CHAPTER 2

RISK AND RETURN FACTORS ASSOCIATED WITH COMMERCIAL BANK PARTICIPATION IN THE FEDERAL HOME LOAN BANK SYSTEM

Introduction

As financial intermediaries, commercial banks accept deposits from savers and borrow non-deposit sources of funds to make loans to borrowers and meet the withdrawal demands of depositors. Bank assets (loans) and liabilities (deposits, borrowings) are managed to generate returns for the banks' owners, while minimizing or controlling for risk. As assets held by banks continually increases, core deposits as a percentage of total assets have been on the decline, rendering non-deposit sources of funds, such as Federal Home Loan Bank (FHLB) advances, an increasingly important source of liquidity and risk management for commercial banks. The perception of a government guarantee, and other special privileges associated with their government-sponsored status, allow the FHLBs to borrow funds in capital markets at rates only slightly higher than those paid by the U.S. Treasury. Consequently, the FHLBs are able to extend low-cost advances to their member institutions.

Commercial bank membership to the FHLB System continually grows, and provisions of the Gramm-Leach-Bliley Act (GLB) of 1999 have the potential to further increase small bank access to FHLB funds. Concerns arise regarding the quality and condition of the institutions that seek participation in the FHLB program, since expanded access to FHLB funding may have unintended consequences. Federal Deposit Insurance Corporation (FDIC) officials are concerned that FHLB lending may, at times, enable rather than deter risk-taking by banks and thrifts. Deposit insurance funds are at risk if FHLBs provide advances to troubled, federally-insured institutions, since liens associated with the FHLB advances have priority over other security interests, including insured deposits, in the assets of failed insured institutions.

During the 1980s, a negative correlation existed between FHLB advances to thrifts and thrift capital levels, a widely used indicator of riskiness. FHLB lending to poorly capitalized thrifts

increased Federal Savings and Loan Insurance Corporation losses during the thrift crisis (Ashley, et al., 1998). In an attempt to limit excessive lending to riskier institutions, Congress created an independent Federal agency, the Federal Housing Finance Board (FHFB), in 1989 to regulate FHLB safety and soundness and mission compliance. The effectiveness of this reform remains an empirical question.

This analysis provides empirical evidence about the characteristics of commercial banks that have joined an FHLB, and those member banks that have used FHLB advances as a funding source. While the period of analysis, 1994 through 1998, predates enactment of GLB, results are expected to remain relevant by providing baseline evidence on the characteristics of banks that have chosen to participate in the FHLB program under the more stringent pre-GLB requirements. The study may also shed light on safety and soundness concerns regarding FHLB activity.

Section 1 presents a theoretical framework of the commercial bank problem and shows how optimization may involve attaining FHLB membership and using advances. Section 2 describes potential reasons for and against commercial bank interest in FHLB participation, FHLB membership implications for rural areas, and the agricultural bank-lending environment. The models and variables used in the empirical estimations are described in Section 3, followed by the presentation and discussion of results in Section 4, and concludes with a summary and discussion of policy implications in Section 5.

1. The Commercial Bank Problem: Portfolio Selection Theory of Banking

The commercial bank operates by accepting deposits and borrowing non-deposit funds to extend loans to borrowers and meet the withdrawal needs of depositors. The bank manages assets and liabilities to control for risk generated by the bank's portfolio while generating returns for the bank owners. The available asset and liability sets are assumed to be the same for all commercial banks. The asset set may include investments such as loans, reserves, and government securities. Liabilities are sources of funds, such as deposits, capital, and FHLB borrowings.

FHLB advances are available for all eligible members for all eligible types of loans, so long as the advances are secured by acceptable collateral. Membership requirements must be met during the application process, but neither membership nor borrowing eligibility is forfeited if the requirements are not subsequently met. Therefore, an elastic supply of FHLB funds is available to all commercial banks (to the extent of their eligible collateral) once the eligibility requirements are met and membership has been approved and attained. The borrowing rate on advances is flat and fixed. This model is then primarily driven by commercial bank demand for FHLB services, unless the bank is originally constrained by membership eligibility requirements.

Assume commercial bank demand for assets and liabilities, including FHLB advances, is consistent with standard portfolio theory as developed by Pyle (1971). The expected utility of, or satisfaction generated by, any alternative security available for a bank to hold in its portfolio can be expressed as a function of the moments of the security's probability distribution of returns. Assuming the distributions are normally distributed for all securities, only the first two moments of each distribution need be considered: the mean and the variance. The mean of the security's distribution is the average returns generated from holding the security in the bank's portfolio. The variance assesses the deviation from these expected returns, and is used as a measure of risk: higher variance indicates more erratic returns and increases the risk of the security. Therefore, the risk-averse, expected utility-maximizing bank manager[1] chooses an

[1] This analysis is consistent with a utility-maximizing bank manager without agency costs. The bank manager and bank owners/shareholders have common interests, so managers are acting in the best interest of bank owners.

optimal asset-liability portfolio with which to increase expected/average returns (the mean) while controlling portfolio risk (the variance of expected returns).

Liabilities are defined to be negative assets. The proportions held of each asset may change with membership and/or the use of advances, although proportions held of some assets, such as advances, may be zero due to inaccessibility (i.e. nonmembers cannot take out advances). The bank manager's objective is to maximize expected utility over portfolio asset proportions:

$max_{ai}\ E(U)$ subject to: $\pi = \sum_i a_i r_i$

where
$E(U)$ = *expected utility* = $E(\pi) - (b/2)\sigma_\pi^2$
π = *profits*
$E(.)$ = *mean/average*
σ^2 = *variance*
$i = 1, \ldots, n$ *assets*
a_i = *portfolio proportion in asset i*
r_i = *return/all-in cost of asset i*
b = *risk factor*

Derivation of $E(\pi)$ and $var(\pi)$ and substitution yields

$max_{ai} \sum a_i R_i - (b/2)\sum_i \sum_j a_i a_j \sigma_{ij}$ subject to: $L + K = A$

$\delta r_i / \delta a_i > 0$ *if i = assets*
< 0 *if i = liabilities*
$k_i \geq G_i(.)$

where
$\sigma_{ij} = \rho_{ij}\sigma_i\sigma_j$ = *variance/covariance terms of return or cost* r_i
ρ_{ij} = *correlation coefficient between assets i and j*
R_i = *mean return or cost of asset i*
L = *total liabilities*
K = *total capital stock*
A = *total assets*
k_i = *capital held against security i*
$G(.)$ = *minimum capital stock function*

Assuming a nonempty portfolio, the solution to the Lagrangian indicates the optimal share of the portfolio held in security *i* is:

$a_i^* = (R_i/b\sigma_i) - \frac{1}{2}(\sum_j a_j\rho_{ij}\sigma_j)$

Comparative Statics:

$\delta a_i^*/\delta R_i > 0$ $\quad i = asset$
$\delta a_i^*/\delta R_i < 0$ $\quad i = liability$
$\delta a_i^*/\delta \sigma_i < 0$
$\delta a_i^*/\delta a_j$?
$\delta a_i^*/\delta \rho_{ij} < 0$
$\delta a_i^*/\delta \sigma_j$?

The comparative statics indicate that the bank manager chooses an optimal asset-liability portfolio using a mean-variance selection criterion. The higher the expected/mean return on a security, the higher its share held in portfolio. Conversely, the higher the expected cost of a security, the lower the portfolio share held in that security. Additionally, the more risky a security, as measured by greater variance, the lower its share held in portfolio.

The effect of the share of portfolio held in security *j* or the variance of security *j* on the optimal share held in security *i* will depend on the degree of correlation between the returns of securities *i* and *j*. The higher the correlation, the lower the holding of one of the securities, for risk management and diversification purposes. Portfolio diversification is most beneficial when the correlation between the returns of securities is low. As more securities are added to the portfolio, the unique risks associated with a particular security are diversified away. Therefore, as the number of securities in the portfolio approaches infinity (in the limit), the covariance terms determine the relative attractiveness of a security.

Portfolio selection theory suggests that bank managers invest in securities, including joining an FHLB and using System advances, according to risk and return factors. The higher the expected return, or the lower the expected cost, generated by a security renders it more attractive, given a particular risk level. Additionally, given some return, if a security can lower bank risk exposure, it becomes an attractive investment. Securities that increase risk may also be undertaken, if high-enough returns are generated from the investments to offset the additional risk.

2. Commercial Bank Interest in FHLB Membership

Commercial banks are currently the leading farm lenders with their market share of total farm business debt increasing from 21 percent in 1981 to 40 percent in 2000 (U.S. Department of Agriculture, Economic Research Service, 2001). Agricultural banks, those commercial banks with a higher than average share of farm loans in their total loan portfolio, hold over half of all commercial bank farm business loans (Barry and Escalante, 1998). Changes in the financial services industry over the past decade have raised issues concerning the competitiveness of commercial banks, particularly involving the ability of agricultural banks to adequately fund local rural development. Market innovations, technological developments, and legislative and regulatory initiatives have increased concerns about funding pressures on small banks. Since agricultural banks tend to be smaller banks located in rural areas, such funding pressures could disproportionately inhibit financing to rural households and small businesses, and ultimately hinder economic growth in local communities.

Agricultural bank interest in FHLB advances stems from the desire for a lower-cost funding source that enables better liquidity and interest rate risk management (Barry and Ellinger, 1997). Deposits are an important source of liquidity for banks, especially core deposits[2], due to their stability and relatively low interest-rate sensitivity. However, the growth of deposits has been slow relative to loan demand over the past decade. The emergence of higher yielding investment alternatives, such as money market funds and mutual stock and bond funds, has diminished the share of household assets held as bank deposits from over 30 percent in the 1980s to less than 15 percent in the 1990s (Puwalski and Kenner, 1999).

Slow deposit growth is especially important for small banks. By year-end 1998, 72 percent of aggregate community bank assets were funded with core deposits, compared to only 43 percent by their large counterparts (Puwalski and Kenner, 1999). Community banks remain the primary source of credit for small businesses and local borrowers. However, small bank lending can be significantly constrained by deposit levels in smaller markets (Jayaratne and Morgan, 1997).

[2] Core deposits include demand deposits, negotiable order of withdrawal (NOW) accounts, money market deposit accounts (MMDAs), and small time deposits (i.e. total domestic deposits less time deposits in excess of $100,000 and brokered deposits less than $100,000).

During the 1990s, average small bank loan-to-deposit ratios increased 14 percentage points to exceed 69 percent by 1997 (Keeton, 1998). At the same time, small banks have shifted to heavier use of non-deposit liabilities, including FHLB advances. By second quarter 1998, 75 percent of all small banks—compared to 42 percent in 1993—raised over 10 percent of their liabilities from sources other than core deposits. The increase in non-deposit funds reflects the rising use of FHLB advances. By year-end 1998, advances made up over 80 percent of all non-overnight borrowings (excludes federal funds purchased and repurchase agreements) for small banks (Puwalski and Kenner, 1999). By third quarter 1999, one-half of all agricultural banks were members of the FHLB System, compared to only 6 percent in 1992. Three-quarters of these agricultural bank members borrowed from their respective FHLB, compared to only 45 percent in 1992. Additionally, a greater percentage of member agricultural banks have outstanding advances than non-agricultural bank members.

FHLB member banks can take advantage of profitable opportunities that existing liability bases cannot support by using advances to fund loans. Liquidity is further enhanced when qualifying loans are pledged as collateral for System advances. Members can remain active in difficult lending environments, such as rural areas, where seasonal mismatches in loan demand and deposits create funding problems for banks, and the less diversified nature and isolation of rural economies makes diversification of loan portfolios difficult.

Reducing interest rate risk is a major motivation for banks to find alternatives to deposits (Barry and Ellinger, 1997). Interest rate risk is the possibility of a change in cost of funds (market interest rates) without matched changes in rates charged on outstanding loans held in portfolio (fixed-rate loans), which can thereby affect bank earnings and net worth. On average, long-term assets held in bank portfolios have been increasing as a percentage of total assets, as banks increase holdings of residential mortgages and mortgage related securities, which typically have longer maturity periods (Feldman and Schmidt, 2000b; Puwalski, 2000). This is accompanied by a greater reliance on short-term, volatile funding sources, such as federal funds purchased and time deposits in amounts in excess of $100,000. Since net interest margins are extremely volatile and vulnerable to changes in market rates, the interest rate risk of institutions that specialize in mortgages is high.

Attaining membership in the FHLB System gives member banks the potential to finance long-term loans with longer-term liabilities via the use of long-term advances, which reduces exposure to interest rate risk and stabilizes returns. Since capital market instruments have high fixed costs, which are spread over a smaller volume of business activity, direct access to capital markets may be too costly for small banks. Additionally, smaller banks are not as well known and are not easily evaluated by creditors, and so may be forced to pay higher rates for borrowings than their large counterparts. However, advances may also be less costly than core deposits, at the margin, (Hartzog, et al., 1990) and can offer small banks a cost competitive alternative to higher cost sources of funds for financing investment opportunities.

Advances are also an attractive alternative to seasonal borrowing from district Federal Reserve banks and other government-sponsored enterprise (GSE) sources of funds, such as the secondary market for agricultural real estate loans created by Farmer Mac, or borrowing from the Farm Credit System (FCS) institutions. The limitations of the Farmer Mac securitization program may be too restrictive for some banks, while the FCS lending associations compete directly with the very banks that are borrowing from the FCS banks, potentially causing problems due to conflicting interests.

Although FHLB membership can provide a low-cost, long-term, non-deposit source of funding, some banks may not find membership advantageous. On average, rural banks hold fewer loans as a percentage of deposits, when compared to the banking industry as a whole (Keeton, 1998), perhaps indicating limits to the profitable lending opportunities in some areas. Rural banks may lack the management knowledge and skills needed to utilize non-deposit sources of funds and may find the marginal cost of attaining the expertise to do so too high. Member banks are required to purchase stock in their respective FHLB. This required capital investment could deter some banks. Finally, rural bank returns-on-assets and net interest margins have, on average, exceeded those of non-rural banks. Despite high industry loan-to-deposit ratios during the 1990s, rural banks may not need to raise new funds to maintain profitability.

3. Model Specifications

According to the portfolio selection theory presented in Section 1, bank portfolio choice decisions involve a trade-off between expected returns (mean) and risk (deviations in expected returns), where a higher level of risk is accepted only if higher returns are anticipated. The bank manager then handles assets and liabilities to control risk, while increasing returns. Advocates of FHLB activity argue that membership and System funding can provide banks with tools to achieve these goals, suggesting that liquidity-constrained, riskier banks may seek participation in the FHLB program to acquire these tools.

The analysis goal is to empirically assess the economic characteristics of agricultural banks that join their district FHLB and then, after obtaining membership, choose to use advances. Specifically, the following hypotheses will be tested:

1. H_0: Banks perceived to have fewer funding options seek FHLB membership and use System advances.
2. H_0: Attractive FHLB stock dividend returns attract members.
3. H_0: Relatively riskier banks, defined by various measures of risk, seek FHLB membership and use System funds.

A reduced-form equation, derived from the supply of FHLB services to, and the demand for FHLB services by, agricultural banks, is developed. On the supply side, the model assumes an elastic supply of FHLB funds if an agricultural bank has passed the membership eligibility requirements. On the demand side, a standard portfolio theory-based banking model in the tradition of Pyle (1971) is used, wherein the risk-averse, expected utility-maximizing banker chooses an optimal asset-liability portfolio using a mean-variance selection criterion. Each agricultural bank manager must weigh how FHLB-related decisions affect returns and risk. The variables introduced in the following discussion are presented in Table 2.1.

Variable	Description[a]
Net interest margin	The ratio of net interest income to earning assets (assets generating interest income).
Dividend rate	Rate paid on FHLB stock held by ag bank members; varies depending on the FHLB region.
Interest rate risk	Measured by the long-term maturity gap, which is the difference between the dollar amounts of the bank's long-term assets and long-term liabilities as a percentage of total assetsb.
Liquidity risk	Measured by loan-to-core-deposit ratios, where core deposits are those that tend not to be highly interest rate sensitive: demand and small time deposits, negotiable orders of withdrawal, and money market demand accounts.
Credit risk	Measured as the ratio of nonperforming loans (at least 90 days overdue or in nonaccrual status) to total loans.
Size of bank	Total assets in ten-millions.
BHC affiliation	Binary variable equal to 1 if the agricultural bank is affiliated with a bank holding company.
Membership eligibilty requirements:	**Binary variables equal to 1 if…**
Residential mortgage assets	At least 10 percent of total assets are invested in residential mortgage loans or mortgage-related assets.
Risk-based capital	Total risk-based capital is at least 8 percent of adjusted total assets.
Equity capital	Tier 1 capital is at least 4 percent of risk-weighted assets.
Domestic deposits	The agricultural bank must collect domestic deposits.
Asset quality	Nonperforming loans make up less than 10 percent of total loans

[a] All variables are computed from FDIC Call Report data, except for the dividend rate, which was provided by the FHFB, and BHC affiliation, which comes from the Federal Reserve's Bank Structure database.

[b] Call Report entries used to derive the maturity gap measures changed during the analysis years. For 1994 and 1995, the long-term gap measure included debt securities, loans and leases, and deposits with maturity or repricing frequency of over 5 years. For 1997 and 1998, the measure was extended to include these assets and liabilities with maturity or repricing frequency of over 3 years. Maturity and repricing frequency data did not exist for deposits in 1996, so long-term assets as a percentage of total assets is used instead. This serves as an adequate proxy since, on average, long-term deposits made up less than 1 percent of total assets.

Table 2.1 Variable Descriptions

FHLB membership and advances affect bank returns in two important ways, namely through net interest margins and through dividends on FHLB stock. Net interest margins are used to measure returns, where tighter net interest margins characterize institutions with higher marginal costs of funds and/or holding lower yielding assets in portfolio. An institution experiencing tight net interest margins may be cash flow constrained, leading to the need for an alternative source of funding which FHLB membership can address. FHLB advances can directly affect expected returns by providing a lower marginal cost of funds. Although FHLB advances often carry higher interest rates than core deposits, their "all-in" cost may be lower because few operating resources are required to raise them compared to the brick-and-mortar retail deposit taking networks. In addition, increasing retail deposits by offering higher interest rates raises the rates on both existing and new deposits, so the marginal cost of new deposits can be considerably higher than the nominal rate offered. Therefore, negative relationships between net interest margins and both FHLB membership and the use of FHLB advances are expected.

The membership decision may also be affected by the rate of return on FHLB stock, which each member is required to purchase. FHLB stock is a safe investment with relatively attractive returns. If the stock dividend rate exceeds the marginal opportunity cost of investing in the stock, becoming an FHLB member would be beneficial regardless of any other effect of membership. If the dividend rate is lower than the cost of investing, then the bank may not join or may weigh the other benefits of membership prior to making its decision. After joining, a higher dividend rate may offset the cost of advances, although there is no marginal link between stock holding and borrowing, in most cases. Conversely, districts with relatively generous payouts may expect a smaller percentage of banks to take out advances, if the dividends were the primary reason for joining. Hence, the dividend rate should be directly related to the membership decision, but is ambiguously related to the borrowing decision.

FHLB membership and advances may affect bank risk in important ways. Once a member, a bank can potentially use FHLB funds to manage exposure to interest rate and liquidity risks. The ready availability of non-deposit funds may also affect incentives to bear credit risks. *Interest rate risk* is the possibility of a change in cost of funds (market interest rate) without a matching change in rates charged on outstanding loans held in portfolio (fixed-rate loans). This risk is

often measured using shock tests, duration information on bank assets and liabilities, or differences in the repricing intervals of assets and liabilities. While imperfect, interest rate risk is measured using the differences in repricing intervals (maturity gaps), which are reported to the FDIC and are readily available.

A wide maturity gap implies that the maturity on assets (loans and investments) held in portfolio differ significantly from the maturity on liabilities (deposits and other sources of funds). These mismatched maturities indicate higher interest rate risk, since movements in market interest rates may cause wide variations in net interest income[3]. Long-term maturity gaps are used since they reflect the risk incurred to make long-term loans, but not short-term liquidity risks. On average, long-term assets held in commercial bank portfolios have been increasing as a percentage of total assets, accompanied by a greater reliance on short-term, volatile funding sources (Feldman and Schmidt, 2000b; Puwalski, 2000). Obtaining membership in the FHLB System gives member banks the potential to finance long-term loans with longer-term liabilities via the use of advances, reducing interest rate risk, and stabilizing returns. Therefore, the relationships between both membership and use of advances with measures of interest rate risk are expected to be positive.

Liquidity risk arises when banks must meet obligations of deposit withdrawals and when banks want to take advantage of profitable opportunities that the existing liability base cannot support. Liquidity risk is measured using loan-to-core deposit ratios, since core deposits are stable and relatively insensitive to interest rate changes. A high loan-to-core deposit ratio may indicate that the bank is 'loaned-up', and so represents high liquidity risk.

Liquidity allows banks to remain active in difficult lending environments, such as rural areas, where seasonal mismatches in loan demand and deposits create funding problems for agricultural banks and the less diversified nature and isolation of rural economies makes diversification of loan portfolios difficult. FHLBs provide member banks with an alternative source of readily available liquidity on standardized and attractive terms. Therefore, membership in the System

[3] Note that maturity gaps are intended to measure interest rate risk, not profitability, which we control for using the net interest margin.

and the use of FHLB advances may be more attractive to those agricultural banks with high loan-to-core deposit ratios.

Access to FHLB funds may also affect a bank's willingness and/or ability to take on credit risk, the possibility that loan payments may not be made on time or that loan principle may not be fully recovered in the event of default. Either situation may result in significant loan losses. Loans constitute a major portion of earning assets and generate the bulk of interest income for most banks. A bank with a relatively high level of credit risk, as measured by percentage of non-performing loans to total loans--a common measure of loan portfolio quality--may find raising funds (especially uninsured liabilities) increasingly difficult. During the 1980s, FHLB advances enabled risky thrifts to continue operating, though ultimately at great cost to taxpayers. A positive relationship between banks that seek membership and, especially that use advances, and their credit risk, may support the concerns expressed by the FDIC with respect to possible unintended adverse consequences for bank safety and soundness from FHLB activities.

Based on the above discussion, a reduced-form equation is developed to test whether risk and return characteristics of agricultural banks affect decisions to join the FHLBs and to use System advances. Variables are also included to capture an agricultural bank's total asset size and its affiliation with a bank holding company (BHC). BHC affiliation may be important because it indicates an alternative to FHLB advances—namely, the internal capital market among BHC affiliates (Houston and James, 1998). Smaller banks and banks unaffiliated with BHCs may have fewer funding options. Alternatively, BHC affiliation may indicate a more sophisticated operation and one that can spread any fixed costs of seeking FHLB membership or learning how to profitably use FHLB advances over a larger asset base.

Estimation Approach and Data

For each year from 1994 through 1998, probit regressions test whether factors related to returns or risk are associated with nonmember agricultural banks attaining FHLB membership in a given year, and, separately, whether these factors are associated with the decisions of member agricultural banks to use advances. The univariate probit model[4] is

$$z_i = \beta' \mathbf{x_i} + \varepsilon_i$$
$$y_i = 1 \text{ if } z_i > 0$$
$$y_i = 0 \text{ if } z_i \leq 0$$
$$\varepsilon_i \sim N(0,1)$$

where z_i is an unobserved, latent variable with the threshold level set at zero, and y_i is a binary variable indicating whether the event (joining an FHLB or taking out advances) has occurred. Bank characteristics discussed in the previous section are the explanatory variables $\mathbf{x_i}$, which includes measures of returns (the *Net Interest Margin*, the FHLB *Dividend Rate*), *Interest Rate Risk* (the long-term maturity gap), *Liquidity Risk* (the loan-to-core-deposit ratio), *Credit Risk* (the nonperforming-to-total-loans ratio), and other bank characteristics (the *Size of Bank* and *BHC Affiliation*). The minimum membership eligibility requirements are also included in the decision-to-join specification, since banks can change their portfolios and balance sheets to ultimately meet these requirements.

Explanatory variables were constructed from balance sheet and income statement from the FDIC's year-end Reports of Condition and Income (Call Reports) and reflect conditions at the beginning of each decision period (that is, they are measured as of the end of the preceding calendar year or lagged one year). Dependent variables indicating which agricultural banks have joined their district FHLB and which have taken out advances are taken from the membership database maintained by the FHFB. The period of analysis runs from 1994 through 1998 due to the limited availability and consistency of maturity gap data[5,6].

[4] The univariate model assumes the joining and borrowing decisions are made independently, which is a valid assumption since the market is dynamic and is continuously changing over time.
[5] Refer to Table 1, footnote b.
[6] Farm income as measured by net cash income (NCI) and net farm income (NFI) varied considerably during this period, being strong in 1996 and 1997 and weaker in 1994 and 1995 when NCI and/or NFI were below their decade averages. Farm income deteriorated again in 1998. Federal farm program and emergency payments mitigate the adverse impact of farm income fluctuations on the credit risk of agricultural bank loan portfolios.

A commercial bank is classified as an agricultural bank if it holds at least 15 percent of its total loan portfolio in agricultural operating and agricultural real-estate loans. In any analysis year 1994 to 1998, three groups of agricultural banks exist: (1) non-members, (2) new members, or (3) existing members of the FHLB System. Banks within group 1 have not joined as of the beginning of the year and do not join during the year. Group 2 banks have not joined as of the beginning of the year, but become members within the year analyzed, and banks within group 3 are already members as of the beginning of the year. Once a bank or one of its predecessors (if the bank is formed through merger or consolidation of existing banks) has attained membership, it remains in the third group in subsequent periods.

Two mutually exclusive sets of agricultural banks can then be formed for each year. The first set contains all agricultural banks that were members of the FHLB System prior to the year of analysis (group 3 banks). For example, the existing member data set in 1994 will consist of all agricultural banks that were already members by calendar year-end 1993. The second set contains all other agricultural banks, i.e. non-members and new members (banks within groups 1 and 2). For 1994, this set consists of all agricultural banks that join in 1994, as well as the remaining banks that continue to opt against FHLB membership. The new members of 1994 are then included in the existing member set for 1995, continuing in that same fashion for all years up to 1998.

Within the year of attaining FHLB membership, it is possible that decisions by banks in the second group to join and to take out FHLB advances are simultaneous and selection bias may be an issue. On the other hand, selection bias may not be important because (1) some banks have joined for reasons other than taking out advances, such as reaping attractive dividend returns on FHLB stock, and (2) the primary motivation for other banks may be precautionary, i.e., if the need should arise, advances could be obtained with minimal effort after a bank is already a member, rather than because of immediate needs. Sample statistics indicate that, on average, less than 30 percent of agricultural banks borrow advances within one year of attaining membership. Thus, the existence of selection bias is as much an empirical issue as a theoretical issue.

If selection bias exists, the univariate probit yields inefficient but consistent estimates (Greene, 1998). A bivariate probit model[7] can jointly determine the characteristics of banks that decide to join the FHLB System and use advances within an analysis year, and so was estimated for Group 2 banks, which were omitted from the univariate probit regressions on the use of advances decision. The bivariate model can also test the robustness of the results to correlation in the errors in the membership and advances regressions. The bivariate probit model is

$z_{i1} = \beta_1' \mathbf{x_{i1}} + \varepsilon_{i1}$
$y_{i1} = 1$ if $z_{i1} > 0$
$y_{i1} = 0$ if $z_{i1} \leq 0$
$z_{i2} = \beta_2' \mathbf{x_{i2}} + \varepsilon_{i2}$
$y_{i2} = 1$ if $z_{i2} > 0$
$y_{i2} = 0$ if $z_{i2} \leq 0$
$\varepsilon_{i1}, \varepsilon_{i2} \sim$ bivariate normal $(0,0,1,1,\rho)$

where
$(y_{i1}, \mathbf{x_{i1}})$ is observed only when $y_{i2} = 1$ and
$y_{i1} = 1$ if new agricultural bank member uses advances
$= 0$ if new agricultural bank member does not use advances
$\mathbf{x_{i1}}$ = explanatory variables listed in Table 2.1, excluding the membership eligibility requirements and
$y_{i2} = 1$ if agricultural bank becomes a member
$= 0$ if agricultural bank does not become a member
$\mathbf{x_{i2}}$ = explanatory variables listed in Table 2.1

Member banks that use advances may form a non-randomly selected sample from the set of new FHLB members and so a correlation may exist between the error terms of the two equations. Including information from this correlation, ρ, can improve the efficiency of the estimates.

[7] Evaluating the bank's simultaneous decisions to join the FHLB System, a discrete decision variable, and the amount of advances to borrow, a continuous decision variable, is also of interest. The Heckman (1979) two-stage estimation procedure can be used to estimate such a model. See Appendix A for additional information.

	1994			1995		
	All	Ag banks that:		All	Ag banks that:	
Variable	**ag banks**	**Join**	**Do not join**	**ag banks**	**Join**	**Do not join**
Net interest margin	0.0441	0.0446	0.0441	0.0440	0.0443	0.0440
Dividend rate	0.0663	0.0687	0.0660	0.0672	0.0682	0.0671
Interest rate risk	0.1110	0.1291	0.1090	0.1023	0.1205	0.1010
Liquidity risk	0.6532	0.7337	0.6439	0.6702	0.7600	0.6634
Credit risk	0.0138	0.0096	0.0143	0.0155	0.0102	0.0159
Size of bank	4.4584	6.3401	4.2425	4.5726	6.9048	4.3963
BHC affiliation	0.7279	0.8665	0.7120	0.7209	0.8571	0.7106
Residential mortgage assets req.	0.6980	0.9496	0.6692	0.6682	0.9337	0.6481
Risk-based capital req.	0.9759	0.9763	0.9758	0.9720	0.9337	0.9749
Equity capital requirement	0.9997	1.0000	0.9997	0.9989	1.0000	0.9988
Domestic deposit req.	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Asset quality requirement	0.9856	1.0000	0.9840	0.9817	1.0000	0.9803
Observations	3275	337	2938	2788	196	2592

	1996			1997		
	All	Ag banks that:		All	Ag banks that:	
Variable	**ag banks**	**Join**	**Do not join**	**ag banks**	**Join**	**Do not join**
Net interest margin	0.0434	0.0436	0.0434	0.0438	0.0435	0.0438
Dividend rate	0.0669	0.0682	0.0667	0.0693	0.0704	0.0692
Interest rate risk	0.7782	0.7862	0.7775	0.8577	0.8777	0.8557
Liquidity risk	0.6814	0.7566	0.6744	0.7158	0.8163	0.7060
Credit risk	0.0171	0.0110	0.0176	0.0149	0.0118	0.0153
Size of bank	4.5817	6.8775	4.3706	4.6717	6.4370	4.4984
BHC affiliation	0.7303	0.8841	0.7161	0.7451	0.8359	0.7362
Residential mortgage assets req.	0.6705	0.9275	0.6468	0.6547	0.9385	0.6269
Risk-based capital req.	0.9654	0.9324	0.9685	0.9661	0.9487	0.9678
Equity capital requirement	0.9996	1.0000	0.9996	1.0000	1.0000	1.0000
Domestic deposit req.	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Asset quality requirement	0.9801	1.0000	0.9782	0.9844	0.9949	0.9834
Observations	2458	207	2251	2181	195	1986

	1998		
	All	Ag banks that:	
Variable	**ag banks**	**Join**	**Do not join**
Net interest margin	0.0428	0.0428	0.0428
Dividend rate	0.0678	0.0687	0.0677
Interest rate risk	0.8272	0.8502	0.8231
Liquidity risk	0.7209	0.8275	0.7018
Credit risk	0.0169	0.0120	0.0178
Size of bank	4.6928	6.0221	4.4546
BHC affiliation	0.7387	0.9088	0.7082
Residential mortgage assets req.	0.6123	0.7474	0.5881
Risk-based capital req.	0.9461	0.9228	0.9503
Equity capital requirement	1.0000	1.0000	1.0000
Domestic deposit req.	1.0000	1.0000	1.0000
Asset quality requirement	0.9787	1.0000	0.9748
Observations	1875	285	1590

Table 2.2 Sample Statistics Comparing FHLB Member Banks to Non-Member Banks

Table 2.2 displays the descriptive statistics of the data for agricultural banks that decided to join (group 2 banks) and those that decided not to join (banks in group 1) an FHLB. Agricultural banks that join in a given year have, on average, larger long-term maturity gaps, higher loan-to-core deposit ratios, higher regional dividend rates on FHLB stock, lower nonperforming loan-to-total loan ratios, are larger in size as measured by total assets, and are more likely to be affiliated with a BHC than those not seeking membership. The percentage of agricultural banks that are members in the FHLB System grew from 22.3 percent in 1994 to 48.3 percent in 1998.

Table 2.3 shows the summary statistics of the data for member agricultural banks (banks in the third group) that use and those that do not use FHLB advances. On average, member banks that use advances have larger long-term maturity gaps, higher loan-to-core deposit ratios, lower net interest margins, are larger in size, and are more likely to be affiliated with a BHC than members not borrowing from the FHLBs. The percentage of member agricultural banks with outstanding advances increased from 52.7 percent in 1994 to 66.9 percent in 1998.

Variable	1994 All ag members	1994 Ag members that: Use advances	1994 Ag members that: Do not use advances	1995 All ag members	1995 Ag members that: Use advances	1995 Ag members that: Do not use advances
Net interest margin	0.0446	0.0442	0.0455	0.0444	0.0440	0.0449
Dividend rate	0.0654	0.0650	0.0663	0.0687	0.0685	0.0690
Interest rate risk	0.1353	0.1411	0.1229	0.1319	0.1377	0.1233
Liquidity risk	0.7434	0.7603	0.7075	0.7663	0.7829	0.7419
Credit risk	0.0100	0.0097	0.0150	0.0106	0.0111	0.0099
Size of bank	7.7804	7.9371	7.4476	8.1031	8.9024	6.9330
BHC affiliation	0.8953	0.9012	0.8827	0.9008	0.9079	0.8903
Observations	506	344	162	786	467	319

Variable	1996 All ag members	1996 Ag members that: Use advances	1996 Ag members that: Do not use advances	1997 All ag members	1997 Ag members that: Use advances	1997 Ag members that: Do not use advances
Net interest margin	0.0439	0.0435	0.0446	0.0439	0.0434	0.0447
Dividend rate	0.0680	0.0680	0.0681	0.0698	0.0702	0.0691
Interest rate risk	0.7918	0.8025	0.7763	0.8702	0.8765	0.8592
Liquidity risk	0.7928	0.8085	0.7704	0.8250	0.8578	0.7684
Credit risk	0.0123	0.0125	0.0119	0.0111	0.0108	0.0117
Size of bank	8.7067	9.5574	7.4911	9.2444	10.4543	7.1598
BHC affiliation	0.8992	0.9042	0.8921	0.9191	0.9308	0.8990
Observations	923	543	380	1051	665	386

Variable	1998 All ag members	1998 Ag members that: Use advances	1998 Ag members that: Do not use advances
Net interest margin	0.0427	0.0419	0.0446
Dividend rate	0.0686	0.0688	0.0679
Interest rate risk	0.8510	0.8579	0.8335
Liquidity risk	0.8457	0.8712	0.7809
Credit risk	0.0130	0.0125	0.0142
Size of bank	9.4741	10.3644	7.2171
BHC affiliation	0.9035	0.9176	0.8676
Observations	1202	862	340

Table 2.3 Sample Statistics Comparing Member Banks that Use Advances to Non-Users

4. Estimation Results

Table 2.4 displays the univariate probit estimates for the characteristics of agricultural banks joining the FHLB System in any given year, and Table 2.5 displays similar results for agricultural bank members that borrow System advances. The number of observations is different in each year and different for the two regressions within each year. For the membership regressions, the number of observations is the number of agricultural banks that had not joined at the beginning of the year. For the borrowing regressions, the number of observations is the number of agricultural banks that joined the FHLBs by the beginning of the calendar year. The membership probit regressions have average pairwise concordance rates of 90 percent, while the FHLB-borrowing probit regressions have average pairwise concordance rates of 67 percent. For all years 1994 to 1998, the χ^2-test statistic rejects the hypothesis that the explanatory variables have no influence on the membership and use of advances decisions at the 1 percent probability level.

Membership

As seen in Table 2.4, the residential mortgage loan constraint is consistently statistically significant for agricultural banks, which indicates that agricultural banks chose not to rebalance their assets (for example, by selling Treasury securities and buying mortgage backed securities) to qualify for membership. As indicated by Feldman and Schmidt (2000a), GLB's elimination of this constraint makes almost all agricultural banks eligible to join the FHLBs. The risk-based capital constraint is weakly statistically significant and positive only for 1994. Other membership requirements were dropped from the estimated equations because few, if any, agricultural banks failed to meet them during these years.

Interest rate and liquidity risks prove to be important factors associated with the decision of agricultural banks to seek FHLB membership. As expected, the coefficients on measures of interest rate risk (the long-term maturity gap) and liquidity risk (the loan-to-core-deposit ratio) are significantly positive in the decision to join analysis, except for interest rate risk in 1996. The coefficients on the credit risk variable (the ratio of nonperforming loans to total loans) in the membership decision regression are uniformly negative and significant with respect to

membership, except for 1997. This negative relationship may reflect screening by the FHLBs or pressure from bank regulators to discourage riskier banks from seeking access to FHLB funds.

Net interest margins are only weakly related to agricultural banks seeking FHLB membership in 1994 and 1995. In FHLB regions with higher dividend rates, agricultural banks are more likely to become members, as indicated by the positive and statistically significant association of dividend rates with the decision to join an FHLB, with the exception of 1995. Larger agricultural banks and those affiliated with bank holding companies are also more likely to become members.

Variable	**1994**	**1995**	**1996**	**1997**	**1998**
Intercept	-4.1426***	-3.9261***	-4.3507***	-7.4896***	-5.8563***
	(-10.495)	(-5.872)	(-5.860)	(-7.034)	(-7.577)
Net interest margin	-7.6300*	-8.8791*	-4.4125	-6.4277	-6.9030
	(-1.610)	(-1.609)	(-0.754)	(-1.062)	(-1.380)
Dividend rate	6.1497**	10.9683	22.7028**	32.5642***	15.4136**
	(2.508)	(1.353)	(2.522)	(3.160)	(1.967)
Interest rate risk	1.0640***	1.4261***	-0.0462	1.7564**	2.0422***
	(2.828)	(2.990)	(-0.094)	(2.231)	(3.343)
Liquidity risk	1.7575***	1.9559***	1.0679***	1.6829***	2.0718***
	(7.770)	(6.879)	(4.117)	(6.402)	(9.325)
Credit risk	-6.1102***	-6.5455**	-7.2779***	-1.5391	-5.8543***
	(-2.647)	(-2.441)	(-2.872)	(-0.688)	(-2.787)
Size of bank	0.0139***	0.0075*	0.0145***	0.0190***	0.0157**
	(3.197)	(1.627)	(3.119)	(3.047)	(2.509)
BHC affiliation	0.3417***	0.3143***	0.4241***	0.1621	0.6457***
	(3.956)	(3.066)	(3.944)	(1.522)	(5.827)
Residential mortgage	0.9955***	0.8468***	0.8611***	1.0501***	0.3606***
assets requirement	(8.904)	(6.757)	(7.217)	(7.916)	(4.173)
Risk-based capital	0.3565*	-0.2902	-0.2170	0.1304	0.0087
Requirement[a]	(1.637)	(-1.464)	(-1.206)	(0.616)	(0.055)
Observations	3275	2788	2458	2181	1875
Pairwise concordance rate	89.62%	92.93%	91.50%	90.92%	84.37%
Chi-squared	286.9174***	184.9110***	172.3344***	193.0463***	223.8276***

Notes: Single, double, and triple asterisks (*) denote statistical significance at the 10,5, and 1 percent levels, respectively. Numbers in parentheses are *t*-ratios.

[a]The equity capital, asset quality, and collection of domestic deposits requirements are met by more than 98 percent of the ag banks in the sample, and so are left out of the analysis.

Table 2.4 Parameter Estimates from the Decision-to-Join the FHLBs Regressions

Advance Use

As seen in Table 2.5, interest rate and liquidity risks are also important factors associated with the decision of agricultural banks to use FHLB funding. As expected, the coefficients on measures of interest rate risk and liquidity risk are significantly positive in the decision to use advances in each year analyzed The result with respect to the loan-to-core-deposit ratio may indicate that agricultural banks are using FHLB funds to manage liquidity, fund expansion, or substitute for core deposits in their liability structures. Regulatory concerns are raised if some banks use advances to fund rapid unsafe growth, or if advances are used as an alternative to core deposits to the detriment of savers.

The coefficients on the credit risk variable in the advance use decision regression are uniformly insignificant, and fail to reject FDIC safety and soundness concerns. However, given the relatively benign business environment banks were facing during the period—few banks had significant problems associated with loan portfolio quality—strong conclusions cannot be reached.

While net interest margins are only weakly related to agricultural banks seeking FHLB membership, they are statistically significant and negatively related to the use of advances. The result on advances is consistent with the marginal cost of funds for advances being lower than deposits. The relationship between the decision to use advances and dividend rates is mixed, being positive and significant in 1997 and 1998, but negative and sometimes significant from 1994 through 1996.

Larger agricultural banks were more likely to have outstanding advances, but BHC affiliation is only significantly related to the use of advances in 1998 when the coefficient is positive. These results indicate that agricultural banks may face economies of scale in taking out advances or larger banks may be more highly leveraged and may act more aggressively. Additionally, the "internal capital market" among bank holding company affiliates—which Houston and James (1998) indicate relieves deposit constraints on bank lending—does not eliminate the attractiveness of FHLB funding.

Variable	1994	1995	1996	1997	1998
Intercept	0.3212	0.7496	-2.3077***	-3.9992***	-2.6663***
	(0.611)	(0.976)	(-3.051)	(-4.096)	(-3.255)
Net interest margin	-27.2929***	-16.8764***	-17.1223***	-30.1779***	-45.3004***
	(-3.272)	(-2.741)	(-2.938)	(-4.972)	(-7.459)
Dividend rate	-6.0901	-21.6740**	-17.1111*	24.1959***	21.1157***
	(-1.368)	(-2.182)	(-1.888)	(2.700)	(2.746)
Interest rate risk	2.3109***	1.6612***	3.6881***	2.2374***	2.0460***
	(3.052)	(2.949)	(6.040)	(2.813)	(3.096)
Liquidity risk	1.9085***	1.4431***	1.6066***	2.1925***	2.1416***
	(4.813)	(4.591)	(5.417)	(8.086)	(8.376)
Credit risk	-1.7703	4.5812	4.0016	-0.6507	-0.2449
	(-0.433)	(1.340)	(1.526)	(-0.227)	(-0.104)
Size of bank	-0.0001	0.0171**	0.0094***	0.2031***	0.0170***
	(-0.011)	(2.603)	(2.741)	(4.129)	(3.597)
BHC affiliation	0.0770	0.0797	0.05136	0.1076	0.2686**
	(0.6917)	(0.514)	(0.361)	(0.718)	(2.005)
Observations	506	786	923	1051	1202
Pairwise concordance rate	67.39%	61.71%	63.81%	68.60%	74.21%
Chi-squared	33.6260***	45.5807***	70.2294***	139.0778***	175.2032***

Notes: Single, double, and triple asterisks (*) denote statistical significance at the 10,5, and 1 percent levels, respectively. Numbers in parentheses are *t*-ratios.

Table 2.5 Parameter Estimates from the Decision-to-Use FHLB Advances Regressions

Robustness Considerations

Results from the bivariate model evaluating only newly joined banks are displayed in Table 2.6. Evidence of selection bias was revealed only in 1994, when the correlation coefficient between the errors in the membership and advances regressions, ρ, was statistically significant. Otherwise, the membership and advance use decisions were not statistically related for this group. The second stage of the bivariate model showed little ability to distinguish banks that use advances from those that do not, which is most likely due to the small numbers of new members that borrow in each year, and the variety of motivations agricultural banks have for seeking membership. The univariate results on agricultural banks that joined in some earlier period indicate that higher interest rate risk, higher liquidity risk, and lower earnings are positively related to the decision to take out advances for all years. The bivariate results also suggest that interest rate risk and liquidity risk are positively related to advance use, and lower net interest margins are significantly related to advance use.

Variable[a]	Parameter Estimates				
	1994	*1995*	*1996*	*1997*	*1998*
Membership					
Intercept	-4.2211***	-3.9365***	-4.3480***	-7.4886***	-5.8086***
	(-10.040)	(-5.215)	(-5.483)	(-6.338)	(-7.320)
BHC Affiliation	0.3440***	0.3146***	0.4239***	0.1621	0.6444***
	(3.788)	(2.984)	(3.830)	(1.475)	(5.676)
Credit Risk	-6.0888**	-6.5455*	-7.2714**	-1.5382	-5.8977**
	(-2.358)	(-1.958)	(-2.466)	(-0.619)	(-2.427)
Dividend Rate	6.0603**	10.9414	22.7237**	32.5683***	15.2289*
	(2.499)	(1.220)	(2.436)	(3.108)	(1.779)
Interest Rate Risk	1.0675***	1.4246***	-0.0451	1.7565*	2.0551***
	(2.646)	(2.835)	(-0.082)	(1.943)	(3.479)
Liquidity Risk	1.7704***	1.9573***	1.0663***	1.6831***	2.0652***
	(7.556)	(6.117)	(4.039)	(6.186)	(10.966)
Net Interest Margin	-7.6049	-8.8560	-4.4200	-6.4375	-6.8451
	(-1.477)	(-1.582)	(-0.666)	(-1.068)	(-1.408)
Size of Bank	0.0142***	0.0076*	0.0145***	0.0190***	0.0156***
	(5.289)	(1.756)	(5.103)	(3.052)	(2.945)
Risk-Based Capital Req	0.4443*	-0.2807	-0.2203	0.1293	-0.0230
	(1.896)	(-1.393)	(-1.227)	(0.642)	(-0.149)
Residential Mortgage Loans Req[b]	0.9842***	0.8481***	0.8610***	1.0501***	0.3604***
	(8.127)	(6.409)	(6.841)	(7.333)	(3.988)
Use of Advances					
Intercept	-2.3397***	-3.8159	-0.5272	-3.9291	-3.4408
	(-3.141)	(-1.252)	(-0.159)	(-1.093)	(-1.266)
BHC Affiliation	0.0660	0.0315	0.2752	0.2294	0.4780
	(0.349)	(0.095)	(0.623)	(0.794)	(1.378)
Credit Risk	-3.8598	2.5306	-3.1653	-3.5991	-4.8784
	(-0.729)	(0.284)	(-0.380)	(-0.505)	(-0.895)
Dividend Rate	4.5702	14.4090	-64.4770**	30.2256	-25.0303
	(0.925)	(0.588)	(-2.230)	(1.101)	(-1.272)
Interest Rate Risk	1.3355*	3.5196**	3.9422**	1.7934	4.0710***
	(1.866)	(2.087)	(2.261)	(0.793)	(3.292)
Liquidity Risk	1.7180***	1.7954	1.1352	1.3361*	1.4958
	(3.681)	(1.207)	(1.334)	(1.650)	(1.900*)
Net Interest Margin	-24.3602**	-0.6107	-11.1160	-29.0789*	-14.2669
	(-2.517)	(-0.047)	(-0.701)	(-1.923)	(-1.459)
Size of Bank	0.0086	0.0441*	0.0061	0.0139	0.0023
	(0.755)	(1.697)	(0.328)	(0.742)	(0.157)
N observations	3275	2788	2458	2181	1875
Log Likelihood Function	-1140.429	-713.7660	-736.0981	-678.3754	-875.6459
rho (1,2)	0.6578***	-0.1644	-0.1421	0.0319	0.4594

Notes: Single, double, and triple asterisks (*) denote statistical significance at the 10, 5, and 1 percent levels, respectively. Numbers in parentheses are *t*-ratios.

[a] Refer to Table 1 for variable descriptions.

[b] See Table 2.4, footnote a.

Table 2.6 Parameter Estimates for the Simultaneous Decisions to Join the FHLBs and to Use System Advances

As was seen in Table 2.4, the coefficients on measures of net interest margin and credit risk are consistently negative, while the coefficients on the dividend rate, the size of the bank, BHC affiliation, the residential mortgage asset requirement, and liquidity risk variables are consistently positive in the membership decision regression. From Table 2.5, the coefficient on net interest margin continues to be consistently negative in the use of advances regression, while the coefficients on the liquidity risk and BHC affiliation variables continue to be consistently positive. Additionally, the coefficient on the interest rate risk variable is consistently positive in the advance use regression. The consistency in the signs of these coefficients adds a measure of robustness to the study.

5. Summary

Probit models are used to assess the characteristics associated with agricultural banks that attain Federal Home Loan Bank (FHLB) membership, and once members, borrow funds from the FHLBs for the years 1994 through 1998. Risk and return factors are found to be important for explaining which agricultural banks join the FHLBs and which agricultural member banks use System advances after joining. In particular, the decisions of agricultural banks to join are associated with a mixture of higher interest rate risk (measured by larger long-term asset-liability maturity gaps), higher liquidity risk (proxied by higher loan-to-core deposit ratios), higher dividend payouts on FHLB stock, and lower credit risk (measured by lower nonperforming loans-to-total loans ratios). Bank asset size and affiliation with a bank holding company (BHC) are also positively related to attaining FHLB membership.

The pre-Gramm-Leach-Bliley (GLB) Act of 1999 requirement that at least ten percent of bank assets be related to residential mortgages has been a significant deterrent to agricultural bank membership, despite the apparent ability of almost all agricultural banks to meet this requirement by swapping government securities for securities issued by Fannie Mae or Freddie Mac. Other membership requirements have not been consistently statistically significant during the sample period.

The decisions of agricultural banks to use FHLB funds are associated with lower net interest margins, as well as most of the factors associated with attaining membership. Variables that are consistently statistically significant in the membership regressions but not in the borrowing regressions include BHC affiliation and credit risk. The insignificance of the credit risk variable may reflect the well-secured position of the FHLBs and support FDIC concerns about the safety and soundness implications of FHLB funding for commercial banks. Alternatively, this result may reflect the relatively healthy state of banks during the estimation period.

As a non-deposit funding alternative, FHLB advances provide agricultural banks with a stable source of lower-cost funds and access to liquidity and interest rate risk management tools. Therefore, the above results are expected to remain relevant in the post-GLB banking environment. However, GLB loosens FHLB membership requirements, and expands the

purposes for which advances may be used and the types of collateral that may be pledged against advances, with respect to small banks (defined as those with less than $500 million in assets). Since GLB targets FHLB activity toward farm and small business lending and makes these loans eligible collateral to support FHLB advances, FHLB membership may become more attractive for agricultural banks. Additionally, agricultural banks that found prior membership eligibility requirements binding will be eligible to attain FHLB membership under GLB. Potential safety and soundness problems associated with the expected increase in FHLB funding will have to be monitored by bank regulators and supervisors.

A fundamental assumption of the GLB expansion of FHLB access for small banks is that such access will induce banks to make more loans for the specified purposes—supporting farms, small business, and rural development. There are many possible avenues for further research with respect to FHLB financing for agricultural and rural banks. Of great interest is how these banks change their funding and lending decisions in response to the new FHLB authorities. Such decisions have implications for rural depositors, eligible rural borrowers, and competing lenders including insurance companies and the Farm Credit System. Another area of interest to the FHLBs and the FDIC is how member banks set the levels of advances to use and under what conditions advances pose a risk to safety and soundness.