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THE CHARACTERISTICS OF VARIABLE INTEREST RATE PLANS AND THEIR EFFECT ON FARM BUSINESSES

Eddy L. LaDue

Proceedings of a Seminar
Sponsored by North Central Regional Project NC-161
"Evaluating Financial Markets for Agriculture"

FINANCIAL MARKETS FOR AGRICULTURE: MACRO, INSTITUTIONAL, AND POLICY ISSUES

St. Louis, Missouri
October 31-November 1, 1984

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Eddy L. LaDue

The rapidly rising and volatile interest rates of the late 1970s and early 1980s resulted in bank losses on fixed-rate loans made during earlier lower rate periods. Many of the sources of funds used by banks were market sensitive and, thus, moved up as general interest rates increased. However, the income that banks received on fixed-rate loans was constant. In response to these losses and an expectation that interest rates will be quite variable in the future, banks started searching for ways to manage this increased interest rate risk.

One method of reducing the interest rate risk that was widely used by the Farm Credit System and by banks for many commercial loans was variable interest rates. Variable interest rates allow the lender to pass the interest rate risk on to the borrower and, thus, avoid the risk of substantial losses when interest rates rise.

The objectives of this study were to: (1) determine the level of use and characteristics of variable rate programs offered by lenders and, (2) to assess the potential impact of variable rates on farm borrowers. Today, I am going to briefly discuss the results of a survey of the variable interest rate programs offered by banks and a simulation analysis of the impact of variable rates on farm businesses.

Survey of Variable Rate Programs

Data on the use and characteristics of variable rate programs were collected via a mail survey of the 80 New York State banks with over $500,000 in farm loans according to the December 31, 1980 Call report. Completed questionnaires were obtained from 52 banks. These banks represented 68 percent of the banks contacted and 86 percent of New York State commercial bank farm loan volume.

The average farm loan volume of respondents was $6.1 million (table 1). Thirty-five banks had farm loan volume of less than $5 million and averaged $1.6 million in farm loans while 17 banks had over $5 million in farm loan volume and averaged $15.3 million in farm loans.

The farm loan to total loan ratio (farm loan ratio) of respondents ranged from 0.1 percent to 40.2 percent with an average of 9.4 percent. Thirty-five percent of the respondents (18 banks) had separate farm loan departments. These banks had average farm loan volume of $13.9 million, median total assets

Eddy LaDue is a Professor in the Department of Agricultural Economics, Cornell University, Ithaca, New York.

of $138.4 million and an average farm loan ratio of 12.0 percent. In contrast, the banks without farm loan departments had an average farm loan volume of only $1.9 million, median total assets of $38.4 million and an average farm loan ratio of 7.8 percent.

Table 1. SURVEY RESPONDENT CHARACTERISTICS
52 New York Banks, 1983

Characteristics	Value
Farm Loan Volume	$6.1 million
Farm Loan Ratio (Farm/Total)	9.4 %
Separate Farm Department	35 %
Member Multi-bank Holding Co.	29 %

Use of Variable Rates

Seventy-five percent of the survey respondents reported using variable rates on at least some loans (table 2). The use of variable rates appears to be closely related to size. The percent of banks using variable rates increased as total loan volume increased and as bank size increased. All banks with farm loan departments reported using variable rates compared to only 62 percent of other banks.

Variable rates were most frequently used on intermediate-term loans followed closely by short-term loans. Because of their limited duration, short-term loans can sometimes be made at fixed rates with little more risk to the bank than a variable rate. Other risk reduction strategies are often used on long-term loans. Some banks, usually the smaller ones, limited risk by not making long-term loans. Others employed other types of interest rate plans, particularly renegotiable rates (table 3). Renegotiable-rate loans[1/] were used on long-term loans by about one-third of the banks. Some banks also used them on intermediate-term loans (table 3). However, no banks used only renegotiable rates on intermediate-term loans. This type of loan results in some risk sharing between the borrower and lender.

1/ A renegotiable rate is fixed for a specified period, usually three to five years, at which time the rate may be changed according to an index or at the lender's discretion. The rate is then fixed at the new rate for a similar specified period. This process is repeated for the duration of the loan.

Table 2. COMMERCIAL BANK USE OF VARIABLE RATE LOANS
52 New York Banks, 1983

Bank Description	Number of Respondents	Use on at least one type	Loan Term		
			Short	Intermediate	Long
		Percent	% of Banks Using Variable Rates		
All Banks	52	75	67	71	48
Banks with total farm loans of:					
$500,000 to $1 million	17	53	47	47	24
$1 million to $5 million	18	72	61	67	44
more than $5 million	17	100	94	100	77

Table 3. INTEREST RATE PLANS OFFERED ON FARM LOANS
52 New York Banks, 1983

Plan	Loan Term		
	Short	Intermediate	Long
	Percent of Banks		
Variable Only	21	19	26
Fixed Only	30	22	13
Variable and Fixed	49	38	6
Renegotiable Only	NA	0	15
Variable and Renegotiable	NA	6	17
Fixed and Renegotiable	NA	4	2
All Three Types	NA	11	2
Do Not Offer	0	0	19

NA = Not applicable, renegotiable rates cannot, by definition, be used on short-term loans.

Many banks offer more than one interest rate plan, indicating that loan officers, at least theoretically, have some latitude in tailoring loan terms to borrower, and possibly lender, needs.

Somewhat surprisingly, a number of banks continued to offer only fixed rate loans. In some cases this likely resulted from a slow or more deliberate response of the bank to the more volatile interest rate environment. In other cases it appears that, at least for the present, bank management has decided that the costs and disadvantages outweigh the benefits. Banks continuing to use only variable rates tended to be smaller banks with low farm loan volume.

Those respondents who did not use variable rate loans and who had no plans to do so were asked how they were able to offer competitive, yet profitable, interest rates on their farm loans. Their responses basically fell into three groups. The first group indicated that they were able to do so only with great difficulty. They relied on providing fast and personal service. A second category of respondents used maturity adjustment to stay profitable. This included matching the maturities of loans and borrowed funds or keeping all of their loans relatively short-term. A third group stated that they were able to compete by giving low fixed-rate loans. These three banks did not indicate how profitable their rates were, but in order to consistently maintain relatively low rates they would need stable, low-cost sources of funds. Except for maturity matching, none of these strategies appear viable in the long run if interest rate variability exists.

One alternative for reducing interest rate risk, which was suggested by some bankers, is to shorten the maturities on loans. The maximum maturity on fixed-rate loans at respondent banks averaged 8.9 months for short-term loans, 6.4 years for intermediate-term loans and 19 years for long-term loans. This was about the same as, or only modestly shorter than, the maximum terms on variable-rate loans which were 9.2 months, 7.4 years and 18.7 years respectively. Although lenders may have increased the frequency with which shorter term loan periods were used, New York banks do not appear to be reducing their interest rate risk by reducing the maximum loan terms allowed.

The primary reason for the low use of variable rates on long-term loans is the use of other risk limiting options which decrease the need for variable rates. Use of renegotiable rates or just not making long-term loans were the most prevalent options. Since only 13 percent of survey respondents currently offer only fixed rates on long-term loans, most banks offering long-term farm loans do so on either a renegotiable or variable rate basis.

Farm Loans at Variable Rates

Although most New York banks use various alternatives to variable-rate loans, the level of use of these alternatives on new farm loans is quite limited. This is especially true among the banks that are most heavily involved in farm lending, those with more than $5 million of farm loans and those with separate

farm loan departments. This situation could result either because banks restrict the use of other alternatives or because farmers choose variable-rate loans rather than one of the other alternatives.

The high rate of use of variable rates by those banks who offer them and the high agricultural loan volume of banks offering variable rates result in the proportion of new farm loans made on a variable rate basis being higher than the proportion of banks offering variable rates (table 4).

Table 4. PROPORTION OF NEW FARM LOANS MADE ON VARIABLE RATE BASIS 52 New York Banks, 1983

Bank Description	Loan Term		
	Short	Intermediate	Long
	Percent of Loans[a]		
All Banks	71	81	81
Banks with total farm loans of:			
$500,000 to $1 million	48	78	70
$1 million to $5 million	63	78	72
More than $5 million	84	84	88
Farm loan department status:			
With department	84	86	90
Without department	57	75	69

[a] Assumes that the actual use by banks falls at the midpoint of the ranges specified in the survey questionnaire.

As would be expected, the existing portfolio has a lower proportion of variable-rate loans than was found for new loans. The proportions of farm loan portfolios with a variable rate are 68 percent for both short- and intermediate-term loans, but only 46 percent for long-term loans. Since 81 percent of new

long-term farm loans are made with a variable rate, the proportion of the long-term portfolio with a variable rate will increase substantially in the coming years as the old, fixed-rate loans are retired from the portfolio and replaced by variable-rate loans.

Variable Rate Indices

The indices used most often by respondents to set and to change their variable rates were their own bank prime rate and the New York City prime rate. These indices were used by 46 percent and 37 percent of the banks respectively (table 5). The percentage using their own bank prime rate includes those respondents who indicated that they base their index on their cost of funds plus a spread, because these are the components of an internal prime rate.

Table 5. VARIABLE-RATE LOAN INDICES
52 New York Banks, 1983

Index	All Banks
	Percent
Own Bank Prime[a/]	46
New York City Prime	37
Federal Reserve Discount Rate	11
Competition[b/]	6
Others[c/]	17

a/ Includes those banks that use their cost of funds plus a spread.

b/ These banks base their rate on what other local lenders are charging.

c/ Each of the following is used by one bank: Federal Home Loan Mortgage Corporation index, Federal Home Loan Bank Board index, Six-month money market rate, Monthly average Treasury Security yield, Demand notes, and no index.

NOTE: Totals do not equal 100 percent because some banks use more than one index.

The third most prevalent index was the Federal Reserve's discount rate which is used by 11 percent of respondents. This is somewhat surprising since the discount rate is used as an instrument of monetary policy and may not move with more general market rates. However, it has apparently been selected because it is less volatile than other rates but keeps variable rates reasonably close to market rates.

Six percent of the banks base their rate on what other local lenders are charging. Seventeen percent of the respondents use other indices, such as the Federal Home Loan Bank Board index, the Federal Home Loan Mortgage Corporation index, the six-month money market rate, and the monthly average Treasury Security yield. One bank uses demand notes and another does not use an index.

Changing Rates Charged

Variable rate indices can be employed in varying ways. Interest rates can be changed whenever and in the amount the index changes, or the index can be used as an indicator of the amount of change that could be made with both the timing and exact amount of change determined by bank management. Nearly half (48 percent) of the respondents indicated that they change loan rates automatically with changes in their index, although one bank that uses the New York City prime rate as their index said they do not usually go to the highest point possible (table 6). The senior management and farm lending personnel decide on the timing and amount of rate changes for 20 percent of the banks, while the loan committee makes the decisions on rate changes for an additional eight percent. For 17 percent of the banks, the loan officer who granted the loan makes the final decision on rate changes. These respondents said that the rate usually changes with the index but, especially during high rate periods, loan officers can selectively freeze or modify interest rates if the borrower's financial position would otherwise be seriously impaired. Most of the time the rate changes at the time and in the amount of the index change, but the loan officer can intercede if it is in the bank's best long run interest to do so.

Table 6. METHOD OF RATE CHANGE DECISIONMAKING
52 New York Banks, 1983

Decision Method	Percent of Banks
Automatic Change With Index Change	48
Management Committee Determined	20
Loan Officer Decision Within Guidelines	17
Other	15

Most banks have considerable flexibility in the frequency with which they change rates. Approximately 50 percent of respondents stated that they can change the interest rates whenever the index necessitates a change, daily if

necessary (table 7). The other 50 percent of the banks generally used monthly, quarterly or annual adjustments.

Table 7. PERMITTED FREQUENCY OF INTEREST RATE CHANGES ON FARM LOANS
52 New York Banks, 1983

Frequency	Loan Term		
	Short	Intermediate	Long
	Percent of Banks		
Daily	51	51	52
Monthly	20	22	8
Quarterly	29	19	8
Annually	NA	3	16
Other[a/]	12	11	20

a/ Weekly, bi-monthly and bi-annual adjustments are each specified by one bank as their maximun adjustment frequency. In addition, one bank usually requires a one percent change in the index.

NOTE: Totals may not equal 100 percent because some banks offer two options.

Making changes no more frequently than once per month or quarter was often used on short- or intermediate-term loans but infrequently used on long-term loans. Annual changes were much more frequently used with long- than intermediate-term loans.

Very few banks had limits on the amount of interest rate adjustment that could be made (table 8). None of the banks had limits on the size of individual rate steps for short-or intermediate-term loans and only 13 percent had a maximum step for long-term loans. Similarly, few banks limited themselves to a maximum rate change over the life of the loan.

When interest rates change nearly half of the banks automatically change the monthly (or annual) payment to a level which, at the new interest rate, will amortize the remaining balance over the remaining maturity of the loan (table 9). However, some banks did recognize and use other alternatives. One alternative is to leave the monthly (or annual) payment constant, and either shorten or lengthen the loan's remaining maturity. The second is to leave the monthly (or annual) payment constant and vary the final payment. If interest rates are rising, the final payment is a balloon payment. If rates decline, this method is equal to changing the maturity.

Table 8. LIMITS ON VARIABLE RATE ADJUSTMENTS
52 New York Banks, 1983

Limit Description	Loan Maturity		
	Short	Intermediate	Long
	Percent of Banks		
Limit on size of individual change:			
None	100	100	87
Maximum	0	0	13
Minimum	0	0	4
Limit on total change over loan term:			
None	97	88	87
Maximum increase	3	9	13
Maximum decrease	0	6	13

Table 9. METHODS OF IMPLEMENTING INTEREST RATE CHANGES ON FARM LOANS
52 New York Banks, 1983

Implementation Method	Loan Term		
	Short	Intermediate	Long
	Percent of Banks		
Change in payment amount only	45	41	48
Borrower option between change in maturity or payment amount	13	18	17
Automatic maturity change, if possible then change in payment amount	23	27	26
Negotiable with borrower (maturity or payment)	13	12	9
Constant payment except final payment	2	2	0
Other method	6	6	4

NOTE: Totals may not equal 100 percent because more than one response is possible.

A significant number of banks did allow changing loan maturities, either automatically when possible, at the borrowers option or upon negotiation with the borrower. Only two banks used a constant periodic payment with a variable final installment.

Effect of Variable Rates on Farm Financial Performance

To assess the affect of the variable interest rate plans observed on the financial performances of farm businesses, a group of actual dairy farm businesses were simulated through the 1977-81 period under different interest rate plans. This was followed by simulating the business through a similar five year period with the same interest rate plans but under different interest rate environments. The alternate interest rate environments were: (1) reverse of 1977-81 (which was a fluctuating rate with a downward trend), and (2) a fluctuating rate without trend.

The Farms Studied

The studied farms were selected from those participating in Cornell University's Dairy Farm Business Summary project during 1977-81. A strata of farms were selected based on farm size and leverage. The three size categories were 40 to 60 cows, 85 to 115 cows and over 130 cows. In order to minimize the complicating effects of farm expansion, only farms which stayed within their size range during the entire five year period were selected. Leverage was measured by the percent equity as of 1977. Three initial leverage ranges were used: 30 to 45 percent, 50 to 65 percent, and 70 to 85 percent. These equity ratios correspond roughly to $2,500 to $3,500, $1,500 to $2,500 and $500 to $1,500 debt per cow, respectively. However, percent equity rather than debt per cow was used in order to accurately reflect the presence of nondairy enterprises on some farms.

The sample included 44 farms. There were six farms in each of the nine stratification cells except for some of the large-farm, low-equity combinations where fewer than six farms were available. All farms had complete balance sheet, income statement and production data for the entire five year period.

Interest Rate Plans

Nine different interest rate plans[2/] were used in the analysis (table 10). Each made use of one of three indices. Two frequently used bank related variable rate indices were employed: (1) the monthly average New York City prime rate, and (2) the Federal Reserve discount rate. The third variable rate index used was the Farm Credit Service effective rate on loans made in New York State.

2/ Interest rate type refers to the basic kind of interest rate used (i.e., fixed, variable or renegotiable). Interest rate index is the mover that specifies the level and/or adjustments that can be made in rates charged. Interest rate plan specifies the exact rate at any point in time and reflects such factors as the relation of the rate to the index (i.e., prime plus one) and the frequency of rate changes (i.e., quarterly).

Table 10. INTEREST RATE PLANS

Plan Description	Interest Rate Type	Index	Date Rates Set
1. Prime +1	Variable	Prime Rate	Monthly
2. Prime +1 with ceiling	Variable	Prime Rate	Monthly
3. Discount rate +4	Variable	Discount Rate	Monthly
4. Farm Credit	Variable	Average Cost of Outstanding bonds	Monthly
5. Renegotiable 1	Renegotiable and Variable	Prime Rate	Monthly, except long term on 1/1/75 1/1/78 and 1/1/81
6. Renegotiable 2	Renegotiable and Variable	Prime Rate	Monthly, except long term on 1/1/76 and 1/1/79
7. Renegotiable 3	Renegotiable and Variable	Prime Rate	Monthly, except long term on 1/1/77 and 1/1/80
8. Fixed Prime +1	Fixed	Prime Rate	Date loan originated
9. Adjusted Fixed	Fixed	Prime Rate	Date loan originated

Four different variable rate plans were used. The first, the prime rate plus one percent, is the rate most frequently used by banks. The second is the prime rate plus one percent but with a ceiling of 18 percent. This modification protects farmers from violent interest rate changes while requiring farmers to assume most of the interest rate risk. The third was the Federal Reserve discount rate plus four percent. The fourth variable rate was the average rate charged in New York State by the Farm Credit Service (FCS) adjusted for the stock requirement. Short- and intermediate-term loans were set at the average Production Credit Association (PCA) rate adjusted for a 10 percent stock requirement with automatic cancellation (as defined by LaDue, p. 51). Long-term loans were charged at the average Federal Land Bank rate adjusted for a five percent stock requirement with automatic cancellation. Use of automatic rather than end-of-period cancellation (which is used in New York) slightly underestimates actual FLB annual equivalent rates but adds greatly to computational ease.

Only one basic renegotiable rate plan was assessed. This plan allowed the interest rate to be changed every three years with no limits on the amount of change. Prime plus one was used as the index. Since the rate paid on these loans depends on when the loan was initiated, three renegotiable interest rate plans were developed based on when the initial loan was originated: 1975, 1976 or 1977. Under this plan only long term rates were handled on a renegotiable basis; short- and intermediate-term loans were variable and were based on prime plus one.

The seven variable rate plans were compared to two fixed rate alternatives. Under the first, rates were set at prime plus one as of the date of each loan's origination. This implies that a borrower can obtain a fixed rate at the same initial rate that would be paid for a variable-rate loan. The second fixed rate scenario adjusted these rates based on the relationship between fixed and variable rates charged on farm loans over the 1977-81 period (Zook and LaDue). These rates reflected lender expectations in that fixed rates were above initial variable rates when lenders expected rates to rise and below such rates when rates were expected to decline.

Analysis Procedure

The analysis procedure involved establishing the initial debt level and loan repayment schedule for each farm as of January 1, 1977 and then simulating the farm's financial situation through time based on the interest rate environment, the interest rate plan, and the farm's actual operating income and expenses.

The initial repayment schedule was based on the actual outstanding debt on the farm on January 1, 1977 and an assumption that all intermediate term debt had just been refinanced with maturities of five years. Operating loans with six-month maturities and April 30 initiation dates were used to finance crop expenses. A new five year intermediate-term loan was used for each year's capital purchases, as well as any real estate improvements actually financed by the farmer on an intermediate term basis. These loans were initiated on June 30.

The outstanding long term debt, as of January 1, 1977 was assumed to have 15 years remaining on an original loan term of 20 years. Any new real estate purchases or improvements actually financed with a long-term loan by the farmer were assumed to be financed with a 20 year loan beginning on January 1 of the year in which the purchase was made.

All loans required level principal and interest payments with complete amortization of the loan over its term. When rates were changed the loan was reamortized over the remainder of the life of the loan.

The amount of cash the farmer had available for making debt payments was calculated by subtracting total cash farm expenses from total cash farm receipts, adding back in the amount of interest included in cash farm expenses,

adding sales of capital items, adjusting for changes in accounts payable, and subtracting family living expenses. Family living expenses were estimated using a function specified as a base living allowance plus four percent of cash receipts.

The difference between debt service requirements and the amount available for debt service resulted in either an annual surplus or deficit which influenced the debt service burden through deficit financing, or the cash available in future years through surplus carryover. Surplus repayment capacity earned interest at one-half the average interest rate paid on loans for that year, or 5.25 percent, whichever was greater. Deficits were financed at the average interest rate paid on loans for the year and were financed over the next 12 months, unless the deficit exceeded 20 percent of the next year's total cash receipts. In the latter case, it was assumed that the lender would refinance the deficit with an intermediate-term loan for five years.

Payment Level and Variation

The direct effect of the various interest rate plans is shown through the resulting level and variation in debt service requirements. When evaluated over the 1977-81 period the variable rates based on the discount rate and the prime rate had the highest mean monthly payment for all farm groups, averaging 17 percent higher than fixed rates (table 11). The variable rate with an 18 percent ceiling had the next highest mean followed by the three renegotiable rates. Average payment under the renegotiable rate was only 10 percent above fixed rates. The two fixed rate scenarios generally had the lowest mean with the unadjusted scenario slightly lower than the adjusted one. The FCS plan normally ranked higher (five percent) than the fixed rates but below all other variable and renegotiable rates.

The variable rate based on prime had the highest average standard deviation among the nine plans. This was true for all but one of the nine size/equity farm groups. The only exception was for the large herd size/low percent equity group where the renegotiable rate set every three years beginning in 1975 had a higher standard deviation. This renegotiable rate also had the second highest degree of variability for all farms.

Contrary to conventional wisdom, the discount rate also resulted in a high degree of variability in debt payments. Renegotiable long term rates resulted in significant reductions in variability only in some cases. In those cases where rates are reset when interest rates are high (or low), variability is little affected. When they are set before an interest rate surge and hold throughout a rate peak, variability is reduced. However, since they normally apply only to long term debt, the degree of debt service stability provided is modest. Variability was lowest for the two fixed rate plans, followed closely by the FCS rates.

The highest maximum monthly payment for the majority of the farm groups occurred with the variable rate based on prime, although the variable rate based on the discount rate was highest for two groups. Again, the plans with the

lowest monthly payments were nearly always the FCS plan and the two plans with fixed rates.

Table 11. LEVEL AND VARIABILTY OF REQUIRED DEBT PAYMENTS[a]
44 New York Dairy Farms
1977-81 Interest Rate Environment

Interest Rate Scenario	Mean Monthly Payment	Standard Deviation	Maximum Monthly Payment
		Dollars	
Prime Rate +1	5,603	2,519	10,308
Prime Rate +1 with ceiling	5,492	2,365	9,580
Discount Rate +4	5,677	2,393	9,909
Farm Credit Service Rates	5,035	1,984	8,573
Renegotiable 1 (1975 Base)	5,471	2,450	10,216
Renegotiable 2 (1976 Base)	5,272	2,170	9,074
Renegotiable 3 (1977 Base)	5,205	2,290	9,293
Prime Rate +1 Fixed Rate	4,683	1,826	7,963
Adjusted Fixed Rate	4,815	1,855	8,103

[a] Average for all nine herd size/percent equity groups.

The effects of the different types of interest rates appear to be generally size and equity neutral (table 12). Although there was some variability, there was no consistent pattern of change in relative payments as herd size or percent equity increased.

From the results generated under the 1977-81 interest rate environment it is clear that the index used can seriously effect both the magnitude and variability of debt payments when a variable interest rate is employed. Not all variable rates are alike. Prime plus one resulted in higher payments and

variability than did other variable rates. The Farm Credit System rates, though variable, generate both level and variability of payments that are more like fixed rates than variable rates based on other indices. In general, low equity farms were unable to make their payments during the 1977-81 rising interest rate period (table 13). As expected, increases in equity raised the frequency with which payments could be made. However, the different types of interest rates had a relatively modest effect on the frequency with which debt commitments were met for all equity levels. On average, use of a variable rate reduced the frequency with which payments could be made by only 0.4 years out of five, or eight percent of all payments. Use of renegotiable rates had slightly less effect. The frequency with which payments could be made under FCS rates was very close to that observed with fixed rates.

Table 12. DIFFERENCES IN MEAN MONTHLY PAYMENT BY HERD SIZE AND PERCENT EQUITY
44 New York Dairy Farms
1977-81 Interest Rate Environment

Description	Fixed Rate Plan	Alternative Interest Rate Type		
		Variable[a/]	Renegotiable[b/]	Farm Credit Service
	dollars	Percent Higher than Fixed Rate		
Herd Size:				
40 - 60 cows	2,552	17	11	5
85 - 115 cows	4,878	13	6	1
more than 130 cows	7,015	18	11	7
Percent Equity:				
30 - 45	7,139	17	9	6
50 - 65	4,385	16	11	4
70 - 85	2,921	25	9	4

a/ Prime plus one.

b/ Initial rates set in 1976.

The use of variable rates had more effect on small and medium sized farms than large ones. This occurred because the large herd size/high percent equity farms could make all their payments every year, and none of the large herd size/low equity farms could make them in any years regardless of the interest rate plan. For these farms, factors other than the type of interest rate were more important in determining the frequency with which payments could be

made. Average debt service requirements were too high relative to the cash flow generated, indicating excess leverage or low profitability.

Table 13. AVERAGE NUMBER OF YEARS ALL DEBT PAYMENTS CAN BE MADE BY HERD SIZE AND PERCENT EQUITY[a/]
44 New York Dairy Farms
1977-81 Interest Rate Environment

Description	Interest Rate Type			
	Fixed	Variable	Renegotiable	Farm Credit Service
	Number of Years out of Five			
Herd Size:				
40 - 60 cows	2.4	1.9	2.0	2.2
85 - 115 cows	2.0	1.5	1.6	1.8
more than 130 cows	2.5	2.4	2.5	2.5
Percent Equity:				
30 - 45	0.2	0.1	0.1	0.1
50 - 65	2.5	1.8	2.1	2.3
70 - 85	4.2	3.9	3.9	4.1

[a/]Includes the use of any cash reserve to help meet cash flow shortfalls.

Alternate Interest Rate Environments

To observe the impact of variable rates in other environments the farms were simulated through two alternate interest rate environments: (1) the reverse of the 1977-81 experience and (2) the fluctuating, no trend environment. Prime plus one fixed and variable rate plans were compared under these environments.

Under the reverse 1977-81 environment the variable rate was better than the fixed rate from the borrowers' perspective. The mean monthly payment, the standard deviation of monthly payments and the maximum monthly payment were all lower for the variable rate than for the fixed rate (table 14).

For this analysis it was assumed that no refinancing of fixed-rate loans with high interest rates occurred when market rates declined. Farmers and other borrowers have frequently refinanced loans in the past; this practice

enabled them to borrow money when rates were high and then, after rates dropped, refinance at a lower interest rate. It is likely, however, that future fixed-rate loans will carry prepayment penalties that limit the benefits of refinancing. Otherwise, lenders are carrying the upside interest rate risk without being able to benefit from any possible declines in market rates.

Table 14. LEVEL AND VARIABILITY OF REQUIRED DEBT PAYMENTS
44 New York Dairy Farms
Alternate Interest Rate Environments

Interest Rate Environment and Plan	Mean Monthly Payment	Standard Deviation	Maximum Monthly Payment
		Dollars	
Actual 1977-81 Environment:			
Variable Prime +1	5,603	2,519	10,308
Fixed Prime +1	4,683	1,826	7,963
Reverse 1977-81 Environment:			
Variable Prime +1	6,148	1,734	9,020
Fixed Prime +1	6,614	2,266	10,254
Fluctuating, no Trend Environment:			
Variable Prime +1	5,749	1,971	9,117
Fixed Prime +1	5,661	1,956	8,912

In an environment where interest rates fluctuate with no trend, the differences between variable- and fixed-rate loans were minimal. The mean monthly payment, standard deviation and maximum monthly payment were only slightly less with a variable than with a fixed rate.

The effect of type of interest rate (fixed or variable) on debt repayment under the alternate interest rate environments was even less pronounced than the effect observed during the 1977-81 period (table 15). The frequency with which payments could be made was very similar for both fixed and variable rates with both the reverse 1977-81 and the fluctuating environments. Variable-rate loans, thus, do make it more difficult for farmers to meet their required debt payments. However, the magnitude of this increased difficulty is small.

Table 15. AVERAGE NUMBER OF YEARS ALL DEBT PAYMENTS CAN BE MADE BY HERD SIZE AND PERCENT EQUITY
44 New York Dairy Farms
Alternate Interest Rate Environments

Description	Interest Rate Type			
	Reverse 1977-81		Fluctuating	
	Fixed	Variable	Fixed	Variable
	Number of Years out of Five			
Herd Size:				
40 - 60 cows	0.9	1.0	1.3	1.4
85 - 115 cows	0.8	0.8	1.2	1.2
more than 130 cows	1.7	1.7	2.3	2.2
Percent Equity:				
30 - 45	0.1	0.1	0.1	0.1
50 - 65	0.1	0.1	1.3	0.9
70 - 85	3.2	3.2	3.8	3.7

The low absolute frequency with which payment ability exceeds cash available has a number of partial explanations. First the stratification procedure that was used insured a more than proportional representation of low equity farms. Second, many farmers have more liberal credit terms than the five years on intermediate-term and 20 years on long-term loans than was used in this analysis. Third, a number of farms had other serious problems limiting their repayment performance. Finally, investment decisions and family living withdrawal amounts were fixed regardless of business performance. Some adjustment of these items could be expected in response to variation in repayment ability. The particular cause of the low repayment frequency likely varied from farm to farm, but may also have included excessive leverage, low product price and inferior management skills. For many farmers in the sample this was the most important determinant of the results and indicates that variable rates are not likely to be the primary cause of repayment difficulties on most farms.

Debt Carrying Capacity

An alternate measure of the effect of variable rates is debt carrying capacity. Debt carrying capacity is the debt level that would exactly exhaust the farm's annual repayment capacity given the amount of cash required to service an average dollar of debt in any given year. This was calculated by determining the total debt service payments required during the year for

intermediate- and long-term loans separately. Then the average payment per dollar of outstanding loan volume is determined by dividing these payment amounts by the average outstanding balance for the year for each term. A weighted average of these two rates is then calculated using the total outstanding principal balances as weights. This average is the amount required to service an average dollar of debt. Debt carrying capacity is calculated by dividing the amount generated by the business for debt payments by the amount required to service an average dollar of debt.

Under the actual 1977-81 interest rate environment the amount of debt that a farm business could carry was 12 percent less under a variable rate regime than with fixed rates (table 16). Not surprisingly, under the reverse 1977-81 interest rate environment fixed rates were at an 11 percent disadvantage compared to variable rates. Debt carrying capacity under a fluctuating interest rate with no trend is identical under both fixed and variable rates.

Table 16. MEAN DEBT CARRYING CAPACITY
44 New York Dairy Farms
Three Interest Rate Environments

Interest Rate Environment	Interest Rate Type		Percent Change From Fixed
	Fixed	Variable	
	Thousands of Dollars		
Actual 1977-81	181	159	-12
Reverse 1977-81	141	156	+11
Fluctuating	157	157	0

Conclusions

Seventy-five percent of the banks in New York use variable rates on at least some of their loans. Variable rates are most frequently used on short- and intermediate-term loans. The somewhat lower rate of use of variable rates on long-term loans (51 percent of banks) results from use of renegotiable rates instead of variable rates by some banks and withdrawal from long term lending by other banks. Many banks offer a combination of rate plans.

Banks with larger farm loan volume tended to make greater use of variable rates resulting in nearly 80 percent of all new agricultural loans being made on a variable rate basis.

The most frequently used rate indices were "own" bank prime, New York City prime and the Federal Reserve Discount Rate. Rate changes were

automatic with index changes at about half of the banks. The others were about evenly divided between those for which a management team divided changes and those that gave the loan officer some discretion.

One-half of the banks permitted rate changes as frequently as desired. Monthly and quarterly maximum frequencies were often used for short- and intermediate-term loans while annual changes were used by a number of banks on long-term loans. Few banks had limits on the interest rate step size or total rate change over the life of the loan.

About half of the banks allowed maturity changes, under some conditions, instead of changing the payment amount. Few banks held the periodic payment constant and changed the final payment amount.

The index used to adjust variable rate loans significantly influences both the level and variability of loan payments. Of rates frequently used on farm loans, a variable rate specified as prime plus one percent resulted in the greatest variability and maximum payment within the interest rate environment experienced during 1977-81. Counter to commonly held expectations the discount rate plus four percent resulted in the highest average payment as well as high variability in payment amounts.

The use of renegotiable rates on long-term loans can reduce payment volatility and, in a rising interest rate environment like 1977-81, also reduce average payments. However, the actual effect depends on the coincidence between rate change dates and the peaks and valleys of interest rate movements. Farm Credit System rates, although variable, resulted in payment levels and variability that were more like fixed rates than the variable rates that other lenders would normally use. Use of the average cost of funds as the index results in a high degree of stability in the payments that farmers make.

As would be expected based on theoretical bases the relative advantage of fixed versus variable rates depends upon the interest rate environment. In the highly variable but generally rising interest rate environment experienced during the 1977-81 period, variable rates reduced the debt carrying capacity of farm businesses by about 12 percent. The frequency with which these businesses were able to make their payments declined eight percentage points (from 46 to 38 percent).

With a fluctuating but generally declining rate environment (reverse 1977-81) variable rates provided an advantage over fixed rates roughly similar to the disadvantage experienced during the 1977-81 period. A fluctuating environment with no trend produced similar results over the five year period with either fixed or variable rates.

In a period such as 1977-81 when interest rates were rising, variable interest rates definitely reduced the frequency with which farmers were able to meet their debt commitments. However, this effect was modest compared to

the sum of all other factors limiting repayment. With fixed rates the group of farms studied were able to make their payments only about half of the time. Although the stratification procedure used to select the farms and the rather stringent credit terms used in the analysis contributed to this average result, the most important factor causing farms to be unable to meet debt service commitments was inability to generate sufficient cash flow, or too much debt for the business, rather than the imposition of variable instead of fixed rates.

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