which are simultaneously equal to the four critical points. This characteristic of critical points also suggests that a range of trade-offs may exist among the identified factors when banks undertake individual loan restructuring. Second, the post-restructure interest rate represents a policy variable that the FCB could use to influence the performance of its restructured loans. The other predictor variables are exogenous to the FCB. Therefore, the critical-point concept is analyzed in terms of the trade-off between projections about changes in the level of gross cash farm income and the post-restructure interest rate which the FCB could set to achieve a level of nonperformance that is both financially feasible and acceptable.

For illustration, the 9 percent level of nonperformance predicted by the model (at the means of the variables) is assumed to be financially sustainable by, and acceptable to, the FCB. Various levels of gross cash farm income are assumed due to uncertainty about farm prices and/or yields. The resulting GCFI indices are varied between a 30 percent improvement and a 30 percent deterioration (while holding the DSI index and DA index at their sample means) to simulate the problem (Table 4). Note also that the base projection for the GCFI index is 1.05, which corresponds with the mean 5 percent increase in gross cash farm income found in the sample. To maintain a 9 percent level of expected nonperformance, the FCB would need to reduce the interest rate on restructured loans to offset the effects of lower projected cash farm income. A 10 percent lower projected GCFI (which reduces the GCFI index from 1.05 to 0.95) would imply a decrease in the interest rate from 9.18 percent to 8.63 percent. Con-

Table 4. Relationship Between the Projected GCFI Index and the Post-Restructure Interest Rate

Projected Change in GCFI Index (%)	GCFI[a] Index	Implied Interest Rate (%)
-30	0.735	7.45
-20	0.840	8.03
-10	0.950	8.63
-5	1.000	8.90
0 (base)	1.050	9.18
5	1.1025	9.46
10	1.155	9.76
20	1.260	10.34
30	1.365	10.91

[a] Gross cash farm income.

versely, a 10 percent improvement in the projected GCFI index variable (from 1.05 to 1.155) would allow the FCB to restructure nonperforming loans at a 9.76 percent rate and still maintain the target rate of loan nonperformance. In this way the FCB's interest rate policy could become a more integral part of its strategic plan for restructuring nonaccrual loans.

SUMMARY

A binomial logit analysis was developed using cross-sectional data to estimate the probability that a restructured loan would not perform during the post-restructure period. Not surprisingly, the analysis of post-restructure performance indicated that loans had a higher probability of not performing if the post-restructure interest rate was higher, the level of borrower gross cash farm income was lower, the debt structure index was lower, and financial leverage was higher in the post-restructure period. However, the empirical analysis also shows that these factors were not equally important, and that the probability effects of these factors are not linear. For example, the post-restructure interest rate was found to be a relatively more important predictor of loan performance than the other variables in the model. The probability of loan nonperformance was also shown to vary in a nonlinear fashion as interest rates and other determinants were allowed to vary. Significance of the interest rate, cash farm income, debt structure and total financial leverage variables in the model indicated that restructured loans remained highly sensitive to factors which determine the debt repayment burden and the repayment ability of the restructured farm operations.

These results suggest factors which the Farm Credit Banks and other agricultural lenders might consider to achieve a desired level of performance on restructured loans. Furthermore, marginal analysis indicates that interest rates could be adjusted to offset changes in projected farm income and maintain farm loan performance at an acceptable level. Since only one year of information was available for the analysis, the determinants we identify apply primarily to the short-run performance of these loans. Other factors may also be important in determining long term performance of these loans. This becomes relatively more important as the Farm Credit Bank considers raising restructured loan interest rates to levels that are consistent with rates on other accruing loans in its portfolio and as financial and income conditions in agriculture change.

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