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## **Profitability of Agricultural Lending Relationships**

**Michael A. Gunderson, Brent A. Gloy, and Eddy L. LaDue**

**Cornell University  
Department of Applied Economics and Management  
305 Warren Hall  
Ithaca, NY 14853**

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**Abstract:** Detailed customer loan records were used to investigate the profitability of agricultural lending relationships. Analyses consider a variety of factors that influence the costs and returns associated with agricultural lending relationships. Among other things, the results provide evidence of substantial economies of size at the relationship level.

**Keywords:** agricultural lending, customer profitability, relationship lending

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## **Profitability of Agricultural Lending Relationships**

### **Introduction**

The agricultural lending market is sizable as commercial banks, farm credit associations, and others compete to supply farmers more than \$180 billion of total farm business debt (United States Department of Agriculture [USDA] Economic Research Service [ERS], 1997). Agricultural borrowers differ by age, education, capital resources, management capability, and other factors that influence the risk and credit volume associated with loans. The risk, loan volume, and the demands that the borrower places on the lender impact the revenues and costs associated with a lending relationship. Furthermore, the demographics of farm operators and the characteristics of their businesses are changing. For instance, the average age of America's farmers and the amount of assets controlled by the average farmer are both increasing (USDA National Agricultural Statistics Service [NASS], 2003).

Changes in production agriculture have had a significant impact on agricultural lenders. There are fewer agricultural borrowers, each requiring greater amounts of capital to acquire and operate farms. Consolidation has led to larger loan volumes and a concentration of risk. Because there are fewer loans in an agricultural lender's portfolio, default by a large customer could have a tremendous impact on the financial strength of a lender. Consolidation has also altered the market power of the large borrower. Larger borrowers often negotiate lower interest rates, demand more and better service, and influence smaller agricultural borrowers.

In such a competitive market, a lender must have a clear understanding of the factors that influence the profitability of serving various types of customers. Understanding customer relationships will aid in managing variables that impact short-term profits. For instance, lenders can use information regarding the borrower, operation, and lending relationship to set interest

rates, establish loan fees, and price financial services. Improving short-term profits can also be approached by attempting to minimize the costs of serving various types of borrowers. By analyzing the factors that drive servicing costs lenders can identify the types of relationships that are worthy of more resources, those that require a disproportionately large amount of the institution's time relative to profitability, and assist in developing more cost effective methods for supplying credit to all types of borrowers.

The objective of this research is to identify the factors that influence the costs, revenues, and profits associated with serving agricultural borrowers. Profitability is examined at the relationship level to determine the extent to which economies of size at the borrower loan volume level influence the profitability of agricultural lending. Attention is also paid to a variety of factors that influence relationship profitability such as risk and borrower characteristics. The study makes use of a data set consisting of over 1,000 borrower level records collected from six agricultural lenders in the northeastern U.S. In the next section, we develop a conceptual model that explains the factors thought to influence the costs, revenues, and profitability of serving agricultural borrowers. Next, the data are presented and models are estimated to test the hypothesized relationships. The results and conclusions are then presented.

### **Conceptual Model**

A basic profit function for an agricultural loan relationship is given by (1).

$$(1) \pi = V * M(V, \delta, L, FT, LTD) + F(V, \delta, L, BS, STD) - C(V, \delta, L, BS, STD, RS) - W + S$$

where,  $\pi$  is relationship profit,  $V$  is loan volume,  $M$  is the difference between the interest rate on the loan and the institution's cost of funds or the interest rate margin,  $F$  is loan fees,  $C$  are the costs associated with servicing the customer,  $W$  is the amount of principle and interest written-off, and  $S$  is the net income earned from providing non-loan services to the borrower. This

model is intended to represent the profits derived from serving a borrower over one period. The profit is determined by the levels and interaction of these key variables. In this formulation, the key variables are functions of or influenced by characteristics of the borrower and by characteristics of the borrower-lender relationship.

This paper examines how a variety of factors influence the interest rate margin, servicing costs, fee income, and ultimately relationship profitability. The hypothesized relationships are presented in Table 1. The next section discusses the factors hypothesized to influence the relationship profitability through their impacts on the interest rate margin, fee income, and servicing cost components of relationship profit<sup>1</sup>.

#### *Loan Volume and Interest Rate Margin*

Lenders obtain loanable funds from investors who accept debt or equity claims in return for interest or dividends or through deposit accounts (in the case of banks). The rate that lenders pay for a dollar of loanable funds is often referred to as the lender's cost of funds. The lender then evaluates loan applicants and makes loans at a rate and amount that they feel provides an acceptable risk/return trade-off. The amount of loan volume ( $V$ ) made available to a customer is a critical component of the revenue generated by the relationship. The lender charges the borrowers an interest rate, which is a percentage of loan volume. The difference between the interest the lender charges borrowers and the lender's cost of funds is often called the interest rate margin ( $M$ ).

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<sup>1</sup> Although potentially important, the paper does not address the financial service income (such as brokerage accounts or farm business consulting) or loan write-off components of the profit function. Additional data must be collected to adequately examine these issues.

In the one-period profitability model, loan volume is treated as exogenous<sup>2</sup>. Because loan volume fluctuates over one period as the borrower regularly pays down/off line of credit and mortgages, loan volume was measured by the average daily balance of the relationship for one year. The impact of loan volume is critical because its relationship with profitability ultimately determines the degree to which economies of size exist at the borrower level. It is expected that economies of scale exist with respect to servicing costs, and that these economies of scale are not offset by narrower interest rate margins.

Loan volume should influence interest rate margin. Lenders likely recognize that a slightly lower margin on a much larger loan volume can result in larger revenues. Thus, a borrower seeking a large loan volume might use this to negotiate better rates resulting in a narrower margin. However, the extent to which margin can narrow with size is limited by the lender's cost of funds. It is anticipated that increasing loan volume will reduce interest rate margin and that the reduction in interest rate margin associated with size will decline as size increases.

Additionally, risk is an important borrower characteristic that influences relationship profits. Lenders attempt to set interest rates such that increased likelihood of default is accompanied by greater interest rates (Barry and Calvert, 1983). It is expected that this risk/return trade-off will be viewed differently across lenders. Lender practices should also influence interest rate margin through their impact on the cost of funds. It is expected that the cost of funds will differ by institution.

Interest rate margin will also likely be influenced by the borrower's enterprise type. Lenders may have differing degrees of expertise in lending to various types of agricultural

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<sup>2</sup> Additional work is being conducted to examine relationship profits over a longer time frame where it is expected that loan volume is also a function of several variables.

enterprises. Expertise should influence their costs and willingness to make loans to businesses of a particular agricultural enterprise type. If there are a small number of borrowers of one type, the lender might find it more difficult to assess the credit risk of the enterprise. If the lender has expertise in dealing with borrowers producing specific types of agricultural commodities, one would expect them to be able to offer better rates to these types of borrowers.

Finally, type and duration of the loan instruments used by the borrower is hypothesized to influence the interest rate margin. Providing capital over a longer time frame brings greater uncertainty about the success of the enterprise and repayment. However, this uncertainty can be offset with higher quality collateral and lower servicing costs. Because mortgages tend to be of longer durations than lines of credit and short-term loans, it is hypothesized that they often carry a higher interest rate. Therefore, a borrower might be charged a higher interest rate than that of a peer with similar volume and risk if a larger proportion of the debt is in mortgages.

#### *Loan Fees*

Lenders charge borrowers a variety of fees, such as credit check fees, origination fees, late fees, and appraisal fees. Loan fees can be charged as a flat amount to all borrowers, such as a credit check fee, or on the basis of loan volume, such as a percent of the amount of a delinquent payment. It is expected that loan volume will increase the amount of flat fees and volume based fees collected. Risk may also influence loan fees. First, low risk borrowers might be more likely to apply for and receive additional credit, thus incurring more up-front fees. However, high risk borrowers may be more likely to make delinquent payments, resulting in greater late fees. Fee magnitude and usage varies considerably across lenders and are often influenced by marketing strategies. Therefore, it is expected that fee income will differ across lenders.

If the borrower is more likely to acquire additional capital in a given period, it is likely they will generate more loan fees in that period. In order to capture this effect, definitions of various business stages were developed based on the business/operator lifecycle model developed by Boehlje and Eidman (1984). The business stages used in this study are defined in Table 2. It was expected that beginning and growth enterprises will be more likely to apply for new loans than farms in other business stages, and would therefore generate greater loan fees than the farms in other stages of business. To the extent that the use of short and intermediate term loan instruments results in more frequent financing activities, an increase in the percent of total loan volume in short or intermediate length loans should increase loan fees.

### *Servicing Costs*

Servicing costs consist of any bookkeeping, analyst, and loan officer time needed to maintain loan relationships. The study does not consider fixed costs, such as property and equipment and overhead costs such as executive salaries and administrative support. Loan officers incur costs for visits to the enterprises, which are used to assess and understand the borrowers' operations. One of the key drivers of costs is how loan officers allocate time and resources to servicing relationships. Another servicing cost is the use of a credit committee to review and approve loans. Credit committees are often composed of the most senior officers of the organization because they have the most experience in evaluating risk and credit worthiness. Moreover, because of their expertise and tenure, these officers are often the most highly paid employees of the organization. Because an hour of credit committee time is costly, the credit committee might be consulted only when a relationship has a very large loan volume or is deemed particularly valuable to the portfolio.



Servicing costs are a potential source of economies of size in lending. If loan officers allocate their time according to the loan volumes lenders would be indifferent between several relationships with small loan volumes and a single large relationship if the total debt was the same under each scenario. However, it is very unlikely that a loan officer allocates his time in such a manner.

Loan volume is expected to increase servicing costs, but at a decreasing rate. Larger loans concentrate risk among one borrower. Thus, the loan application receives greater scrutiny by more people. Moreover, large loan volumes require additional approval from loan officer supervisors or even credit committees. In addition to simply requiring their attention, the hourly cost of senior managers is greater than that of loan officers. Larger borrowers also tend to use lines of credit, which often undergo an annual review, more frequently than smaller borrowers.

One would expect the costs to increase with loan volume, but the increase should be less rapid as the loan volume increases. Many cost elements are similar for small and large borrowers. For example, the costs of traveling to a borrower will be similar regardless of any other characteristic. Assuming borrowers are located randomly around the lender, the mileage and time costs of farm visits would be similar. Accounting and analyst time spent entering financial data will be influenced less by the amount of loan volume and more by the quality of records kept by the operators.

The risk associated with the relationship will also affect the servicing costs. This will be primarily the result of increased monitoring costs. Increased amounts of attention will be dedicated to monitoring the balance sheet and income statement of the borrower's operation. In addition to monitoring costs, it is possible that the borrower may interact more frequently with the loan officer, increasing servicing costs.

Business stage, the strength of the relationship, and the use of short-term debt should also affect costs. Business stage seems particularly important when considering loan officer time. If operators are satisfied with the size of the enterprise, they may simply pay down the debt. If payments are made on time and annual financial statements suggest strong performance, there might be very little interaction between the borrower and the lender. However, if a farm is undergoing major expansion, the loan officer will need to evaluate plans and requests for additional capital. Likewise, beginning farmers are often new relationships that require additional assessment of the credit worthiness of the operators.

The use of short and intermediate term debt rather than long-term mortgages should influence the cost of serving the customer. Short and intermediate term debts, such as lines of credit, require that the lender frequently monitor the operation and the ability of the borrower to repay debts. Although mortgage covenants limit the borrower's ability to sell or dispose of collateral, mortgages tend to be secured by more secure long-term assets, such as land. Short-term assets such as inventory are frequently used to secure lines of credit and intermediate term loans.

A strong relationship should require less loan officer time because of an already established understanding of the business goals. The percent of a borrower's total liabilities that are held with the lender in question is used as a proxy for the strength of the borrower/lender relationship. This should signal the preference the borrower has for the lender as a source of credit. Additionally, a high share of a business's liabilities might signal confidence by the lender in the capabilities of the borrower.

## **Data and Method**

Data consistent with the conceptual model were gathered from the agricultural lending portfolios of six financial institutions that serve agricultural borrowers in the northeastern U.S. The total population of agricultural borrowers from which the sample was drawn was composed of the 9,848 borrowing relationships in the lenders' portfolios and the sample consisted of 1,038 loan relationships (Table 3). The portfolios were stratified by three loan volume categories and three risk categories to insure adequate representation of loans from all size and risk categories (Table 3). The data were gathered over the period of approximately one year. Cornell research associates worked with lender personnel to gather the appropriate data from the study. The data were gathered from lender loan files, lender computerized loan records, and loan officer interviews. Additional details of the sampling procedure and data collection process can be found in Gunderson (2003).

The summary statistics reported in this paper represent the sample averages and are not characteristic of the population of borrowers in the lenders' portfolios. Relationships in the sample averaged \$630,851 of agricultural sales on \$1,480,483 of assets (Table 4). On average the borrowers had \$588,246 of total liabilities, with about half (51%) of that with the lender considered. Nearly 70% of the borrowers reported off-farm income, with those that did having a median off-farm income of \$30,397. Borrowers' ages had an average and median of 48 years.

The borrowers were involved in a wide variety of agricultural enterprises such as livestock production, wineries, and greenhouses, with nearly half (48%) involved in dairy production or raising dairy heifers (Table 4). Most relationships were involved in only one type of enterprise with 84 businesses involved in two or more. Most of the businesses were formed as sole proprietorships, with 14% organized as partnerships and 15% as corporations. The data

indicate farming has remained a family business, as there were only 14 instances where none of the partners were related. Choosing among new, growth, major growth, stable, transferring, declining or not in business for stage of business growth, loan officers classified more than half (52%) of the farm businesses as stable (Table 4).

### *Regression Models*

Because the conceptual model of profit is nonlinear and because several factors have multiple impacts on profitability four regression equations were used to examine the impact of various factors on profitability. Specifically, profitability (2), interest rate margin (3), loan fee (4), and service cost (5) models were estimated.

$$(2) \quad \pi = \beta_0 + \beta_1 V + \beta_2 V^2 + \sum_{i=3}^4 \beta_i \delta_{i-2} + \sum_{i=5}^9 \beta_i L_{i-4} + \sum_{i=10}^{14} \beta_i BS_{i-9} + \sum_{i=15}^{19} \beta_i FT_{i-14} + \beta_{20} STD + \beta_{21} RS + \varepsilon$$

$$(3) \quad M = \beta_0 + \beta_1 V + \beta_2 V^2 + \sum_{i=3}^4 \beta_i \delta_{i-2} + \sum_{i=5}^9 \beta_i L_{i-4} + \sum_{i=10}^{14} \beta_i BS_{i-9} + \sum_{i=15}^{19} \beta_i FT_{i-14} + \varepsilon$$

$$(4) \quad F = \beta_0 + \beta_1 V + \beta_2 V^2 + \sum_{i=3}^4 \beta_i \delta_{i-2} + \sum_{i=5}^9 \beta_i L_{i-4} + \sum_{i=10}^{14} \beta_i BS_{i-9} + \beta_{15} STD + \varepsilon$$

$$(5) \quad C = \beta_0 + \beta_1 V + \beta_2 V^2 + \sum_{i=3}^4 \beta_i \delta_{i-2} + \sum_{i=5}^9 \beta_i L_{i-4} + \sum_{i=10}^{14} \beta_i BS_{i-9} + \beta_{15} STD + \beta_{16} RS + \varepsilon$$

Where the  $\beta$ 's are parameters to be estimated, the  $\varepsilon$ 's are normally distributed error term with mean 0 and variance  $\sigma^2$  and the rest are described previously (Table 1). The models were estimated using SAS V8 (SAS Institute, Inc.). Dummy variables are used to identify subgroups of certain factors, e.g., risk, farm type, business stage, and lender. Three risk categories were used in order to provide congruence across the various lender risk ratings. In each case the

omitted dummy variables identify low risk, agricultural service enterprises, stable business stage, and lender 6.

### **Results: Interest Rate Margin**

The interest rate margin is expressed as a percentage, i.e. dollars per dollar of average daily balance. For example, if a borrower was charged an interest rate of 5.25% and the lender's cost of funds for that particular loan was 2.75%, then the interest rate margin was entered as 0.025. Table 5 presents the regression results for interest rate margin model. The model has an  $R^2$  of 0.4975 and the F-statistic for the joint significance of the estimated parameters is 69.22 indicating a model with reasonably good fit.

Increases in loan volume initially decrease interest rate margin, but its impact is offset as loan volume becomes very large. Other things equal, if loan volume increases from \$100,000 to \$400,000 the interest rate margin narrows by 0.2%. This is a small change when one considers that lenders often adjust rates by at least 0.25% or 25 basis points. However, if loan volume becomes very large, margin narrows considerably. For instance the difference in interest rate margin between \$100,000 of loan volume and \$1,000,000 is 59 basis points. It appears that the borrowers with the largest loan volumes have negotiated slightly better rates. This is also evidence that the lenders are pricing modest economies of size in loan rates.

Increasing default risk from low to medium results in a larger margin (56 basis points) to cover the increased monitoring costs and potential write-off costs. The interest rate margin difference between loss loans and low risk loans is even more substantial, 166 basis points.

Interest rate margin differences between lenders are the result of how well they have managed the cost of funds and the interest rate they charge borrowers. For most of the lenders the difference with lender 6 is about 50 basis points. Lender 5 earns a much larger margin than

the others, nearly 300 basis points. The results for lender 5 are a function of the costs that were excluded from this particular lender's cost of funds. The average interest rates earned on loan volumes were similar across lenders. The fact that such a large difference emerges for lender 5 is not totally unexpected as the calculation of the cost of funds is particularly challenging for commercial banks<sup>3</sup>.

There also exist statically significant differences in farm type. Traditional production agricultural borrowers tended to have narrower margins, than agricultural service enterprises. Notably, permanent plantings (vineyards and orchards) and green industry enterprises (greenhouses and tree nurseries) have the narrowest margins by more than 50 basis points. Although risk has been accounted for at the relationship level, these industries on whole might be inherently less risky than other enterprises. There is not a single loan classified as loss/non-accrual in the green industry and relatively few in permanent plantings.

Animal production (other than dairy) has the widest margin. The Northeast is not particularly noted for large amounts of non-dairy animal agriculture, possibly resulting in less expertise by loan officers in this industry. Therefore, capital used to fund animal production appears to be priced higher than capital for other industries. The results with respect to farm type are likely region dependent. It is reasonable to assume that the results by farm type might be entirely different in a region dominated by animal agriculture, such as Texas, or in a region dominated by annual crops, such as the Corn Belt.

The percent of loan volume held as mortgages did not influence interest rate margin. Expectations were that longer-term debt would carry higher interest rates to offset the greater

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<sup>3</sup> A variety of fixed costs could be included in the cost of funds. Lender 5 chose to include a relatively small proportion of these costs. The accounting practices used by the other lenders tended to allocate a greater amount of these overhead costs when determining the cost of funds for variable rate mortgages. Gunderson presents a detailed explanation of the procedures used to calculate the cost of funds for fixed and variable rate mortgages (2003).

uncertainty that comes with providing debt capital for several years into the future. It is possible that lenders are pricing these loans on the belief that the improved security of the assets that are used as collateral for the loans, i.e. lands and buildings are better security than are inventories or dairy cows, allows them to make longer-term loans with less cost. In other words, the pricing might reflect the expectation that the amount of time spent monitoring mortgages will be less than short and intermediate-term instruments. Additionally, many of the mortgages were adjustable rate or variable rate mortgages. This would also weaken the effect of carrying debt for long terms.

### **Results: Loan Fees**

All loan fees collected from a borrower were summed to arrive at a measure of total loan fee income. For example, if a relationship applied for a new loan and was charged \$25 for a credit check, an appraisal fee of \$100, and no other loan fees were charged on any other loans in the relationship, then the loan fees for this relationship were \$125.

The parameter estimates for loan fees model are shown in Table 6. The fit of the regression model is not as good as that for interest rate margin. However the F-statistic remains quite large (9.44). Loan volume has a positive impact on the loan fees collected, but it is very small at \$0.0003 per dollar of loan volume. Lender's use of fees varied and the results illustrate this point. Lenders 1 and 3 earn loan fees in greater amounts than does lender 6.

Business stage plays a role in explaining whether a borrower is in the process of obtaining new loans (e.g., beginning, growth, major growth, and transferring), which would result in more fees collected. The regression results illustrate this as the coefficients for these subgroups are positive compared to the omitted subgroup, stable.

Surprisingly, higher risk loans tend to have fewer loan fees collected. It is possible that lower risk customers are more likely to be provided additional capital as needed. If the fees are incurred at the time of applying for additional credit, these borrowers would generate more fee income. Furthermore, it was anticipated that late fees might lead to greater loan fees paid by loss and non-accrual loans. However, filing for bankruptcy protects a borrower from further late fees. As a result the relationship incurs neither upfront fees nor late fees.

Also, unexpected is the decrease in loan fees collected as the proportion of short and intermediate-term debt increases. Coupled with the result that lenders did not tend to increase interest rate margin for long-term loans, one would infer that lenders do not perceive the servicing costs to be substantially different for short-term versus long-term loans.

### **Results: Servicing Costs**

While the interest rate margin and loan fee results represent the impact of past pricing strategies, the servicing cost results reflect the impact of past operational strategies. The total dollar value of relationship servicing costs served as the dependent variable. For instance, if 12 hours of loan officer time were incurred at a rate of \$30 per hour, 1 hour of accountant time was incurred at \$20 per hour, and the relationship's loans went to credit committee once incurring \$400 per credit committee review, then the other servicing costs would be recorded as \$780. The rates charged for personnel costs varied by lender.

The regression results are generally consistent with expectations (Table 7). The intercept is positive and significantly different from zero, which is reasonable considering any relationship is certain to incur servicing costs. If loan officer time comprises the bulk of servicing costs, a \$30/hour average for loan officer time would indicate that a relationship would require on average about 25 hours of loan officer time per year.



Loan volume has the anticipated impact. The regression model demonstrates that increases in servicing costs are expected as loan volume increases, but that they increase at a decreasing rate over the relevant range. This means that the marginal cost of adding an additional dollar of loan volume declines as loan volume grows, although the impact is very small. However, the average cost differentials for loans of different sizes can be dramatic. For example, the cost for a relationship with loan volume of \$100,000 is \$0.0060 per dollar of average daily balance more than a relationship with a loan volume of \$400,000, other things equal.

Risk also influences servicing costs as anticipated. As a relationship becomes more risky it incurs greater servicing costs. Nearly an additional \$200 is incurred for medium risk loans and an additional \$300 is incurred for loans that are classified as loss or non-accrual as opposed to low risk loans. This would amount to additional costs of about 20 to 30 basis points on a \$100,000 loan. Recall that the impact of risk on interest rate margins were 53 and 167 basis points for medium and loss/non-accrual loans as opposed to low risk loans. The apparent default risk premium is approximately 30 to 137 basis points for medium and loss/non-accrual loans respectively. This would suggest that the lenders (at least the six in the sample) have done an adequate job of setting interest rates to offset additional servicing and monitoring costs. The question remains if the increased risk of loan default over time is also covered by the higher interest rates earned on higher risk loans.

It was expected that there would be differences in servicing costs among lenders, but the substantial difference between lender 6 and the other lenders was unanticipated. It seems that lenders 1-5 have much lower costs of servicing the customer. These differences are likely the result of different management practices and personnel costs at each of the lenders.

For farms that are currently completing major growth, the servicing cost is nearly \$1,000 more than stable farms, other things equal. At \$30 per hour of loan officer time that is more than an additional 30 hours of loan officer time. Similarly, relationships undergoing an ownership transfer cost more to service than stable farms, although the difference is not as great as that for growth and major growth farms. This was expected because for transferring farms the loan officer will already be familiar with the operation. The additional costs will be meeting with the transferring parties and arranging credit for the new owners. The differences between stable, declining, and not in business are small and not significantly different from zero, suggesting that these loans require little monitoring from the loan officer, other things equal.

The percent of liabilities held by the lender seems to indicate that the more understanding the lender has of the borrower's operation, the lower the servicing costs. If the fact that a greater percent of a borrower's total liabilities are held by a lender indicates that the lender is the borrower's lender of choice, then the borrower would be more likely to approach the loan officer when additional capital is desired rather than the loan officer having to "sell" the borrower on the lender. For example, a borrower with half of his \$200,000 of total liabilities with the lender will create \$69.62 more in servicing costs than a borrower with all of her \$100,000 of liabilities with the lender, other things equal.

Finally, an increase in the percent of debt in short-term credits results in an increase in servicing costs, as predicted. Because inventories and more liquid assets generally secure short-term credits the relationship requires additional monitoring. Furthermore, if the loan instrument is a line of credit, the lender will typically evaluate at least annually the amount and use of the line, whereas a mortgage will undergo less scrutiny each year as the payment schedule is already established at the beginning of the loan.

## **Results: Relationship Profitability**

Relationship profit was measured as a dollar contribution to the profit of the lender. A model was estimated for profit incorporating all of the variables used in the component models. This model highlights relationships identified in the component models. However, the net influence of several factors are difficult to anticipate because these variables influence revenue and cost components differently. For example, volume tends to decrease margin and increase costs, but it should also generate greater revenues. Furthermore, greater default risk increases margin, but increases servicing costs and the likelihood of write-offs.

The profit model fits quite well (Table 8), with a high  $R^2$  (0.8922) and large F-statistic (295.36). However, many of the subgroups do not test significantly different than zero. In fact, the most important elements are loan volume and risk, the two variables by which the portfolio was stratified. Clearly understanding risk and loan volume is a good place to begin for understanding agricultural lending relationship profitability.

The negative intercept indicates that there are substantial fixed costs associated with the loan relationships. For each additional dollar of average daily balance, profit increases by \$0.015, other things equal. Furthermore, the squared term for loan volume is also positive suggesting that profit increases with loan volume at an increasing rate. The large differences in profitability between lenders reflect differences in management practices, resources, and opportunities.

The percent of liabilities held by the lender has a positive impact on profitability. To the extent that this variable signals the strength of lender/borrower relationship, stronger relationships earn additional profit. The model results suggest that the increase is more than \$18

for each increased percent of liabilities with the lender, other things equal. The percent of debt held as mortgages also positively influences relationship profit.

## **Conclusion**

The results of the study of loan relationships lead to several important conclusions. First loan volume is a critical determinant of profitability. Although interest rate margin fell as loan volume increased, it did not fall as quickly as average servicing costs. It appears that there are substantial economies of size at the relationship level. The apparent presence of substantial economies of size will continue to provide an incentive for banks to make larger loans. This economic pressure is countered by the concentration of risk that accompanies larger loans. The net result is that financial institutions will face continuing pressure to consolidate so as to increase their ability to extend larger credits. Additionally, innovations in credit markets which allow agricultural lenders to sell credits through participations will work to offset this risk and create increased competition for large credits.

The study also examined how risk influenced both costs and revenues. Riskier credits incurred greater servicing costs, but the increased interest rate margins more than offset these short-term costs. The study also calculated the apparent default premium pricing associated with agricultural loans. This premium over low risk loans average 37 to 137 basis points for medium and loss/non-accrual loans. Further examination is needed to assess whether the default premiums accurately assess both the probability and magnitude of potential losses associated with default.

The management practices employed by the lenders influence a variety of aspects of relationship profitability. This study found that servicing costs, interest rate margin, and loan fee income differed by lender. Additional work is needed to examine the various management

practices employed by the lenders and to measure their associated returns. The characteristics of the borrower and their businesses also impacted the profitability of agricultural loan relationships. Borrowers who were in the process of enlarging their businesses were more costly to serve, but also generated more loan fees. The net result was that borrowers in growth stages were equally as profitable as borrowers in other business stages. The results also suggest that lending to beginning farmers is at least as profitable as lending to farmers whose businesses are stable with respect to farm size. Combining this result with the observation that many beginning farmers will probably enter growth phases one would expect that beginning farmers might present a profitable opportunity for agricultural lenders.

Many farm borrowers rely on several agricultural lenders. Evidence was provided indicating that, other things equal, increases in the percent of total relationship loan volume held by one lender increased profits. This result suggests that as lenders become familiar with the customer in question, it is quite profitable to increase market share at the customer level. The one-period analyses conducted in this study provide a foundation for understanding customer profitability in agricultural lending and serve as a basis for a long-term analysis of relationship value to the lender.

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Table 1. Factors Hypothesized to Impact the Components of Relationship Profitability

Variable	Variable is a function of:	Hypothesized Effect
Loan Volume (V)	Exogenous	
Interest rate margin (M)	Loan volume (V)	-
	Risk ( $\delta$ )	+
	Lender practices (L)	mixed
	Farm type (FT)	-
	Proportion of V in long-term mortgages (LTD)	mixed
Loan Fees (F)	Loan volume (V)	+
	Risk ( $\delta$ )	+
	Lender practices (L)	mixed
	Farm business stage (BS)	mixed
	Proportion of V in short-term credits (STD)	+
Servicing costs (C)	Loan volume (V)	+
	Risk ( $\delta$ )	+
	Farm business stage (BS)	mixed
	Proportion of V in short-term credits (STD)	+
	Proportion of total liabilities held with lender (RS)	-

Table 2. Definitions of the Business Stages Used in the Models

Stage	Description
Beginning Farmer	<ul style="list-style-type: none"> <li>- Farming business that is recently established</li> <li>- Just started farming on a full or part-time basis</li> <li>- Switched from part-time to approximately full-time farm</li> </ul>
Growth Stage	<ul style="list-style-type: none"> <li>- Growth within the last few years or planning to grow within the next few years</li> </ul>
Major Growth Stage	<ul style="list-style-type: none"> <li>- Farming business undergoing growth in the current period</li> <li>- Growth taking place now or within the last year or two</li> </ul>
Stable	<ul style="list-style-type: none"> <li>- Farming business that has achieved the maximum size that operators desire or believe to be achievable</li> <li>- Modest growth or decline in the size of the business may take place over time, but not the intent of the management to increase (or decrease) the size of the business</li> </ul>
Transferring	<ul style="list-style-type: none"> <li>- Period when new ownership becomes the primary decision-maker and a high proportion of the farming business operating assets are transferred</li> <li>- Does not include the period when potentially new ownership joins the business and works as an employee</li> </ul>
Declining (or Disinvesting)	<ul style="list-style-type: none"> <li>- Farming business in decline of size and/or aggressiveness of the manager</li> </ul>

Table 3. Number of Relationships Sampled by Size and Risk Categories

Risk Rating	Total Outstanding Relationship Balances		
	Small (<\$100K)	Medium (\$100k-\$400k)	Large (>\$400k)
Low Risk	158	142	143
Medium Risk	120	113	98
Loss and non-accrual	67	32	11

Table 4. Descriptive Statistics for the Sampled Lending Relationships

Characteristic	Average	Standard Deviation
Sales	\$630,851	\$2,217,851
Total Assets	\$1,480,483	\$3,291,462
Total Liabilities	\$588,246	\$1,835,606
Proportion of Total Liabilities with the lender	51.32%	32.22%
Age	48.14	12.53
Off-Farm Income	\$62,931	\$134,417
Relationship Length	8.21	8.34

Farm Type	Percent of Sample
Dairy	48.3%
Annual Crops	19.6%
Other Animal Production	11.9%
Permanent Plantings	8.9%
Green Industry	5.4%
Service Providers	5.9%

Business Stage	Percent of Sample
Beginning	4.9%
Growth	14.2%
Major Growth	3.7%
Stable	51.6%
Transferring	4.8%
Declining	13.9%
Not in Business	6.9%



Table 5. Parameter Estimates for Interest Rate Margin Model

Variable	Estimate	T-Statistic
Intercept	0.02105	8.30**
Average Daily Balance	-7.03023*10 <sup>-9</sup>	-6.44**
(Average Daily Balance) <sup>2</sup>	3.22247*10 <sup>-16</sup>	5.15**
Medium Risk	0.00536	5.51**
Loss/Non-Accrual	0.01687	10.17**
	F-Value for Risk = 56.81**	
Lender 1	-0.00359	-1.89
Lender 2	0.00887	4.28**
Lender 3	-0.00551	-2.73**
Lender 4	-0.00616	-3.00**
Lender 5	0.02912	14.62**
	F-Value for Lender = 148.09**	
Dairy	-0.00559	-2.88**
Annual Crops	-0.00520	-2.51**
Other Animals	-0.00407	-1.84
Permanent Plantings	-0.00792	-3.39**
Green Industry	-0.00760	-2.85**
	F-Value for Farm Type = 2.84*	
% debt in mortgages	-0.00096453	-0.84
Regression Statistics:	F-statistic=68.14**	R <sup>2</sup> =0.5055
	Adj. R <sup>2</sup> =0.4981	n=1,016

\* indicates significance at the 0.05 level

\*\* indicates significance at the 0.01 level

Table 6. Parameter Estimates for Loan Fees Model

Variable	Estimate	T-Statistic
Intercept	137.19616	0.81
Average Daily Balance	0.00035971	3.80**
(Average Daily Balance) <sup>2</sup>	-8.3737*10 <sup>-12</sup>	-1.57
Medium Risk	-71.95847	-0.84
Loss/Non-Accrual	-235.541111	-1.54
F-value for Risk = 1.26**		
Lender 1	460.01051	2.88**
Lender 2	-83.49926	-0.48
Lender 3	775.49167	4.57**
Lender 4	113.68462	0.66
Lender 5	44.27729	0.26
F-value for Lender = 12.84**		
Beginning	238.49023	1.33
Growth	323.92934	2.87**
Major Growth	712.94076	3.55**
Transferring	104.73502	0.58
Declining	-118.67294	-1.01
Not in Business	-75.08690	-0.46
F-value for Business Stage = 3.72**		
Regression Statistics:	F-value=9.22**	R <sup>2</sup> =0.1287
	Adj. R <sup>2</sup> =0.1147	n=1,016

\* indicates significance at the 0.05 level

\*\* indicates significance at the 0.01 level

Table 7. Parameter Estimates for Servicing Cost Model

Variable	Estimate	T-Statistic
Intercept	801.93554	8.14**
Average Daily Balance	0.00097777	18.71**
(Average Daily Balance) <sup>2</sup>	-1.1471565*10 <sup>-11</sup>	-3.92**
Medium Risk	185.02006	3.98**
Loss/Non-Accrual	301.64839	3.55**
	F-value for Risk = 10.75*	
Lender 1	-695.43365	-8.11**
Lender 2	-592.58168	-6.36**
Lender 3	-560.35364	-6.18**
Lender 4	-691.27638	-7.47**
Lender 5	-654.39134	-7.22**
	F-value for Lender = 15.14**	
Beginning	105.21193	1.02
Growth	314.24429	5.20**
Major Growth	995.27323	9.16**
Transferring	215.06917	2.23*
Declining	27.18439	0.42
Not in Business	128.77911	1.44
	F-value for Business Stage = 17.63**	
% debt in short-term credits	78.25876	1.48
% liabilities with lender	-143.23385	-2.12*
Regression Statistics:	F-value=89.95**	R <sup>2</sup> =0.6133
	Adj. R <sup>2</sup> =0.6065	n=982

\* indicates significance at the 0.05 level

\*\* indicates significance at the 0.01 level

Table 8. Parameter Estimates for Profitability Model

Variable	Estimate	T-Statistic
Intercept	-7,341.81410	-5.05**
Average Daily Balance	0.01454	23.19**
(Average Daily Balance) <sup>2</sup>	6.14397*10 <sup>-10</sup>	17.50**
Medium Risk	1,667.73763	2.98**
Loss/Non-Accrual	-3,368.47245	-3.30**
	F-Value for Risk = 14.66**	
Lender 1	8,373.78342	8.03**
Lender 2	8,907.61138	7.92**
Lender 3	6,760.71845	6.15**
Lender 4	5,335.68986	4.76**
Lender 5	12,596	11.57**
	F-Value for Lender = 31.96**	
Dairy	-1,168.07109	-1.08
Annual Crops	-1,096.26729	-0.96
Other Animal Production	16.66712	0.01
Permanent Plantings	-1,588.24585	-1.23
Green Industry Enterprises	1,412.56575	0.96
	F-Value for Farm Type = 1.62	
Beginning	-203.47394	-0.17
Growth	622.04227	0.86
Major Growth	278.64972	0.21
Transferring	-909.11865	-0.79
Declining	-190.13112	-0.25
Not in Business	-522.20738	-0.49
	F-Value for Business Stage = 0.32	
% liabilities with the lender	1,999.75181	2.47*
% debt in mortgages	1,154.23283	1.82
Regression Statistics:	F-value=359.77**	R <sup>2</sup> =0.8919
	Adj. R <sup>2</sup> =0.8895	n=982

\* indicates significance at the 0.05 level

\*\* indicates significance at the 0.01 level