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Location, Branching, and Bank Portfolio Diversification: The Case of Agricultural Lending

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In this paper, we hypothesize that loan monitoring costs increase with distance from the borrower, and, thus, that bank loan portfolio choice depends on the bank's location. A corollary of our hypothesis is that branching increases bank loan portfolio diversification. To empirically test our hypothesis, we focus on banks' choice between agricultural and nonagricultural loans. We find that, even after controlling for a variety of other factors, rural banks devote a significantly larger proportion of their loan portfolio to agricultural loans than do urban banks. Moreover, we find that, when statewide branching is permitted, rural banks hold higher nonagricultural loan portfolio shares, and urban banks hold higher agricultural loan portfolio shares, than when branching is restricted. Thus, we conclude that branching enhances bank loan portfolio diversification.

Banking economists have given considerable attention to the special nature of commercial bank lending. Leland and Pyle (1977) and Diamond (1984), among others, argue that bank lending differs from other forms of lending, such as the purchase of debt that is directly issued by companies, because of the extensive information gathering and monitoring functions that banks perform. These authors argue that, to a greater extent than other lenders, banks gather their own detailed information on loan projects and monitor borrowers' conditions and adherence to loan covenants. Thus, although all lenders attempt to monitor their loans and enforce loan or debt covenants, banks may specialize in lending to borrowers who are particularly costly to monitor.

One implication of the importance of bank monitoring is that a bank's location may be a significant determinant of its choice of borrowers. It is reasonable to suppose that monitoring is more difficult and more costly from a distance, so banks would tend to favor local borrowers over distant borrowers, all other things equal.

Support for this view comes from the work of Black (1975), who suggests that deposit relationships with borrowers enhance a bank's ability to monitor.[1] Black argues that since bank borrowers often are depositors as well, the bank has a low-cost ongoing history of financial information. If deposit markets are local, as some evidence shows, then this effect would strengthen the tie between banks and local borrowers by reducing monitoring costs.[2]

The dependence of monitoring costs on distance implies that constraints on a bank's ability to expand beyond the local headquarters area through branching may directly affect its loan portfolio choice and perhaps its ability to diversify assets. This is because branching restrictions may impinge on the ability of banks to locate offices near different types of borrowers and thus efficiently monitor their loans. The effect on diversification is important because, in many situations, diversification across assets can reduce expected bankruptcy costs and the probability of bank failure.

In this article, we present evidence supporting the

hypothesis that location affects the types of loans that banks choose, and, consequently, that branching enhances diversification. We focus on banks' choice between agricultural and nonagricultural loans. This choice is well-suited to our study because, by its nature, agriculture is location-specific and concentrated in rural areas.[3]

Unlike earlier related work, which was limited to a study of different types of rural banks, our analysis includes institutions headquartered in both urban and rural locations in restricted and unrestricted branching states. Our results indicate that rural banks have a significantly higher share of agricultural loans than urban banks, even after controlling for a variety of other factors. Moreover, we find that rural banks increase the share of nonagricultural loans in their portfolios when they are allowed to branch statewide, *and* that *urban* banks increase the share of *agricultural* loans in their portfolio when they are allowed to branch statewide. This offers support for the hypothesis that branching enhances diversification, and stronger support than can be obtained from a study of rural banks alone.

A theoretical model demonstrating the effects of location and branching laws on portfolio choice is presented in Section I. In Section II, we empirically test the implications of the theory, examining differences in agricultural loan shares across a wide selection of commercial banks over the period 1981-86. Results from the estimation are described in Section III, with concluding remarks in Section IV.

I. A Portfolio Model

In this paper, we hypothesize that monitoring costs increase with distance from the borrower, and, thus, that a bank's location affects its relative monitoring costs for different types of loans. Our hypothesis is based on reasoning that bank personnel are more familiar with local borrowers and local market conditions, and therefore can more easily monitor local borrowers than distant ones.[4] In addition, personnel should be better able to keep a close watch on a local loan project's progress.

We assume that monitoring costs are important for banks, so that differences in relative monitoring costs for different types of loans should influence a bank's loan portfolio choices. Thus, our hypothesis implies that location affects a bank's loan portfolio choices. To test our hypothesis, we focus on a bank's choice between agricultural and non-agricultural loans. Agricultural borrowers, by their nature, are assumed to be located in rural areas, while most nonagricultural loans are assumed to be for projects in urban areas. Thus, our hypothesis predicts that, at least when branching is restricted, banks located in rural areas will have lower monitoring costs for agricultural loans than will banks located in urban areas and will therefore devote a larger proportion of their portfolio to farm-related lending.

If branching is unrestricted, it may still be the case that agricultural shares will be higher for rural-headquartered banks, but we expect that the difference between rural and urban banks' agricultural shares will be smaller than when branching is restricted. This is because branching should decrease differences in monitoring costs between agricultural and nonagricultural loans. This would encourage banks to take advantage of the benefits of diversification, thereby lowering rural banks' agricultural loan portfolio shares and raising urban banks' agricultural portfolio shares.[5]

Previous researchers have already conducted some investigation of these topics. Gilbert and Belongia (1988) study how rural bank portfolios are affected by regulatory structure by examining whether affiliation with large multi-bank bank holding companies affects the proportion of loans devoted to agriculture in rural banks' portfolios. In some states, multi-bank bank holding companies are not permitted.

They find that rural banks which are subsidiaries of bank holding companies with assets greater than $1 billion have a lower agricultural loan ratio than other banks in the same counties. They attribute this to the greater ability that such banks have to diversify their loan portfolios away from agriculture. Thus, Gilbert and Belongia's results implicitly suggest that laws that restrict the geographic dispersion of bank affiliates or even bank offices also restrict the diversification of rural bank portfolios out of agriculture.

White (1984) suggests that geographic restrictions prevented loan diversification at small rural banks in the 1930s, increasing their failure rate, but he does not empirically test this hypothesis. In their empirical examination of the effect of bank credit on farm output, Calomiris, Hubbard, and Stock (1986) argue that branching restrictions, by impairing the ability of small rural banks to diversify assets, may contribute to bank failure, the depletion of bank credit, and a decline in farm output.[6] Again, though, they do not empirically test this hypothesis.

The Model

The effect of location and branching laws on portfolio choice can be seen using a portfolio model.[7] For simplicity,

we assume that the *amount* of monitoring required per dollar lent is fixed.[8] However, following the above discussion, the *cost* per dollar of producing the required monitoring depends on the bank's location vis-a-vis the borrower, or distance from the borrower. Thus, the monitoring cost for an agricultural loan of a given size will be higher for an urban bank than a rural bank. We also assume the bank has a fixed stock of loanable funds to allocate among the two types of loans, agricultural and nonagricultural.

In the following discussion, we will introduce several variables that are not choice variables for the bank. Some of these variables, namely monitoring costs, interest rates, and risk-related variables, depend on bank-specific exogenous factors, such as location, that enter into our empirical analysis. We will explicitly introduce these exogenous factors in the next section, but, for the sake of notational simplicity, we will suppress these factors in the following formulas.

The explication of the theoretical model proceeds in two steps, first without uncertainty, and then with uncertainty added. In the absence of uncertainty, the bank would allocate all funds to the project yielding the highest return net of monitoring costs. Since the volume of total loans is fixed, we can normalize the volume to one. Mathematically, the decision is simple:

$$Maximize\ \pi = \theta i_A + (1-\theta) i_N - \theta C_A - (1-\theta) C_N - r_d. \quad (1)$$

The bank chooses θ, the share of loans made to agricultural projects, so as to maximize profits, π, net of the cost of obtaining loanable funds, r_d. The interest rates on agricultural and nonagricultural loans, i_A and i_N, respectively, and the monitoring costs per dollar for agricultural and nonagricultural loans, C_A and C_N, respectively, determine the optimal allocation. In this simple case, the bank allocates all credit to the types of projects that pay the highest interest rate net of monitoring costs.

Now let returns to the two types of projects be randomly distributed. The random return variables for agricultural and nonagricultural projects are denoted by r_A and r_N, respectively. These are the returns to the project owners themselves. The expected return and variance may differ between agricultural and nonagricultural project pools, but we assume that individual project returns *within* a given loan pool are drawn from the same distribution.[9]

The bank is assumed to be risk-neutral, in the sense that its objective is simply to maximize expected profits. Portfolio variance enters the bank's objective function through bankruptcy costs; we assume that if the bank cannot pay off its own liabilities, it will face bankruptcy costs.[10] Because the probability of bankruptcy increases as the variance of the portfolio increases, holding interest rates constant, expected profits decrease with increased variance. In this way, uncertainty enters into the allocation decision of the bank.

The variances of individual project returns will affect expected profits through the portfolio variance and, independently, through a separate channel. The separate, independent influence is due to the effect of project return variance on the probability of borrower default. As the variance of a project's return increases, holding the loan rate and the expected value of the return constant, the probability of the borrower defaulting increases. Because the highest return that the bank can receive is the contracted loan rate, the bank is not compensated on the high end for the increase in the probability of default. Therefore, the increase in variance lowers the expected return to the bank from that particular loan.

The introduction of uncertainty into the model gives the bank an incentive to diversify its portfolio and hold some of both types of loans.[11] The principle of diversification says that by making loans to different types of borrowers, the risk to the lender's portfolio can be reduced in most cases. Realizations of future events that cause some projects to be successful can cause others to fail. Therefore, by combining different types of loans into the same portfolio, these offsetting risks cancel to some extent, thus reducing overall portfolio variance. Diversification is therefore defined, in this paper, as an adjustment of portfolio shares in such a way as to reduce portfolio variance.[12]

The decision problem for the bank now becomes the following:

$$\begin{aligned} Maximize\ \pi = {} & \theta i_A + (1-\theta) i_N - \theta C_A - (1-\theta) C_N \\ & - \beta var(\theta r_A + (1-\theta) r_N) - \theta \alpha_A var(r_A) \\ & - (1-\theta) \alpha_N var(r_N) - r_d, \end{aligned} \quad (2)$$

where π is now *expected* profits. The effect of portfolio variance on bankruptcy is captured in the fifth term of (2), while the independent effects of agricultural and nonagricultural loan defaults are captured in the sixth and seventh terms of (2), respectively. Here, $\beta var(\theta r_A + (1-\theta) r_N)$ is the expected cost of bankruptcy, which we assume rises linearly with the portfolio's variance, and $\theta \alpha_A var(r_A)$ and $(1-\theta) \alpha_N var(r_N)$ represent the expected costs associated with the default of agricultural and nonagricultural loan projects, respectively.

The optimal portfolio for the bank can be determined by maximizing (2) with respect to θ and solving for the equilibrium value of θ:

$$\theta^* = \frac{i_A - i_N - 2\beta cov(r_A, r_N) + 2\beta var(r_N) - \alpha_A var(r_A) + \alpha_N var(r_N) - C_A + C_N}{2\beta[var(r_A) + var(r_N) - 2cov(r_A, r_N)]} \quad (3)$$

Equation (3) shows that three types of factors affect the proportion of a bank's portfolio that is devoted to agriculture: interest rate spreads, relative monitoring costs and relative risk. Holding all other factors constant, an increase in the interest rate on agricultural loans (i_A) relative to the rate on nonagricultural loans (i_N) will increase agriculture's portfolio share. On the other hand, an increase in monitoring costs for agricultural loans (C_A) relative to monitoring costs on nonagricultural loans (C_N) will decrease agriculture's portfolio share. Finally, an increase in the relative variance of agricultural loan projects or in the relative cost of agricultural loan project defaults (which depends on relative variances and the relative sizes of the parameters α_A and α_N) will decrease agriculture's portfolio share.

We also can use equation (3) to see the effect of differences in relative monitoring costs on diversification. For simplicity, set the interest rates and project return variances equal on the two types of projects, and set the covariance between project returns equal to zero. Then, equation (3) tells us that, in the absence of differences in monitoring costs between the two types of loans, the optimal proportion of the portfolio devoted to agriculture is one-half. Since there are no differences in interest rates and no differences in monitoring costs to keep the bank from choosing a perfectly diversified portfolio, this must be the portfolio of minimum variance. An increase in monitoring costs for agricultural loans, for example, would decrease θ below one-half. This move away from the minimum variance portfolio, and into nonagricultural loans, would decrease portfolio diversification, as we have defined diversification.[13] Similarly, an increase in monitoring costs for nonagricultural loans would decrease diversification by decreasing the proportion of the portfolio devoted to nonagricultural loans.

As seen in equation (3), exogenous variables that affect relative monitoring costs, interest rate spreads, and relative risk, will, in turn, affect the share of a bank's portfolio that is devoted to agriculture. In the next section we will empirically examine how observable variables that should affect these three types of factors actually influence agricultural portfolio shares. Among the factors we will be examining are:

- Location and branching restrictions. These should affect relative monitoring costs. For example, banks that are located in urban areas and are prohibited from setting up branches in rural areas will have relatively higher monitoring costs for agricultural projects, and, therefore, lower agricultural loan portfolio shares. In addition, it may be the case that even urban headquartered banks that *can* branch have a comparative disadvantage in agricultural lending, relative to rural banks that can branch.[14] However, we expect that, for a given bank, branching reduces differences in monitoring costs between agricultural and nonagricultural loans, thereby encouraging diversificaion and narrowing the difference in agricultural loan portfolio shares between rural and urban banks.
- Competition in the agricultural loan market. If competition from other lenders in agriculture increases and forces agricultural interest rates downward, the bank will shift its portfolio away from agriculture.
- Government subsidies or guarantees for crops. An increase in government agricultural support, which stabilizes farm income, should decrease the relative risk of agricultural lending and increase bank willingness to lend to agriculture.

Graphical Solution

The bank's portfolio choice can be depicted graphically. This helps to illustrate the effect of location and branching restrictions on loan portfolio choice.

Figure 1 breaks total profits into its two component parts. The vertical axis measures expected profits, while the horizontal axis measures agriculture's share of the

Figure 1

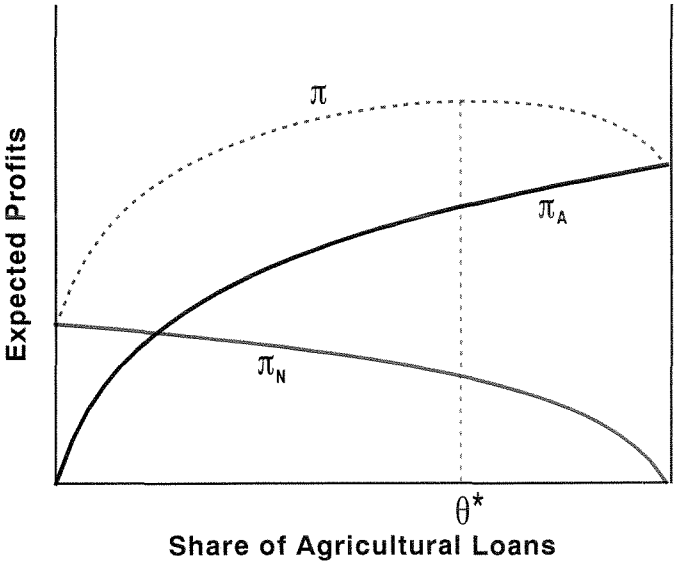


Figure 2

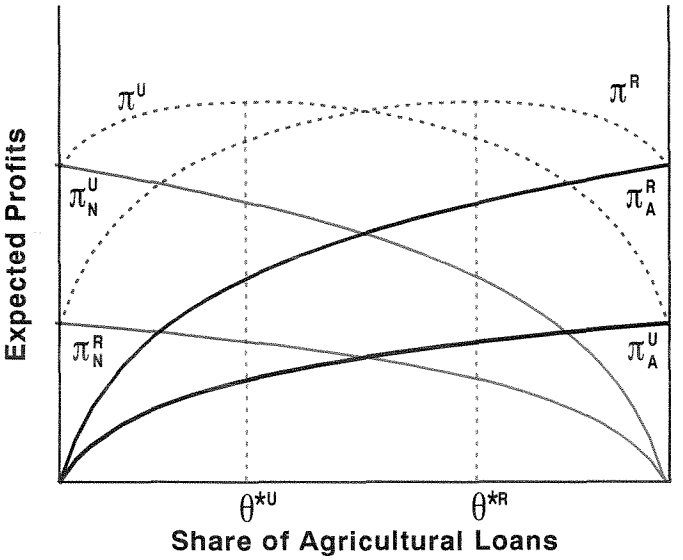
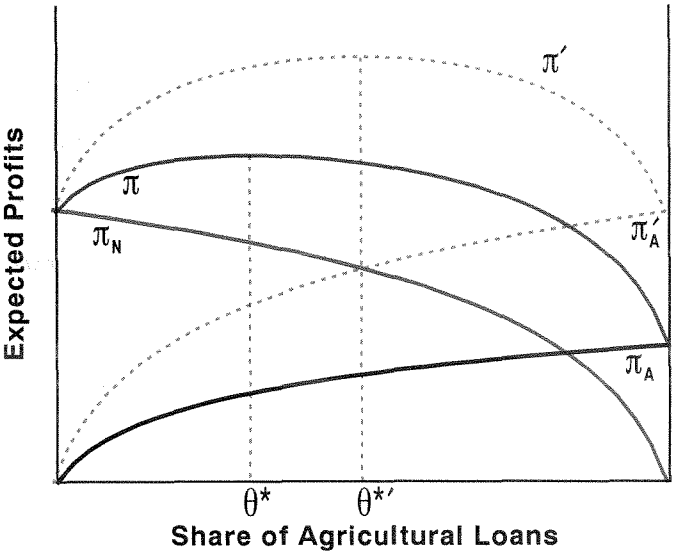


Figure 3



portfolio, ranging from 0 to 100 percent. The curve labeled π_A denotes total expected profits from agricultural lending. Expected profits from that source rise as more loans are made to agriculture, but the marginal profits begin to diminish as the benefits of diversification are lost. Similarly, the curve labeled π_N measures expected profits from nonagricultural lending, which fall as more of the portfolio is shifted into agriculture. The total profits for the bank are the vertical sum of the π_A and π_N curves. Expected total profits, π, are maximized at θ^*.[15]

Differences in bank locations can result in different optimal portfolios. Figure 2 compares two stylized banks, one urban (denoted with a U superscript) and the other rural (denoted with an R superscript). The rural bank is assumed to have lower monitoring costs for agricultural loans, while the urban bank has lower costs for nonagricultural loans. The effect of this assumption is to yield an expected agricultural profit function for the rural bank that lies above that of the urban bank ($\pi^R_A > \pi^U_A$), while the nonagricultural loan profit function of the urban bank exceeds that of the rural bank ($\pi^U_N > \pi^R_N$) at any given level of θ. As shown in Figure 2, these differences result in the urban bank lending less to agriculture.

Changes in monitoring costs (or other key variables) can change a bank's portfolio. Consider the case of changes in relative monitoring costs due to liberalization of branching restrictions. Figure 3 depicts the situation facing an urban bank that is suddenly permitted to open or acquire a rural branch. Monitoring costs fall for agricultural loans, because the bank now has a monitoring presence in an agricultural area.

The drop in monitoring costs pushes π_A up to π'_A and raises the total profit function to π' from π. The optimal allocation of credit, therefore, shifts in the direction of greater diversification, which, for the urban bank, corresponds to more agricultural lending ($\theta^{*\prime} > \theta^*$).

II. The Data and the Empirical Model

In Section I we suggest that differences in location and branching restrictions, among other factors, are likely to help explain differences in bank portfolios. In this section, we choose empirical counterparts for these factors and present an empirical model of differences in commercial banks' agricultural production loans as a proportion of total loans.[16] The model seeks to explain deviations in banks' agricultural portfolio shares from the average for the sample.

We model bank agricultural production loan portfolio shares as functions of exogenous factors which influence relative monitoring costs for the two types of loans, or interest rate spreads, or the relative amount and cost of risk for the two loan types.

Our empirical model is similar to Gilbert and Belongia's model in that, like these authors, we are modeling the relationship between the geographic dispersion of bank offices and bank loan portfolio choice. Three important factors distinguish our model from Gilbert and Belongia's model, however. First, we include urban banks in our study, while Gilbert and Belongia do not. If we find that urban banks respond to branching opportunities by holding more agricultural loans, we can better argue that it is the benefits of diversification that drive the results than if

we only have evidence on the response of rural banks to branching opportunities.

The second difference between the two models is that Gilbert and Belongia do not place their model in the context of a bank portfolio choice model. Thus, we include some important explanatory variables that are not included in the Gilbert and Belongia model.[17] The third difference between the two models is that we look at the effects of branching laws per se, while Gilbert and Belongia look at the effects of affiliation with a multi-bank bank holding company.

The Variables

The explanatory variables of greatest interest to us involve the location of the bank and the branching laws in the state in which the bank operates. As discussed above, whether a bank is located in a metropolitan or rural area should influence its cost of monitoring agricultural loans and thus its agricultural production loan share.

Holding other factors constant, it is expected that a metropolitan bank will have a lower agricultural loan share than a rural bank, because it will find it relatively more difficult to monitor agricultural loans. However, if the metropolitan bank is located in a statewide branching state, we expect that it will have a higher agricultural loan share than if it is located in a limited branching or unit banking state. Likewise, we expect that a rural bank will have a lower agricultural loan share in a statewide branching state than in a restricted branching state.[18]

Thus, we include three interaction terms, one indicating whether the bank is a metropolitan bank in a restricted branching state, one indicating whether the bank is a rural bank in a restricted branching state, and one indicating whether the bank is a metropolitan bank in a statewide branching state. These are all thought to influence relative monitoring costs and thereby the proportion of the loan portfolio devoted to agriculture. (This leaves rural banks in statewide branching states as the control group.)

We also include the percent of gross state product accounted for by agriculture, bank size and average farm size in the regression. All three variables may influence relative monitoring costs. The first is an important additional location variable; banks that are located in "farm states" should have lower monitoring costs for agricultural loans and thus higher agricultural loan shares than banks located in nonfarm states.

Bank size and average farm size are included to allow for the possibility that there are economies of scale in monitoring.[19] Figures reported by "The Survey of Terms of Bank Lending" indicate that there may be consistently large differences in average loan sizes between commercial and agricultural loans, and that this difference is more pronounced for large banks than for small banks.[20] This means that if large loans have lower monitoring costs per dollar than small loans, then, all other things equal, large banks would have a comparative advantage in commercial loans and would devote a smaller proportion of their portfolio to agricultural loans than would small banks. In addition, if large farms require large loans, then an increase in average farm size may lower monitoring costs on agricultural loans relative to nonagricultural loans, thereby increasing agriculture's portfolio share.

On the other hand, it is possible that an increase in average farm size would decrease agriculture's portfolio share through its influence on the demand for bank loans. As stated in the introduction, banks may have a comparative advantage in lending to borrowers who are especially costly to monitor. To the extent that farm size is positively correlated with ease of monitoring, large farm borrowers may have less need for banks' special monitoring capabilities. They may have greater access to other types of lenders and may therefore have less of a demand for bank loans.

The remaining variables in our regression should influence either interest rate spreads or relative risk factors between the two types of loans. We include one variable that may influence interest rate spreads: competition from nonbank agricultural lenders, specifically, the Farm Credit System (FCS). In a survey of several California banks' agricultural lending, respondents noted that they face vigorous competition from the government-sponsored FCS.[21] (See Box for a brief description of the types of agricultural lenders, including the FCS.)

Such competition lowers the relative return that banks receive on agricultural loans. As pointed out by Gray, Woolridge, and Ferrara (1982), the FCS has some advantages over commercial banks in lending to agriculture. Its advantages help it to be an effective competitor with banks, thereby lowering equilibrium rates of return on agricultural loans. These include access to the national money markets through a government-sponsored entity, favorable tax treatment, and the absence of the loans-to-one-borrower limits that are imposed on nationally chartered commercial banks.[22]

The FCS's competitive disadvantages include strict eligibility restrictions for FCS loans to ensure that it remains only an agricultural lender, an obligation to serve *all* agricultural areas during *all* economic times and an inability to provide the full range of services provided by commercial banks.[23]

We measure the degree of competition from the FCS by

the percent of total agricultural production loans outstanding in the state that were held by the FCS in the previous year. We expect this variable to have a negative coefficient. We use the *lagged* FCS market share rather than the contemporaneous market share because the contemporaneous share likely is a function of the dependent variable in the regression. Moreover, it is in the nature of lending relationships that the short-term price elasticity of demand would be relatively low, so the lagged FCS share should be strongly positively correlated with *current* competition facing banks.[24]

Our risk-related variables are the share of government payments in farm net income and the bank's deposit-to-loan ratio. An increase in the share of government guarantees (through price supports or export subsidies) should decrease the level of risk in agricultural lending and should increase agriculture's portfolio share.

The deposit-to-loan ratio is included to capture firm-specific differences in attitudes toward risk. Such differences may depend on management's goals concerning, for example, firm growth. Generally, the more "aggressive" the bank, the more it depends on borrowed funds, rather than just deposits, for loan funding. We consider such aggressiveness to be a sign that, given the variances of project returns, a relatively low cost is assigned to overall portfolio risk. (In other words, the parameter β in our theoretical model is relatively low.)

Agricultural Loans and Lenders

Agricultural loans can be divided into two main categories, real estate and non-real estate, or production, loans. Agricultural real estate loans tend to be relatively long-term, whereas production loans have a shorter maturity.

There are five major types of agricultural real estate lenders: the Farm Credit Banks, life insurance companies, commercial banks, the Farmers Home Administration and individuals, along with other noninstitutional lenders. In the production loan category, there are four major types of lenders: the Farm Credit Banks, commercial banks, the Farmers Home Administration and individuals and noninstitutional lenders.

The Farm Credit Banks are part of the Farm Credit System (FCS).[a] The FCS was established by the government, in 1917, to help meet the specific credit needs of farmers. At that time, commercial banks apparently were reluctant to make the long-term loans, with maturities greater than 90 days, that farmers needed. Moreover, there were relatively few commercial banks located in agricultural areas.[b]

As explained by Todd (1985), the FCS sells securities in the money market and, through the Farm Credit Banks, lends the proceeds to farmers. Each Farm Credit Bank has the primary responsibility for meeting its share of the scheduled interest and principal payments on the system-wide securities, but these securities are ultimately the joint responsibility of all FCS banks.

At the time the loan is made, an FCS borrower is required to obtain stock in the lending office of the Farm Credit Bank that is issuing the loan. The amount of stock is equal to a certain percentage of the loan (usually 5 or 10 percent). Normally, stock is bought back by the FCS lender at its original price when the loan is paid off. However, should a Farm Credit Bank's financial reserves run out, borrowers' stock may be frozen.[c]

The other lenders fit into the agricultural loan market in various ways. The Farmers Home Administration is the government's farm lender of last resort. This agency provides credit to farmers who cannot obtain loans at reasonable rates from any other lender. Insurance companies have traditionally provided long-term or real estate credit to farmers. Commercial banks are the single most important source of short-term credit, although they also are involved in agricultural real estate lending. Finally, individual and noninstitutional lenders are active both in real estate and non-real estate agricultural lending. Included in this category are agricultural merchants and supply companies. These lenders often finance the equipment or materials that they sell, but also offer general purpose loans.[d]

a. Currently there are 12 FCS Districts, and 12 corresponding Farm Credit Banks. However, the Farm Credit Act of 1987 permitted the reorganization of the Farm Credit System into no fewer than six districts, and there are plans for several District mergers. (See Sullivan, 1990.) Also, it should be pointed out that the Farm Credit Banks are the result of mergers between Federal Land Banks and Federal Intermediate Credit Banks that were mandated by the 1987 Act. The Federal Land Banks provided real estate loans, while the Federal Intermediate Credit Banks provided short- and intermediate-term production credit.

b. See Sullivan (1990).

c. This happened on November 9, 1984, at two FCS lenders in Nebraska. See Todd (1985.)

d. See, for example, Blank (1990).

A decrease in the expected cost of bankruptcy, holding variances constant, would induce a bank to invest more in the projects with higher risk and higher contract interest rates.[25] Therefore, if agricultural loans tend to have higher interest rates, an increase in the deposit-to-loan ratio, corresponding to an increase in the cost assigned to bankruptcy, would decrease the agricultural loan portfolio share. If, on the other hand, commercial loans tend to have higher risk and higher interest rates, an increase in the deposit-to-loan ratio would increase the agricultural loan portfolio share.[26] We do not predict the sign of the coefficient for the deposit-to-loan ratio.

One variable not included explicitly in the model is the interest rate spread. This variable is excluded because of data limitations. The appropriate variable to include is bank-specific and not directly obtainable. The relevant spread depends on the bank's alternatives to agricultural loans—be they commercial, real estate or consumer loans. We do not have this information, nor do we have the relevant interest rates for each type of loan for each bank.

We would like to point out that the narrow categorization of several of the variables in the regression is mainly for the sake of exposition. Specifically, bank size, the deposit-to-loan ratio and average farm size may work through any or all of the monitoring costs, interest rate spread, or risk channels to influence the agricultural portfolio share. For example, examination of several years of data from the Survey of Terms of Bank Lending reveals that large farm loans tend to carry lower interest rates than small loans.[27] Therefore, if farm size is positively correlated with loan size, then farm size may be negatively correlated with interest rates on farm loans.

This caveat means that the coefficients on the bank size, deposit-to-loan ratio and average farm size variables should be interpreted with caution. These are reduced-form coefficients, not structural coefficients. Most important, their interpretation does not affect the interpretation of coefficients on the main variables of interest, the location and branching law interaction terms, and agriculture's share of gross state product.

The Data

We examine a subset of a sample of commercial banks that the Federal Reserve's Board of Governors has determined are representative of banks making farm production loans.[28] This sample consists of the banks that were surveyed on the quarterly FR 2028b, the Survey of Terms of Bank Lending to Agriculture, between 1981 and 1986.[29] The FR2028b surveys between 168 and 188 banks in each quarter. The set of banks can differ from survey to survey, with some banks reporting data throughout the sample period and other banks reporting only once or twice.

There are 1069 observations in our sample. A bank was included in our sample for a particular year if it reported having outstanding fixed or variable rate agricultural production loans on the FR2028b in at least one quarter of that year. In total, banks in 33 states are represented.[30] (The remaining states were not represented because they either had less than 2 percent of their gross state product in agriculture, or they had no banks surveyed in the sample.)

For purposes of our analysis it is important that the sample of banks be fairly evenly divided between banks with their head offices in metropolitan areas (565 observations) and those located in rural areas (504 observations). The breakdown between banks located in restricted branching states and statewide branching states is 811 and 258, respectively.

Our dependent variable, the share of agricultural production loans in total loans, bank assets, and the deposit-to-loan ratio were all obtained from data reported on

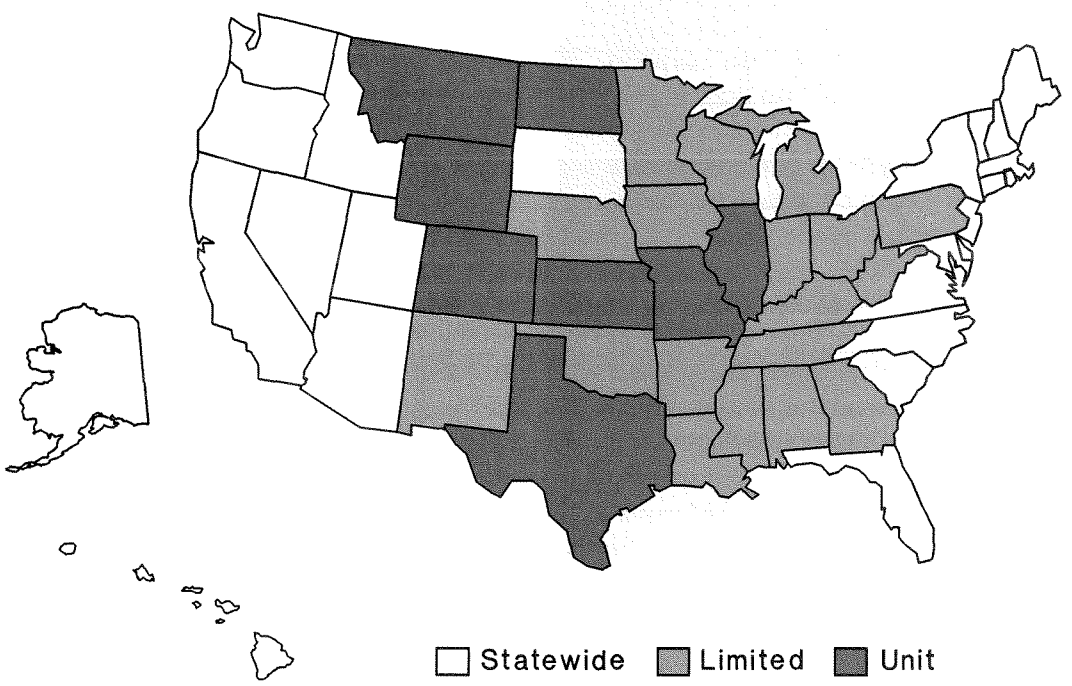
Table 1

Mean Values by Branching Status

(Standard Deviations in Parentheses)

		Statewide Branching States		Restricted Branching States	
Variable	Entire Sample	Urban	Rural	Urban	Rural
Number of Observations	1069	215	43	350	461
Agricultural Production Loan Share (% of Total Loans)	17.35 (20.82)	4.29 (6.20)	19.98 (18.78)	5.31 (10.23)	32.33 (21.48)
Bank Size ($ Assets, Millions)	2,579 (7,939)	8,846 (15,304)	115 (101)	2,364 (3,978)	50 (58)
Deposits to Loan Ratio (%)	154.40 (46.01)	135.14 (33.81)	160.16 (20.06)	138.30 (37.51)	175.08 (49.76)
Agriculture's Share of Gross State Product (%)	4.11 (3.70)	2.26 (1.76)	3.89 (2.65)	3.01 (2.39)	5.82 (4.46)
Average Farm Size (# of Acres)	615.59 (961.18)	900.48 (1,741.44)	501.91 (195.83)	482.74 (364.25)	594.20 (759.57)
Government Support as a Share of Farm Income (%)	4.67 (3.57)	2.22 (2.12)	4.92 (4.08)	4.90 (3.11)	5.61 (3.87)
Farm Credit System Share of Farm Loans, Lagged (%)	25.44 (9.47)	29.27 (9.16)	19.10 (11.51)	24.82 (8.31)	24.71 (9.66)

Figure 4
State Branching Laws in 1986



the quarterly "Report of Condition and Income (Call Report)." These items were averaged for the entire year to generate annual figures. The branching law variables were obtained from various editions of the *Annual Statistical Digest,* published by the Board of Governors of the Federal Reserve System.

The percent of gross state product in agriculture was obtained from the Bureau of Economic Analysis of the U.S. Department of Labor. Average farm size and the percent of state farm income from government payments were obtained from *Agricultural Statistics,* published by the U.S. Department of Agriculture. The Farm Credit System market share was obtained from editions of *Agricultural Finance Statistics*. Both of these publications are published annually by the U.S. Department of Agriculture.

Figure 4 shows the branching laws for all the states in 1986. (Unit and limited branching states are considered restricted branching states.) Table 1 presents the mean values for the agricultural production loan share and for the continuous independent variables. Means are given for the entire sample and for subsamples broken down by bank headquarters location and branching law status. Note the large differences in agricultural production loan shares between rural and urban banks. Also, urban banks in the sample are significantly larger than rural banks, especially in statewide branching states. We control for this difference in the regression.

The Empirical Model

The dependent variable in our regression is the difference between the bank's agricultural production loan portfolio share and the mean value of this variable for all banks in the sample for that year. All explanatory variables except the location and the branching law interaction terms also are expressed as deviations from sample means. Expressing variables as deviations from means helps to control for macroeconomic effects such as agricultural business cycles and government policy cycles for which we have inadequate empirical measures.

The regression equation that we estimate is:

AGRICULTURAL PRODUCTION LOAN SHARE =
B1*ASSETS +
B2*DEPOSIT-TO-LOAN RATIO +
B3*AGRICULTURE'S SHARE OF GROSS STATE PRODUCT +
B4*AVERAGE FARM SIZE +
B5*GOVERNMENT SUPPORT +

B6*LAGGED FARM CREDIT SYSTEM SHARE OF FARM LOANS +
B7*RESTRICTED BRANCHING, RURAL +
B8*RESTRICTED BRANCHING, URBAN +
B9*STATEWIDE BRANCHING, URBAN +
ϵ,

where AGRICULTURAL PRODUCTION LOAN SHARE = percent of total loans outstanding in agricultural production loans;
ASSETS = bank assets, in billions of dollars;
DEPOSIT-TO-LOAN RATIO = the ratio of total deposits to total loans outstanding, in percent (positively correlated with the cost of risk);
AGRICULTURE'S SHARE OF GROSS STATE PRODUCT = for the state in which the bank is located, the percent of gross state product that is accounted for by agriculture;
AVERAGE FARM SIZE = average farm size in the state in 1978, in acres;
GOVERNMENT SUPPORT = the share of government payments in total state farm net income, in percent;
LAGGED FARM CREDIT SYSTEM SHARE OF FARM LOANS = the percent of total agricultural production loans outstanding in the state held by the FCS in the previous year;
RESTRICTED BRANCHING, RURAL = 1 if the bank's main office is not in a Metropolitan Statistical Area and if it is in a unit banking or limited branching state, 0 otherwise;[31]
RESTRICTED BRANCHING, URBAN = 1 if the bank's main office is in a Metropolitan Statistical Area and if it is in a unit banking or limited branching state, 0 otherwise;
STATEWIDE BRANCHING, URBAN = 1 if the bank's main office is in a Metropolitan Statistical Area and if it is in a statewide branching state, 0 otherwise;
and ϵ is an error term.

Our method of estimation was ordinary least squares. Because of the sample composition, we did not have a "panel" data set giving a consistent time series for each bank.[32] Therefore, we could not perform the usual corrections for heteroskedasticity and autocorrelation that are done for time-series, cross-section regressions.

Table 2

Estimated Relationships between Agricultural Production Loan Share, Regulatory Structure and Bank Location

Dependent Variable: Agricultural Production Loan Share (% of Total Loans)		
Independent Variable	Coefficient	*t*-statistic
Bank Size ($ Assets, billions)	−0.0700	−1.283
Deposit-to-loan-ratio (%)	0.0130	1.368
Agriculture's Share of Gross State Product (%)	2.4383***	19.545
Average Farm Size (Acres)	−0.0008*	−1.831
Government Support as a Percent of Farm Income (%)	0.3796**	2.088
Lagged Farm Credit System Share of Farm Loans (%)	−0.3552***	−7.360
Restricted Branching States, Rural Location	9.7481***	14.938
Restricted Branching States, Urban Location	−9.6175***	−13.492
Statewide Branching States, Urban Location	−5.3484***	−5.284
Number of Observations	1,069	
Adjusted R^2	0.6416	

Notes: *(**)(***) indicates coefficient significantly different from zero at the 10(5)(1) percent level.

III. Regression Results

The regression results are reported in Table 2. In general, the results provide strong evidence to support the importance of location in explaining differences in bank portfolios. As indicated by the adjusted R^2, the equation explains 64 percent of the variation in agricultural loan portfolio shares.

Coefficients on the three interactive dummies indicate the importance of location and restrictions on branching. All three are highly significant with the predicted signs. Results in Table 2 are consistent with the hypothesis that location, through its influence on relative monitoring costs, is an important determinant of bank portfolio choice, even when branching is permitted. Urban banks have significantly smaller portfolio shares in agricultural

loans than rural banks, ranging from 5.3 percentage points smaller in statewide branching states to 19.3 percentage points smaller in restricted branching states.

Branching restrictions work in the expected direction. To the extent that branching allows urban banks to reduce the costs of monitoring agricultural loans and rural banks to lower monitoring costs for nonagricultural loans, unrestricted urban banks would be expected to have greater agricultural loan portfolio shares than restricted urban banks, and unrestricted rural banks would have smaller agricultural shares than restricted rural banks. As shown in Table 2, holding other factors constant, unrestricted urban banks would hold 4.3 percentage points more of their portfolio in agricultural loans than restricted urban banks.[33] Likewise, unrestricted rural banks would hold 9.7 percentage points less of their portfolio in agricultural loans than restricted rural banks. These effects are responsible for the considerably smaller difference in agricultural shares between urban and rural unrestricted banks than between urban and rural restricted banks.

As discussed above, monitoring costs for agricultural loans should be influenced not only by the location of the bank within the state, be it urban or rural, but also by the agricultural orientation of the state's economy as a whole. The regression results in Table 2 show that, as expected, AGRICULTURE'S SHARE OF GROSS STATE PRODUCT has a positive and highly significant coefficient.

Other factors besides bank location and branching laws may affect farm production loan portfolio shares. Although the coefficient on ASSETS is insignificant, indicating that bank size does not appear to affect relative monitoring costs in such a way as to significantly influence agricultural portfolio shares, AVERAGE FARM SIZE has a significant negative coefficient. This sign is consistent with the hypothesis that large farm borrowers may demand fewer bank loans.

One of the risk-related variables, GOVERNMENT SUPPORT, has a statistically significant coefficient. As expected, the sign is positive, indicating that such payments decrease the relative risk of agricultural loans, thereby making them more attractive investments. The other risk-related variable, the DEPOSIT-TO-LOAN RATIO, has an insignificant coefficient.

As discussed above, the interest rates on agricultural loans relative to nonagricultural loans for commercial banks should be negatively correlated with the lagged Farm Credit Share of the agricultural loan market. As expected, the regression results do show a negative and significant coefficient for LAGGED FARM CREDIT SYSTEM SHARE OF FARM LOANS.

V. Conclusion

In this paper, we present empirical evidence to support the hypothesis that location, through its effect on relative monitoring costs, affects bank loan portfolio choice. We also present evidence that branching restrictions, by confining the location of bank offices to a relatively small area, inhibits bank loan portfolio diversification.

Specifically, we find that rural banks devote a larger proportion of their loan portfolio to agricultural loans than do urban banks. Moreover, we find that, when branching is unrestricted, rural banks hold higher nonagricultural loan portfolio shares, *and* urban banks hold higher agricultural loan portfolio shares. As a result, the allocation of loan portfolios across agricultural and nonagricultural loans is more similar for urban and rural banks that are not constrained in their ability to branch than it is for constrained urban and rural banks.

Within the context of our theoretical model, our empirical results indicate that a move to statewide branching causes banks to *diversify* their loan portfolios. By permitting banks to locate branches near both agricultural and nonagricultural borrowers, statewide branching narrows the difference in monitoring costs between agricultural and nonagricultural loans for a given bank. As demonstrated in the theoretical model, differences in monitoring costs cause rural banks to concentrate more on agricultural loans and urban banks to concentrate more on nonagricultural loans than they would were their portfolio perfectly diversified. Therefore, the convergence of relative monitoring costs increases rural bank lending to nonagricultural projects and urban bank lending to agricultural projects, thereby increasing diversification. Given this interpretation, we can say that the benefits of intrastate branching liberalization would include the benefits that accompany asset diversification. Among these are a decrease in the risk of credit disruption as a result of bank failure and a decrease in the expected withdrawals from the deposit insurance fund.

Although our results are broadly consistent with those found by Gilbert and Belongia, our inclusion of urban banks in the study has enabled us to provide stronger confirmation of the hypothesis that branching restrictions constrain asset diversification. Previous authors made this conjecture, but did not provide any strong empirical evidence.

We also find evidence supporting the general conclusions of the theoretical model regarding the effect of

relative rates of return and relative risks on bank loan portfolio choice. Specifically, we find that factors that presumably decrease the relative rate of return on agricultural loans, such as an increase in the Farm Credit System's competitiveness, have a statistically significant negative effect on agricultural loan portfolio shares. In addition, an increase in government agricultural supports, which likely is associated with a decrease in the relative riskiness of agricultural loans, has a statistically significant positive effect on a bank's agricultural lending. These results lend support to our theoretical model and, thus, our interpretation of the effects of location and branching laws on bank portfolio diversification.

NOTES

1. Black's work also suggests that banks would have a comparative advantage, all other things equal, over other financial intermediaries in the credit evaluation and monitoring process. For further discussion and evidence on banks' comparative advantage in monitoring, see Fama (1985) and James (1987).

2. See Keeley and Zimmerman (1985) and Neuberger and Zimmerman (1990) for evidence on the extent of geographic markets for different types of deposits.

3. Throughout this paper, in both the theoretical discussion and in the empirical work, we equate rural areas with agricultural areas. See endnote 18 for a discussion of how, ideally, one might deal with this issue.

4. As stated in the introduction, this may be especially true if borrowers tend to be depositors, and if deposit markets are local.

5. We have some evidence that metropolitan banks with branches in rural areas *are* quite active in agricultural lending in some states. California is an example. Zimmerman (1989) reports that although the proportion of large metropolitan California banks' loans in agriculture is quite small, these banks held almost 88 percent of the commercial bank total of $2.6 billion in outstanding agricultural production loans in the state in 1989.

6. Smith (1987) finds empirical evidence that banks in restricted branching states are generally at greater risk of closure than are banks in statewide-branching states. However, the link between branching laws and diversification is not strongly drawn.

7. The model presented in this section is very similar to the model of bank loan portfolio choice presented in Gruben, Neuberger and Schmidt (1990).

8. An alternative would be to have the level of monitoring be a decision variable for the bank, with increases in monitoring imposing costs, but also yielding benefits in the form of decreased project return variances. Such a treatment is beyond the scope of this paper.

9. It is important to note that the returns under discussion here are the returns to *project owners*, as opposed to returns to the bank. Projects may yield returns to their owners that exceed the contract loan rate, but the most the bank can receive, net of costs, is the contract loan rate.

10. For example, managers may face some sort of reputational penalty should their bank fail.

11. It may be argued that although diversification theory applies to investors, it does not apply to individual firms, such as banks. According to this view, bank equity holders are the decision-making agents in the bank, and their objective is to have the bank make loan allocations that yield the maximum risk-adjusted expected return on their entire portfolio. Because these investors can be expected to hold more than the stock of the one bank in their portfolios, the argument goes, their objectives will not necessarily be consistent with having the bank maximize the risk-adjusted return on the bank portfolio in isolation.

For this reason, those who model bank behavior sometimes assume that the bank should properly have a risk-neutral objective function, and thus should maximize expected return without any concern for risk. It is assumed that if investors are risk-averse, they can adequately hedge any risk in one bank's stock returns with investments in other firms.

However, several arguments have been made explaining why risk may indeed enter into the bank's asset choice decision. For example, if the bank would face bankruptcy costs should it turn out that its net worth is negative, then an increase in the variance of the bank's portfolio will actually lower its expected return. In this case, diversification within the bank's portfolio again becomes important. (See Santomero (1984), for a more detailed discussion of this issue.) In this paper, we will assume that this sort of mechanism is at work.

12. Even if loan returns are not negatively correlated, diversification can often reduce portfolio risk. As long as the returns on new and existing loans are not perfectly positively correlated, then, given the distribution of the returns on new loans, and their covariance with the return on the existing portfolio, there exists a set of non-zero weights to attach to new and existing loans such that the variance of a combined portfolio is less than the variance of the existing portfolio.

13. It must be emphasized, that, under different assumptions for relative interest rates, monitoring costs, and covariances, portfolio variance would not necessarily be minimized by devoting exactly one-half of the portfolio to agriculture.

14. A bank may have centralized credit policies or credit approval processes that make the location of the bank headquarters important.

15. The solution depends on the relative curvature of the two individual profit functions. A major factor causing the functions to be concave is the importance of bankruptcy costs, β. As β increases, the functions become more concave, making it more likely that diversification will take place.

16. The other type of agricultural loan is an agricultural loan secured by real estate, which typically has a much longer maturity than an agricultural production loan (about 15 years versus about one year). We focus on agricultural production loans because they are more comparable, in maturity, with the commercial loans that we envision as the alternative asset. In addition, commercial banks are more involved in agricultural production lending than in agricultural real estate lending, as measured by market share. Over the years 1981-1986 (the years which we study), an average of 9.35 percent of total agricultural real estate loans were held by commercial banks. The corresponding figure for agricultural production loans was 41.7 percent. (Source: Sullivan, 1990.)

17. Gilbert and Belongia's explanatory variables are limited to variables related to bank holding company size and the length of time that a bank has been affiliated with a bank holding company.

18. Implicitly, we are equating rural areas with agricultural areas. Ideally, we would use county-level information on, for example, agriculture's share of total personal income, to refine our definition of an agricultural area. However, we do not have such information for every county in our study. On the surface, an alternative may be to use the entire state's share of agriculture in gross state product to measure the degree to which rural areas in the state are in fact engaged in agriculture. However, this is not likely to be a good indicator of agricultural activity in rural areas. This is because a state is likely to have a low agricultural gross state product share not because its rural areas are not engaged in agriculture, but because the contribution of industry to the state's economy is more important than the contribution of agriculture. California, with approximately a 2 percent share of agriculture in gross state product, is an example of such a state.

19. This notion was not incorporated into the theoretical model. There, a change in the proportion of funds devoted to agricultural loans, holding loan size constant, did not affect monitoring costs per dollar for agricultural loans. Likewise, a change in average agricultural loan size, holding the total proportion of the portfolio devoted to agriculture constant, did not affect monitoring costs per dollar for agricultural loans. Allowing for such effects in the theoretical model would have unnecessarily complicated the model, given that the main focus is on the relationship between monitoring costs and location.

20. For example, figures for loans made during one week in August in each of the years 1981 to 1986 reveal the following: Averaged over all six years, for the 48 large banks surveyed, the average size of short-term commercial and industrial loans was $1.433 million, the average size of long-term commercial and industrial loans was $1.093 million, and the average size of farm loans was $73,000. For small and medium sized banks, the corresponding numbers were $68,000, $62,000 and $12,000. Moreover, the pattern was consistent over all six years. (Source: Survey of Terms of Bank Lending.)

21. Source: Informal survey conducted by Federal Reserve Bank of San Francisco of six major commercial bank agricultural lenders in the Twelfth Federal Reserve District, March 1990.

22. Nationally chartered banks may lend no more than the value of 10 percent of their capital to any one borrower.

23. In addition, the FCS has a requirement that borrowers purchase stock in the organization. (See Box.) Under certain circumstances this too can be detrimental to its competitiveness. If farmers fear substantial losses on any FCS bank stock, they may "run" on the bank, rushing to pay off loans and redeem their stock at full price. This effort is most feasible for the financially strongest borrowers, so any exodus would leave behind the most troubled borrowers, exacerbating bank losses. Commercial banks do not face the possibility of runs by their borrowers, and deposit insurance protects them from runs by their depositors. Also, until recently the FCS has followed the practice of setting its loan rate based on its historical average cost of funds. This meant that, in periods of falling interest rates, the FCS was less competitive with commercial banks, who are more apt to price on a marginal cost basis.

24. According to the theory of financial intermediation outlined in the introduction to this paper, banks provide credit to borrowers who are unable to obtain funds by issuing their own debt. A bank is willing to lend to such a borrower because it has special credit evaluation and monitoring capabilities that are specific to that borrower. A relatively low short-term interest rate elasticity of demand is consistent with this theory; a borrower could expect that although another lender may offer a lower interest rate, other terms of the contract may be less favorable due to the new lender being less familiar with the borrower. For example, a borrower may rationally have loyalty to his lender born of experience that shows that the lender "stands by" the borrower in difficult times. A lender that has not had a long-term relationship with the borrower would not be expected to be as accommodating. Agricultural lending relationships seem to be particularly stable; an official of one commercial bank involved in agricultural lending stated that in order to win over a customer from another lender you often have to call on the customer for three or four years.

25. We assume that investing in the higher interest rate projects also adds to portfolio risk and/or raises the probability of project defaults. If it did not, then the bank would already have invested its entire portfolio in the projects with the highest interest rates, and changing the cost assigned to bankruptcy would not affect its portfolio.

26. Another variable that may affect the cost of risk to the bank is the capital-to-asset ratio. We included this variable in some versions of our regression, but this did not signifi-

cantly affect the results we report here. Therefore, we report only the version of the regression that excludes the capital-to-asset ratio.

27. For example, for farm loans made by large banks during the week of August 4, 1986, weighted average interest rates for six size classes decreased monotonically from 10.57 percent for $1,000 to $3,000 loans to 8.94 percent for loans of at least $250,000. (Source: Survey of Terms of Bank Lending, August 4-8, 1986.)

28. By restricting our sample to defined "agricultural lenders," we may be introducing selectivity bias into our regression estimation. However, we believe that our model is more applicable to banks that do *some* agricultural lending than it is to banks that do none at all, and that the determination of *whether* a bank does agricultural lending can be separated from the determination of *how much* agricultural lending it does.

29. These banks account for about one-third of total commercial bank agricultural lending nationwide.

30. It may be noted that agricultural loan market conditions experienced a severe downturn during our sample period due to a significant decrease in the trend of expected earnings and a consequent plunge in the value of farmland. (See Melichar (1986) and Melichar (1987) for discussions of this period of financial stress in agriculture.) However, we do not believe that this biases our results.

31. Metropolitan Statistical Area is a designation assigned to counties or areas of contiguous counties by the Census Bureau.

32. Because some banks appear more than once in our data set, we do not have completely independent observations. However, because bank size and the deposit-to-loan ratio should be fairly constant over time for each bank, the inclusion of these variables in the regression should help to control for firm-specific effects.

33. The difference between the coeffients on the restricted branching, urban location variable and the statewide branching, urban location variable is statistically significant.

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