CHAPTER 3

COMMERCIAL BANK PERFORMANCE UNDER THE
FEDERAL HOME LOAN BANK SYSTEM

Introduction

Commercial banks operate with the purpose of earning returns without assuming excessive risk. A potential means with which to assist in achieving this objective is through membership in the Federal Home Loan Bank (FHLB) System. The FHLBs provide loanable funds to qualified members, secured by acceptable collateral. These low-cost funds, called advances, can be used to enhance bank liquidity and potentially contribute to the management of interest rate risk by better matching the maturities and cash flows of assets and liabilities held in bank portfolios. In turn, net interest margins are less volatile and returns are more stable (Barry and Ellinger, 1997). Conversely, although legislation specifies the types of loans for which advances are to be used, the fungibility of money may allow banks to use advances for non-eligible assets, so long as the required collateral is maintained, which may further increase the risk profile of the bank.

Are the potential benefits of the FHLB program realized after a bank joins and uses System funds, or do FHLB lending practices enable rather than deter risk-taking? This chapter assesses the effects of the FHLB System on commercial bank performance and behavior by evaluating whether membership and advance use influence bank profitability levels, exposure to interest rate risk, bank liquidity positions, and the credit quality and composition of bank loan portfolios. Specifically, the following hypotheses will be tested:

1. H_0: Commercial bank participation in the FHLB System is positively related to lending, particularly with respect to mortgage-related investments.
2. H_0: Commercial bank profitability is positively associated with participation in the FHLB System.
3. H_0: FHLB participation reduces member bank exposure to interest rate risk.
4. H_0: FHLB participation alleviates bank liquidity constraints.
5. H_0: FHLB participation has an indeterminate effect on credit quality.

Fixed-effects models of FHLB participation are estimated using a panel data set of performance measures for all commercial banks and for the subset of banks that are FHLB System members. Section 1 discusses the current conditions of the banking industry and some concerns associated with bank participation in the FHLB System. Section 2 presents the specifications of the fixed- and random-effects models, and describes the hypotheses to be tested and the independent variables used to measure bank and FHLB member bank performance. The data and its sources and limitations are discussed in Section 3, followed by the presentation of results in Section 4. Section 5 concludes with a summary.

1. Concerns Associated with FHLB Membership

Safety and soundness, credit quality, and other risk-related concerns emerge due to the involvement of the FHLB System in the thrift debacle of the 1980s. Previous research showed riskier thrift institutions used advances during this time period and moral hazard behavior was responsible for a significant portion of losses incurred by savings and loan associations (S&Ls) (Ashley et al., 1998). Boyd (1999) described the allowance of bankrupt S&Ls to continue operation as a 'government induced, moral hazard in banking'.

The use of advances by commercial banks and advances as a percentage of bank liabilities have increased each year since banks became eligible for membership in 1990. Since the rate charged on FHLB advances is flat and fixed, FHLB members are able to grow without paying a risk premium on System borrowings (Stojanvic et al., 2000). Bank members can also potentially increase their risk profiles, while retaining a comparative advantage in loan origination, by using safe assets (loans) as collateral for System advances. Finally, even though advances must be well-collateralized, deposit insurance funds remain at risk if advances are provided to troubled members since FHLB liens have priority over other security interests, such as insured deposits, on the assets of failed insured institutions. Senator Phil Gramm (R-TX) of the Senate Banking Committee has expressed increasing concern over this subordinated position of the insurance fund during the contemporaneous expansion of the level of advances borrowed, leading to the Committee's recent request for a comprehensive study of the workings of the FHLB System by the Government Accounting Office (ICBA, 2002).

Banks have increasingly become more resilient to sectoral economic problems due to increased portfolio and geographical diversification. The economic expansion of the late 1990s enabled record or near record profit levels but fueled market and financial risks by increasing the leverage position of borrowers as well as banks[1]. This growing indebtedness has made the banking industry more susceptible to rising rates and increases the risk profiles of banks due to rapid growths in securities portfolios, which may further increase the risk to deposit insurance

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[1] Financial leverage represents the use of debt or fixed income securities, as opposed to equity, in financing assets. Taking note that bank return-on-equity (net income/average equity) is equal to the product of return-on-assets (net income/average assets) and financial leverage (average assets/average equity), banks earning low returns-on-assets can increase return-to-equity ratios by generating more debt.

funds. Further, the Federal Deposit Insurance Corporation (FDIC), taxpayers, and the banking industry will ultimately pay any costs if the government rescues the FHLB System in a crisis. Coupled with the under-priced and fixed rate characteristics of deposit insurance, which provides incentives for insured institutions to increase the value of shareholder equity by investing in assets that shifts risks onto the insurer (Brewer, 1995), FDIC officials remain concerned with whether FHLB lending policies are enabling rather than deterring risk-taking by FHLB System members.

Based on previous research on commercial banks and the FHLB System, relatively larger and riskier banks, as characterized by lower profitability, higher levels of interest rate and liquidity risks, and their less diversified and more isolated rural locales, were more likely to seek FHLB membership and/or use System advances as a source of funding (Collender and Frizell, 2002; Dolan, 2000; Dolan and Collender, 2000 and 2001). Given that potentially riskier commercial banks find the FHLB program attractive, does FHLB participation induce or discourage additional risk-taking behavior subsequent to obtaining membership or to using System funds? This research evaluates the effects of commercial bank participation in the FHLB System by assessing the changes in an individual bank's behavior following membership attainment and the borrowing of advances.

2. The Models and Hypotheses

Panel, or longitudinal, data incorporates both the cross-sectional, reflecting long-run behavior, and time-series, emphasizing short-run effects, information of the available data. Compared to a pure cross-section or time-series, panel data contains more observations to produce more reliable parameter estimates. Efficiency is improved since explanatory variables that vary across time and cross-sections are less likely to be highly correlated, thereby generating data that displays less multi-collinearity (Kennedy, 1998; Greene, 1993; Dielman, 1989).

Typically, as is the case for the current data, panel data sets are characterized by many cross-sectional units followed over a relatively small number of time periods (wide but short data). Time effects are viewed as discrete changes of state and are modeled to be specific to the period within which they occur and are not carried across periods within a cross-sectional unit[2]. Therefore, panel data sets are oriented toward cross-section analysis, focusing on the heterogeneity across units and evaluating the outcome of different effects on different cross-sectional units. When conducting empirical analyses, the failure to account for this individual heterogeneity causes misspecification problems.

The basic model of heterogeneity is

$$y_{it} = \alpha + \beta' x_{it} + \varepsilon_{it} \qquad i = 1, \ldots, N; t = 1, \ldots, T; K \text{ regressors in } x_{it}.$$

The one-way error component model for disturbances is characterized by an overall intercept and a 2-part error term, $\varepsilon_{it} = u_i + v_{it}$, where u_i represents the time invariant, unobservable individual specific effect associated with bank i that are not included in the regression and signifies the extent to which the intercept of the ith bank differs from the overall intercept specific to each observation in the panel, and v_{it} represents the usual error term that varies across observations.

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[2] Autocorrelated models have been developed for panel data sets. See Greene (1993).

If $u_i = u$ for all i, then ordinary least squares estimation yields consistent and efficient estimates of $\alpha' = (\alpha + u)$ and β. If there exists differences across units, i.e. $u_i \neq u$ for all i, then a common assumption is that these differences can be captured by differences in the intercept and so are viewed as parametric shifts of the regression function. Each u_i is then an unknown parameter to be estimated and varies across banks, but the behavior of all banks with common characteristics is assumed to be the same, generating fixed and identical regression coefficients[3].

The fixed-effects model, or least squares dummy variable (LSDV) model, assumes u_i are fixed parameters to be estimated. The usual error term, v_{it}, remains stochastic and independently and identically distributed, and the x_{it} are assumed independent of v_{it}, for all i and t. Dummy variables are included to indicate the ith cross-sectional unit (Kennedy, 1998; Greene, 1993) where their coefficients measure the shifts of the regression function due to unknown individual unit-specific differences. The FEM uses each cross-section as a control for itself when evaluating changes in behavior and is the appropriate specification when the focus is solely on the units in the sample and inference is restricted to the behavior of these included units (i.e. inference is restricted to the effects in the model). Therefore, FEMs are appropriate if the population is sampled exhaustively or the main objective is to predict individual units' behaviors. For example, Focarelli, et al. (1999) and Panetta (1999) utilize the FEM to evaluate Italian bank performance changes after a merger.

On the other hand, the individual specific effect, u_i, can be characterized as random. Inference then pertains to the population from which the sample was randomly drawn, where the population can consist of an infinity of banks or an infinity of decisions an individual bank can make with respect to the value of y (Mátyás and Sevestre, 1992). This reformulation is known as the random-effects model (REM), under the assumptions of the u_i and the v_{it} both stochastic and independently and identically distributed, the u_i are independent of the v_{it}, and the x_{it} are

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[3] Alternatively, firms with similar characteristics may not have fixed and identical regression coefficients and the variation between coefficients can represent the effects of various explanatory variables on the demand for membership and advances for different banks, say for banks located in different regions. Therefore, the parameters to be estimated may not be the same for every observation, requiring the use of the random-coefficients model (RCM). The RCM requires OLS estimation for each individual bank, therefore, necessitating the total number of time periods in the data set to exceed the number of parameters to be estimated, i.e. $T \geq K$. Since the data used here does not meet this requirement, with the maximum number of time periods being 9 years, alternative models were considered. See Appendix B for further discussion on the RCM.

independent of u_i and v_{it}, for all i and t. The generalized least squares random-effects estimator (b1) is a matrix-weighted average of the between- and fixed-effects results, incorporating both the cross-section (the between-effects) and the time-series (or fixed-effects) information in a data set. Hence, b1 says an increase of an explanatory variable (X1) by one unit will increase the dependent variable (y) by b1, whether 2 different banks are observed with a one-unit difference in X1 between them (between-effects), or the same bank is observed whose X1 value increases by one unit (fixed-effects).

The REM is preferred over the FEM when the data set contains a large number of cross-sectional units and a small number of time periods, such as the panel data set used here, since the REM saves on degrees of freedom with the assumption of a random u_i. Unlike the FEM, inferences can be made about a population of effects from which those in the data are considered to be a random sample, for example, inferring differences in non-member bank behavior from that of a member bank, or a non-advance user to a member that uses advances. The effects of time-invariant variables, such as the FHLB district location variable, can also be estimated with the use of the REM.

One limiting assumption of the REM is that the random error associated with each cross-section, u_i (the unobserved individual effect), is uncorrelated with the other regressors, x_{it}. This is unlikely if an explanatory variable that affects the intercept has been omitted from the regression and if the omitted variable is correlated with an existing explanatory variable. Modeling as a REM will then create a correlation between the error and the existing regressor, generating a biased and inconsistent estimator for β. Under the null hypothesis of no correlation between u_i and the explanatory variables x_{it} implies the REM is appropriate and its estimated generalized least squares (EGLS) estimate is consistent and efficient. If a correlation exists, this estimate is inconsistent due to omitted variables. The OLS estimate of β obtained from the FEM is consistent whether or not there exists a correlation because the within transformation wipes out these individual effects. Therefore, Hausman's (1978) specification test compares the REM estimator with the within-effects estimator to determine whether the REM is appropriate. The chi-squared test statistic is used to test whether the difference between the variance-covariance matrices of the OLS and EGLS estimates is zero (Kennedy, 1998; Baltagi, 1995).

<u>Hypotheses</u>

Each hypothesis with respect to the effects of commercial bank participation in the FHLB program is presented below, followed by descriptions of the variables used to measure various aspects of bank performance[4], bank- and market-specific control variables, and measures controlling for existing economic conditions.

1. *H_0: Commercial bank participation in the FHLB System is positively related to lending, particularly with respect to mortgage-related investments.*

The mission of the FHLB System is to support residential mortgage lending and other related community investment by providing loanable funds, called advances, to its member institutions. Hence, the effect of FHLB membership and advance use on the percentage of total assets invested in mortgage-related assets (MRAs) is evaluated to determine whether this mission is maintained. MRAs consist of all loans secured by residential properties and mortgage-backed and pass-through securities guaranteed by Ginnie Mae or issued by Fannie Mae and Freddie Mac. Membership attainment should have a positive effect on MRA investment since the minimum membership eligibility requirements must be met. Additionally, a positive relationship is expected between FHLB advance use and bank MRA-to-asset ratios if the original System mission has been upheld.

The principle assets held by commercial banks, especially those classified as small, are securities and loans. On average, loans yield greater returns due to the higher risk associated with them and the informational investment related to making the loan. Historically, high loan-to-asset ratios have been significant indicators of bank failure (Fraser and Fraser, 1990), and a study conducted on bank failures of the 1990s found a one-percent increase in loan-to-asset ratios generated a 3.3 percent higher probability of failure (Anderlik and Walser, 1999). A bank with a more aggressive lending strategy would find membership in an FHLB attractive, since System advances can be used as a source of funding for loans. Therefore, a positive relationship between advance use and loan-to-assets ratios is expected if a member bank using System advances as a source of funds increases loans held in portfolio.

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[4] These variables and ratios of financial performance are those most commonly cited in the literature. See Feldman and Schmidt, 2000a; ABA, 2001; Barth et al., 1992; and Fraser and Fraser, 1990.

The fungibility of money may allow banks to use advances toward funding non-mortgage-related assets. Therefore, various loan types are evaluated, each as a percentage of total assets, to determine whether advances are used as intended to finance real estate lending, or whether System funds are used toward other investments. The loan types evaluated are business (commercial and industrial), small business (commercial and industrial loans not exceeding $1 million) and agricultural loans (loans to finance agricultural production and loans to farmers).

2. *H_0: Commercial bank profitability is positively associated with participation in the FHLB System.*

The FHLB System may directly affect a bank's expected returns without the acquiescence of additional risk. 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 deposit-taking networks (Hartzog et al., 1990). Therefore, advances may be less costly than core deposits, at the margin, and can positively affect bank returns directly. Additionally, FHLB stock, which member banks are required to purchase, are safe investments with relatively attractive returns.

The two most common measures of bank performance and profitability are return-on-average assets (ROAA) and return-on-average equity (ROAE) ratios. ROAA is defined to be the ratio of net income (net profit after taxes) to average total assets, and is an overall measure of how efficiently a firm uses its assets to generate profits. Ceteris paribus, ROAA ratios should be positively related to FHLB membership, if System stock generates significant returns, and to FHLB advance use, if advances do in fact operate at lower costs to members than alternative funding options. Finally, since advance use should increase member loan-to-asset ratios through increased investment in residential mortgage lending and loans generate higher yields than other assets held in portfolio, ROAA should be directly related to a higher proportion of the asset portfolio invested in loans and indirectly associated with the level of advances borrowed. Historically, ROAA has been a leading indicator of bank failure, along with loan-to-asset ratios, where relatively lower ROAAs indicate relatively weaker financial conditions and potentially riskier business practices.

ROAE is equal to net income divided by average stockholders' equity[5] and measures a bank's ability to generate profits relative to shareholder capital. Since advances are offered at a flat, fixed rate for all members and no additional equity capital need be raised against them, ROAE can improve with the use of FHLB funds. For example, a bank earning low ROAAs can maintain or improve ROAE ratios by generating more debt through the use of System advances, thereby appeasing shareholders at the expense of an increase in the overall risk profile of the bank.

3. *H_0: FHLB participation reduces member bank exposure to interest rate risk.*
Improving the management of interest rate risk is a major motivation in finding alternatives to deposit sources of funds for commercial banks (Barry and Ellinger, 1997). Interest rate risk refers to the risk attributable to a change in interest rates (i.e. the potential for changes in interest rates to affect bank earnings and net worth). For example, funding long-term, fixed-rate assets with short-term, and/or floating-rate liabilities in a rising-rate environment will generate significant interest rate risk. Therefore, interest rate risk may be high if mismatched maturities exist between assets and liabilities, and will depend on the interest-rate sensitive asset and liability structures of the bank.

Rate-sensitive assets and rate-sensitive liabilities[6] have interest rates or costs changing (repriceable) within a time period, such as variable-rate securities or securities maturing within the period. The GAP is defined to be the difference between the volume of rate-sensitive assets and the volume of rate-sensitive liabilities (the difference between the dollar values of assets and liabilities that will mature or can be repriced), and the GAP ratio is rate-sensitive assets divided by rate-sensitive liabilities. When the GAP is greater than zero, the GAP ratio is greater than one and profits increase (decrease) when short-term rates increase (decrease). The change in profits

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[5] ROAA and ROAE may increase because of an improvement in profit efficiency associated with membership, where quantities of outputs and inputs are altered for a given vector of input and output prices (change in quantity given prices), or an increase in market power associated with membership (change in prices for a given efficiency level), allowing the prices of bank products to be made less favorable for consumers. These two sources of profitability changes cannot be disentangled without a profit efficiency analysis (Akhavein, et al., 1997).
[6] Rate-sensitive assets include short-term securities, federal funds sold, the expected principal payments on loans, and the outstanding principal on all variable-rate loans. Rate-sensitive liabilities are jumbo certificate of deposits (CDs) maturing within one year, federal funds purchased, negotiable order of withdrawal (NOW) accounts, and money market deposit accounts (MMDA).

is measured by the change in net interest income, defined to be the product of the GAP and the change in the short-term rate. If the GAP is negative, then the corresponding GAP ratio is less than one and profits increase (decrease) when rates decrease (increase). Banks will pay higher rates on all repriceable liabilities while earning higher yields on all repriceable assets, but interest expenses are higher than the interest income generated since more liabilities are repriced when short-term rates increase during some time bucket, so net interest income and margins will decrease. A GAP of zero generates a GAP ratio of one and profit (net interest income) remains unchanged regardless of rate changes, so the bank is fully hedged with no associated risk with changes in interest rates. The GAP model implies that a bank can minimize interest rate risk by maintaining a zero GAP or a GAP ratio of one (Koch, 1988).

Data on the duration of outstanding assets and liabilities are unavailable from Call Reports and are difficult to obtain otherwise. Therefore, interest rate risk is measured by long-term asset-liability maturity gaps, scaled by total assets, and indicates differences in repricing intervals between assets and liabilities held in bank portfolios. Although imperfect, the maturity gap approach is widely used in the research literature. A wide long-term maturity gap implies that the maturity on long-term assets held in portfolio differ significantly from the maturity on long-term liabilities. These mismatched maturities lead to higher interest rate risk, since movements in market rates may cause wide variations in net interest income or net worth.

On the one hand, membership may add to the already increasing percentage of long-term assets held in commercial banks portfolios, since residential mortgages and mortgage-related securities typically have longer maturity periods (Feldman and Schmidt, 2000b; Puwalski, 2000). A positive association between membership and maturity gaps should result if members fund mortgage-related assets with short-term, volatile funding sources, such as purchased federal funds, time deposits in excess of $100,000, or short-term FHLB advances. However, membership in the FHLB System gives banks the ability to finance long-term loans with longer-term liabilities, via the use of advances with longer maturities, which can stabilize returns and reduce interest rate risk. The use of longer-term advances will generate a negative relationship with asset-liability maturity gaps.

4. *H_0: FHLB participation alleviates bank liquidity constraints.*

Small banks, banks located in rural areas, and banks unaffiliated with holding companies[7], are perceived to have relatively limited funding options, potentially producing binding liquidity constraints. Sufficient liquidity is required for all banks to meet withdrawal obligations, to undertake profitable opportunities as they arise, and to remain active in difficult lending environments, such as rural areas, where seasonal mismatches in loan demand and deposits may create potential funding problems.

Deposits are an important source of liquidity for banks, especially core deposits[8] due to their stability and relative low interest-rate sensitivity. 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). The growth of deposits, especially core deposits, has been slow relative to loan demand during the 1990s. Loan growth surpassed deposit growth in the majority of all small banks, which generated annual increases in bank loan-to-deposit ratios (Keeton, 1998). By the end of the decade, total assets expanded faster than deposits, a 6.3 percent growth rate versus 3.9 percent, indicating that banks effectively responded to deposit growth, or liquidity, constraints by utilizing alternatives, such as equity, advances, and other borrowings[9], when deposits were insufficient in satisfying loan demand. In 1993, only 42 percent of all small banks held over 10 percent of total liabilities in non-core deposits, increasing to 75 percent by second quarter 1998 (Puwalski and Kenner, 1999).

Loan-to-core deposit ratios are used to measure relative liquidity. FHLB System membership provides an alternative source of funding for member institutions through the extension of advances, and liquidity is further increased when members pledge qualifying loans as collateral for System advances. Hence, higher loan-to-core deposit ratios indicate low-cost, non-core deposit funding options, such as FHLB advances, are used to fund increasing loan demand.

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[7] Bank holding company affiliates may enjoy access to internally generated capital markets (see Houston and James, 1998).

[8] Core deposits are comprised of demand deposits, money market deposit accounts, some time and savings deposits, and transaction accounts.

[9] Borrowings are comprised of demand notes, federal funds purchased, repurchase agreements, time deposits in excess of $100,000, foreign deposits, and brokered deposits.

5. *H_0: FHLB participation has an indeterminate effect on credit quality.*

While loans make up a great portion of earning assets and generate the majority of interest income for commercial banks, they also carry the highest default rate and are illiquid (Ashley, et al., 1998; Brewer, 1995). The quality and status of loans extended have historically been some of the most common reasons for bank failures, and the emphasis on credit quality and the management of credit risk has increased due to the significant loan losses of the 1980s (Fraser and Fraser, 1990).

The quality of a bank's loan portfolio is measured by the ratio of non-performing loans to total loan holdings and net charge-offs as a percentage of average assets. Loans are classified as non-performing if they are 90 or more days past due or if they are in non-accrual status (not accruing interest due to doubtful repayment of principal and interest). Net charge-offs are loans written off as non-collectable less loan recoveries. FHLB members experiencing earnings pressure may increase loan-to-asset ratios by extending credit to marginal borrowers or undertaking riskier endeavors by borrowing System advances, in an attempt to generate higher returns, which may result in increasing loan losses through defaults or non-payments. Conversely, a bank suffering from binding funding constraints may join an FHLB and use System advances to fund those profitable lending opportunities that previously could not be undertaken. Therefore, FHLB participation has an indeterminate effect on the quality of a member bank's loan portfolio.

<u>Model Specification</u>

Each of the above performance measures, *y*, are regressed against various explanatory variables controlling for bank- and market-specific characteristics and existing economic conditions:

$$y = \alpha + \sum_{j=1}^{k} \beta_j B_j + \sum_{j=k+1}^{l} \beta_j M_j + \sum_{j=l+1}^{m} \beta_j E_j + \varepsilon$$

where individual- and time-specific indices, *i* and *t*, are removed to simplify notation, and B_j, M_j, and E_j represent the vectors of bank-specific characteristics, market structure controls, and measures of economic conditions, respectively.

The bank-specific controls, B_j, fall into 4 broad categories: 1) risk attitude, 2) bank health, 3) sources of funds, and 4) uses of funds, where the performance or behavior to be evaluated, *y*, will determine which bank-specific controls to include. Risk attitudes are proxied by bank size (total assets), the growth rate of a bank (the percentage change in total assets from the previous year), and capital-to-asset ratios. Smaller banks tend to have less diversified loan portfolios and deposit bases. Banks with more aggressive growth strategies are considered more risky due to a possible 'bet big, win big' mentality, thereby undertaking risky, yet potentially highly profitable investments. Finally, capital levels may reflect a bank manager's preference for return versus risk. A more risk-averse bank manager may choose to fund loans with a higher proportion of capital to liabilities (i.e. deposits or other sources of funding) than a risk-neutral or risk-seeking manager (Hughes and Mester, 1994).

The second group of bank-specific characteristics includes variables controlling for bank health. Capital ratios can simultaneously control for bank risk attitude as well as for a bank's ability to withstand risk[10]. Credit and liquidity risks are both related to the role of capital in preventing financial distress by providing both a cushion for loan losses and a source of loanable funds. Anderlik and Walser (1999) found higher capital ratios to be the most significant factor

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[10] As bank scale increases, so does loan portfolio and deposit base diversification. Therefore, the same degree of protection against financial distress can be attained at the lower capital ratios, since managing risk and protecting capital can be accomplished with relatively fewer resources (Hughes and Mester, 1998).

preventing bank failures. The returns-on-assets ratio controls for the bank's ability to generate earnings, and non-performing loan-to-total loan ratios control for portfolio credit quality.

Competing sources of loanable funds are available, including capital, core deposits, other borrowings such as federal funds and repurchase agreements, capital generated by the internal markets associated with bank-holding company affiliation, and increased access to capital markets due to merger participation. Capital may be the preferred marginal funding source for a risk-averse bank, and capital ratios may also indicate a bank's willingness or ability to increase lending and can control for the possible influence of capital regulation. Core deposits as a percentage of total assets have, on average, been on the decline, indicating that a positive and significant result for core deposits could indicate that bank-lending markets are constrained by a lack of funds (Craig and Thomson, 2001). At the margin, other borrowings may be less expensive than raising additional deposits, such as FHLB advances, discussed in further detail below. Small banks affiliated with bank-holding companies may be relatively less liquidity constrained due to internal capital markets, and may behave more like large banks (Jayaratne and Wolken, 1999).

The final group of bank-specific variables control for the competing uses of funds available to banks. The various loan types include real estate loans (relating to the primary mission of the System), small business loans (ongoing concerns are related to available and affordable funding for small business purposes), business loans (all commercial and industrial loans), and agricultural loans. The percent of funds exported into the federal funds market may indicate low demand for loans, since funds are not being used for lending opportunities. Loan loss provision-to-asset ratios, used to control for bank lending propensity, since loan loss experiences may encourage the extension of more loans to make up for past losses (Pilloff, 1999).

The correlation between bank performance and market structure, M_j, is controlled by the use of two location-specific measures. A regional location dummy indicates whether the local market where the bank is headquartered is classified as a metropolitan-statistical area or a rural county. The isolated nature of rural markets may make these areas less contestable and the supply of credit may be more constrained in less competitive markets. The Herfindahl-Hirschman Index

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(HHI) of market deposit concentration, a widely used measure of market structure, controls for the competitive conditions in the bank's primary market. Finally, existing economic conditions, E_j, influence bank performance by altering the demand for credit or the quality of outstanding loans. The change in local market population and levels of per capita income for a bank's primary market are included to control for these contributions.

Four sets of regressions are run for every performance measure. The initial two regressions evaluate the effect of membership attainment and the use of advances on performance, given the structure of the market and economic conditions. In the membership equation, a dummy variable captures the membership status of a bank. Likewise, within the advance use equation, a dummy variable classifies the member as an advance user or non-user. In addition, variables controlling for the level of advances borrowed, as a percentage of total assets, and the accumulated number of membership years are included to the advance use equation. Performance may differ greatly between various levels of advance use indebtedness, while participation may require increasing experience with the advance use program, due to potential learning curve effects associated with the use of the various FHLB products.

The remaining two regressions include various interaction variables to further dissect the results found in the initial regressions. Members and advance users classified as small, affiliated with a bank-holding company, located in highly concentrated or unconcentrated markets [11], and located in markets experiencing population loss, are evaluated by these additional interaction variables. Continued concern exists over the performance and ability of small banks to compete in the banking industry, the focus of the most recent financial modernization legislation. Small banks affiliated with bank-holding companies may overcome the potential constraints associated with a small-size status, and the effect of FHLB participation may vary significantly across various market types. FHLB district interaction dummy variables capture effects of factors common to members and advance users located in the same district, since lending and FHLB activities are likely to vary across regions.

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[11] The Department of Justice characterizes markets with Herfindahl indices in excess of 1800 as highly concentrated and less than 1000 as unconcentrated. Berger & Hannan (1994) also use this definition when they analyzed the efficiency cost of market power in the banking industry.

3. Data

A panel of time-series, cross-sectional data on measures of bank- and local banking market-specific characteristics is constructed from various sources. The FDIC provides 1) the income statement and balance sheet data from commercial bank Consolidated Reports of Condition and Income (Call Reports) to create the aforementioned performance measures and additional control variables, and 2) the share of local deposits controlled by a bank in the Summary of Deposits data, used to compute the HHI for deposit markets. Data pertaining to FHLB membership is obtained from the Federal Housing Finance Board, and the Bureau of Economic Analysis supplies the data on market population and personal incomes to calculate per capita income and growth in local markets.

The panel is unbalanced where some individual banking units are not observed over the entire sample period because of mergers, acquisitions, new entry, and failure, and is limited to the years 1991 to 1999, due to the availability and duration of the data. Legislation permitted commercial bank membership to the FHLB System by 1990, but consistent Call Report data begins in 1991. Although the Call Reports are available through year-end 2001, the available membership data stops in 2000 and obtainable BEA data ends in 1999.

Sample Statistics

Tables 3.1 through 3.12 contain the summary statistics of the data associated with various subsets of the commercial banks in the sample. Table 3.1 shows the descriptive statistics for the entire 9-year sample. The sample's average bank size is considered small at $450 million in total assets, but banks grew at an average rate of 13 percent a year. About 36 percent of the sample are FHLB members with a mean of 3.7 membership years, of which, 58 percent of the members have outstanding advances averaged at 3 percent of total assets. Average capital ratios are at 10 percent, while 56.5 percent of assets are invested in loans (5.7 percent in agricultural loans, 9.7 percent in commercial & industrial loans, 5.6 percent in small business loans, 8.7 percent in loans to individuals, and 31.3 percent in real estate loans) and over 5 percent are sold into the federal funds market, on average. Mortgage-related assets comprised approximately 21 percent of total assets. Banks during the sample period were earning 4.5 percent net interest margins, almost a 1-percent return-on-average assets, and 10.7 percent in returns-on-average equity, while experiencing 1.4 percent of loans in non-performing status and net charge-offs at 34 basis points, on average. Long-term asset and liability maturity gaps were collectively less than 20 percent of total assets and average total loans doubled the level of core deposits held by these banks.

Explanatory Variables	n	mean	std dev	min	max
n=97,039 unless otherwise noted					
Bank-Specific					
Total Assets [a]		449503.60	5880505.5	793.00	584284000
Bank Growth Rate	95698	0.1278	4.4135	-0.9967	1352.42
Small Bank Dummy Variable		0.9370	0.2429	0.0000	1.0000
Capital-to-Asset Ratio		0.1002	0.0487	-0.0751	0.9908
Loan Loss Provision-to-Asset Ratio	97038	0.0026	0.0056	-0.1857	0.5128
Core Deposit-to-Asset Ratio	95997	0.7668	0.1009	0.0000	6.0379
Other Borrowed Money-to-Asset Ratio		0.0285	0.0571	0.0000	0.9465
Use of other Borrowed Money Dummy Variable		0.5432	0.4981	0.0000	1.0000
Bank Holding Company Affiliation Dummy Variable		0.8388	0.3678	0.0000	1.0000
Merger-Involvement Dummy Variable		0.0354	0.1847	0.0000	1.0000
Federal Funds sold-to-Asset Ratio		0.0507	0.0655	0.0000	0.9798
Exporter of Funds Dummy Variable		0.8281	0.3773	0.0000	1.0000
Mortgage Related Assets-to-Asset Ratio		0.2100	0.1303	0.0000	0.9812
Loan-to-Asset Ratio		0.5651	0.1498	0.0001	1.1332
Agricultural Loans-to-Total Assets		0.0570	0.0885	0.0000	0.7361
Commercial & Industrial Loans-to-Total Assets		0.0972	0.0730	0.0000	0.9423
Small Business Loans-to-Total Assets [b]	71311	0.0555	0.0667	0.0000	3.0163
Household Loans-to-Total Assets		0.0871	0.0684	0.0000	0.9488
Real Estate Loan-to-Total Assets		0.3125	0.1475	0.0000	0.9604
Net Interest Margin [c]	63357	0.0453	0.0104	-0.0342	0.4763
Return-on-Assets	97038	0.0099	0.0217	-1.4615	5.0510
Return-on-Equity		0.1070	0.6784	-200.28	16.7692
Nonperforming Loans-to-Total Loan Ratio		0.0136	0.0216	0.0000	0.8653
Net Chargeoffs-to-Average Asset Ratio	97012	0.0034	0.0167	-3.5000	2.3143
Asset/Liability Maturity Gap-to-Asset Ratio [d]	87711	0.1963	0.1474	-0.3309	0.8649
Loan-to-Core Deposit Ratio	95989	1.0042	54.1491	0.0000	16596.12
Market-Specific					
HHI of Local Market Deposit Concentration	96127	2401.36	1526.83	484.91	10000
Percentage Change in Local Market Population [e]	87978	0.0081	0.0146	-0.1692	0.2345
Local Market Per Capita Income [e]	87978	20713.49	6292.36	6043	81665
Bank Located in Rural Area Dummy Variable		0.5583	0.4966	0.0000	1.0000

Table 3.1 Sample Statistics for the Panel of Commercial Banks, 1991-1999

Explanatory Variables	n	mean	std dev	min	max
n=97,039 unless otherwise noted					
FHLB System-Specific					
FHLB Member Dummy Variable		0.3578	0.4794	0.0000	1.0000
District 1-Boston		0.0157	0.1243	0.0000	1.0000
District 2-New York		0.0247	0.1553	0.0000	1.0000
District 3-Pittsburgh		0.0377	0.1904	0.0000	1.0000
District 4-Atlanta		0.1304	0.3368	0.0000	1.0000
District 5-Cincinnati		0.0773	0.2671	0.0000	1.0000
District 6-Indianapolis		0.0406	0.1974	0.0000	1.0000
District 7-Chicago		0.1278	0.3339	0.0000	1.0000
District 8-Des Moines		0.1746	0.3796	0.0000	1.0000
District 9-Dallas		0.1546	0.3616	0.0000	1.0000
District 10-Topeka		0.1399	0.3469	0.0000	1.0000
District 11-San Francisco		0.0404	0.1969	0.0000	1.0000
District 12-Seattle		0.0361	0.1865	0.0000	1.0000
FHLB Member-Specific	34719				
Advance Use Dummy Variable		0.5790	0.4937	0.0000	1.0000
Oustanding Advances [a]		16581.29	144160.41	0.0000	6650540
Advance-to-Asset Ratio		0.0296	0.1719	0.0000	30.8480
Advance Use During the First Year of Membership Dummy		0.0623	0.2418	0.0000	1.0000
Number of Member Years		3.6990	2.8018	0.0000	68.0000
Member for over 3 Years Dummy		0.4552	0.4980	0.0000	1.0000

Notes: a in thousands

b Small business loan data begins in 1993, collected in the June Call Reports.

c Data on held-to-maturity and available-for-sale securities does not exist prior to 1994.

d Data on long-term liabilities does not exist for 1996.

Table 3.1 Entire Sample, continued

Tables 3.2 and 3.3 exhibit the sample statistics for year-end 1991, the first year in the analysis, and year-end 1999, the final year of the time period to be evaluated, respectively. Average bank size in 1991 was $282 million in total assets, growing 130 percent to $646 million in 1999, most likely due to the massive consolidation occurring within the financial services industry during the 1990s. Average capital ratios increased from 8.9 percent in 1991 to 10.6 percent in 1999, potentially due to changing capital requirements. FHLB membership grew from 3.8 percent to almost 63 percent of all banks sampled, with advance use more than doubling from 30.5 percent to 69 percent of total bank members. Average total loans increased as a percentage of core

deposits from just under 70 percent to almost 95 percent, demonstrating the use of non-core deposit sources, such as FHLB advances, to fund loans.

Explanatory Variables	n	mean	std dev	min	max
n=11,677 unless otherwise noted					
Bank-Specific					
Total Assets[a]		281868	2608605	793	162682000
Bank Growth Rate	11561	0.2032	12.5821	-0.9251	1352.4200
Small Bank Dummy Variable		0.9496	0.2187	0.0000	1.0000
Capital-to-Asset Ratio		0.0893	0.0410	-0.0751	0.9891
Loan Loss Provision-to-Asset Ratio	11676	0.0044	0.0084	-0.1857	0.2149
Core Deposit-to-Asset Ratio	11580	0.7952	0.0953	0.0000	2.4113
Other Borrowed Money-to-Asset Ratio		0.0159	0.0446	0.0000	0.9114
Use of other Borrowed Money Dummy Variable		0.4355	0.4958	0.0000	1.0000
Bank Holding Company Affiliation Dummy Variable		0.8523	0.3548	0.0000	1.0000
Merger-Involvement Dummy Variable		0.0342	0.1817	0.0000	1.0000
Federal funds sold-to-Asset Ratio		0.0586	0.0658	0.0000	0.9456
Exporter of Funds Dummy Variable		0.8924	0.3098	0.0000	1.0000
Mortgage Related Assets-to-Asset Ratio		0.1538	0.1040	0.0000	0.8315
Loan-to-Asset Ratio		0.5286	0.1512	0.0001	1.1332
Agricultural Loans-to-Total Assets		0.0549	0.0863	0.0000	0.5966
Commercial & Industrial Loans-to-Total Assets		0.0970	0.0755	0.0000	0.7503
Small Business Loans-to-Total Assets[b]	10377	0.0424	0.0576	0.0000	0.6384
Household Loans-to-Total Assets		0.0939	0.0708	0.0000	0.9304
Real Estate Loans-to-Total Assets		0.2701	0.1390	0.0000	0.8661
Net Interest Margin[c]	10250	0.0464	0.0094	-0.0213	0.1961
Return-on-Assets		0.0068	0.0123	-0.2210	0.1394
Return-on-Equity		0.0719	0.5004	-32.6720	16.7692
Nonperforming Loans-to-Total Loan Ratio		0.0218	0.0302	0.0000	0.8653
Net chargeoffs-to-Average Asset Ratio	11672	0.0068	0.0148	-0.1085	0.7593
Asset/Liability Maturity Gap-to-Asset Ratio		0.1379	0.1059	-0.0145	0.7328
Loan-to-Core Deposit Ratio	11580	0.6963	1.3195	0.0000	99.5814
Market-Specific					
HHI of Local Market Deposit Concentration	11566	2371.69	1587.88	484.91	10000
Percentage Change in Local Market Population	11553	0.0075	0.0141	-0.0664	0.1098
Local Market Per Capita Income	11553	17603.22	4723.38	6043	48993
Bank Located in Rural Area Dummy Variable		0.5610	0.4963	0.0000	1.0000

Table 3.2 Sample Statistics for the Panel of Commercial Banks, year-end 1991

Explanatory Variables	n	mean	std dev	min	max
n=11,677 unless otherwise noted					
FHLB System-Specific					
FHLB Member Dummy Variable		0.0379	0.4619	0.0000	1.0000
District 1-Boston		0.0180	0.1171	0.0000	1.0000
District 2-New York		0.0250	0.1630	0.0000	1.0000
District 3-Pittsburgh		0.0407	0.1827	0.0000	1.0000
District 4-Atlanta		0.1250	0.3451	0.0000	1.0000
District 5-Cincinnati		0.0722	0.2680	0.0000	1.0000
District 6-Indianapolis		0.0433	0.1942	0.0000	1.0000
District 7-Chicago		0.1298	0.3323	0.0000	1.0000
District 8-Des Moines		0.1671	0.3855	0.0000	1.0000
District 9-Dallas		0.1552	0.3539	0.0000	1.0000
District 10-Topeka		0.1452	0.3429	0.0000	1.0000
District 11-San Francisco		0.0403	0.1991	0.0000	1.0000
District 12-Seattle		0.0365	0.1918	0.0000	1.0000
FHLB Member-Specific	442				
Advance Use Dummy Variable		0.3054	0.4678	0.0000	1.0000
Outstanding advances [a]		4091.29	236028	0.0000	275000
Advance-to-Asset Ratio		0.0112	0.0533	0.0000	0.2038
Advance Use During the First Year of Membership Dummy		0.2240	0.1848	0.0000	1.0000

Notes: *a*   in thousands.

b Small business loan data begins in 1993.

c NIM containing held-to-maturity and available-for-sale security values begin in 1994.

Table 3.2 Year-end 1991, continued

The average percentage of assets invested in loans increased from 53 percent to 60.6 percent, represented as increases in assets devoted to loan types such as small business (4.24 to 6.5 percent), all business (9.7 to 10.7 percent), and real estate (27 to 35.3 percent) loans, at the expense of individual and other loan types not evaluated here. The average quality of loan portfolios generally improve, with non-performing loans decreasing as a percentage of total loans from 2.2 percent to 99 basis points, and net charge-offs dropping from 68 to 27 basis points, indicative of the general positive conditions in the economy during the 1990s. Fewer funds are being exported into the federal funds market, decreasing as a average percentage of total assets from almost 6 percent to just over 4 percent, possibly due to increasing demand for loans or the emergence of additional profitable lending opportunities. Mortgage-related assets

consume a heftier portion of total assets, increasing from an average of 15.4 percent in 1991 to 23.5 percent in 1999.

Explanatory Variables	n	mean	std dev	min	max
n=8390, unless otherwise noted					
Bank-Specific					
Total Assets[a]		646062	9296341	1239	571732000
Bank Growth Rate	8158	0.1188	0.3090	-0.7663	7.7188
Small Bank Dummy Variable		0.9236	0.2657	0.0000	1.0000
Capital-to-Asset Ratio		0.1057	0.0620	-0.0150	0.9908
Loan Loss Provision-to-Asset Ratio		0.0024	0.0043	-0.0225	0.1027
Core Deposit-to-Asset Ratio	8226	0.7231	0.1059	0.0000	2.7718
Other Borrowed Money-to-Asset Ratio		0.0487	0.0723	0.0000	0.8150
Use of other Borrowed Money Dummy Variable		0.6741	0.4687	0.0000	1.0000
Bank Holding Company Affiliation Dummy Variable		0.8160	0.3875	0.0000	1.0000
Merger-Involvement Dummy Variable		0.0341	0.1815	0.0000	1.0000
Federal funds sold-to-Asset Ratio		0.0403	0.0688	0.0000	0.9512
Exporter of Funds Dummy Variable		0.7262	0.4459	0.0000	1.0000
Mortgage Related Assets-to-Asset Ratio		0.2353	0.1332	0.0000	0.9100
Loan-to-Asset Ratio		0.6061	0.1474	0.0001	0.9875
Agricultural Loans-to-Total Assets		0.0549	0.0864	0.0000	0.6566
Commercial & Industrial Loans-to-Total Assets		0.1067	0.0788	0.0000	0.9423
Small Business Loans-to-Total Assets[b]	8062	0.0647	0.0696	0.0000	0.5933
Household Loans-to-Total Assets		0.0803	0.0657	0.0000	0.9198
Real Estate Loans-to-Total Assets		0.3531	0.1525	0.0000	0.9604
Net Interest Margin		0.0436	0.0099	0.0000	0.2745
Return-on-Assets		0.0092	0.0143	-0.3814	0.4392
Return-on-Equity		0.1064	0.1090	-2.3527	2.2767
Nonperforming Loans-to-Total Loan Ratio		0.0099	0.0160	0.0000	0.3272
Net chargeoffs-to-Average Asset Ratio	8389	0.0027	0.0123	-0.0512	0.7948
Asset/Liability Maturity Gap-to-Asset Ratio[d]		0.3318	0.1501	-0.3071	0.8222
Loan-to-Core Deposit Ratio	8225	0.9465	5.2574	0.0000	456.2857
Market-Specific					
HHI of Local Market Deposit Concentration	8337	2367.75	1489.65	704.39	10000
Percentage Change in Local Market Population[e]	8330	0.0057	0.0144	-0.0867	0.2279
Local Market Per Capita Income[e]	8330	24991.05	7694.88	8588	81665
Bank Located in Rural Area Dummy Variable		0.5570	0.4963	0.0000	1.0000

Table 3.3 Sample Statistics for the Panel of Commercial Banks, year-end 1999

Explanatory Variables	n	mean	std dev	min	max
n=8390, unless otherwise noted					
FHLB System-Specific					
FHLB Member Dummy Variable		0.6261	0.4839	0.0000	1.0000
District 1-Boston		0.0145	0.1197	0.0000	1.0000
District 2-New York		0.0257	0.1584	0.0000	1.0000
District 3-Pittsburgh		0.0355	0.1851	0.0000	1.0000
District 4-Atlanta		0.1354	0.3422	0.0000	1.0000
District 5-Cincinnati		0.0787	0.2692	0.0000	1.0000
District 6-Indianapolis		0.0391	0.1938	0.0000	1.0000
District 7-Chicago		0.1265	0.3324	0.0000	1.0000
District 8-Des Moines		0.1788	0.3832	0.0000	1.0000
District 9-Dallas		0.1490	0.3561	0.0000	1.0000
District 10-Topeka		0.1389	0.3458	0.0000	1.0000
District 11-San Francisco		0.0416	0.1997	0.0000	1.0000
District 12-Seattle		0.0377	0.1904	0.0000	1.0000
FHLB Member-Specific	5253				
Advance Use Dummy Variable		0.6897	0.4627	0.0000	1.0000
Outstanding advances [a]		26600	198269	0.0000	6650540
Advance-to-Asset Ratio		0.0424	0.0537	0.0000	0.5799
Advance Use During the First Year of Membership Dummy		0.0455	0.2084	0.0000	1.0000

Notes: *a* in thousands.

b Small business loan data is collected annually in the June Call Reports.

Table 3.3 Year-end 1999, continued

Average net interest margins drop 28 basis points over the 9 years from 4.64 percent to 4.36 percent. Mean returns-on-assets increase by 35 percent, from 68 to 92 basis points, and returns-on-equity rise from 7.2 to 10.6 percent. Long-term asset and liability maturity gaps were collectively almost 20 percent more in 1999 than in 1991, increasing from 13.8 to 33.2 percent of total assets, indicating an increase in average interest rate risk over the sample period. Local bank market concentration remained stable, as measured by the Herfindahl index of market deposit concentration.

Small banks, also known as community financial institutions, are defined as commercial banks with total assets not exceeding $500 million. The remaining sample banks are grouped together and are called the large banks. Tables 3.4 and 3.5 compare the mean values of these small and large banks, respectively, over the 9-year sample period.

Explanatory Variables	n	mean	std dev	min	max
n=90,928 unless otherwise noted					
Bank-Specific					
Total Assets [a]		87580.89	87911.46	793.00	499996
Bank Growth Rate	89630	0.1033	0.4073	-0.9967	71.1964
Capital-to-Asset Ratio		0.1014	0.0496	-0.0751	0.9908
Loan Loss Provision-to-Asset Ratio		0.0025	0.0056	-0.1857	0.5128
Core Deposit-to-Asset Ratio	89922	0.7729	0.0925	0.0000	6.0379
Other Borrowed Money-to-Asset Ratio		0.0227	0.0462	0.0000	0.9050
Use of other Borrowed Money Dummy Variable		0.5145	0.4998	0.0000	1.0000
Bank Holding Company Affiliation Dummy Variable		0.8302	0.3755	0.0000	1.0000
Merger-Involvement Dummy Variable		0.0217	0.1458	0.0000	1.0000
Federal Funds sold-to-Asset Ratio		0.0515	0.0657	0.0000	0.9798
Exporter of Funds Dummy Variable		0.8304	0.3753	0.0000	1.0000
Mortgage Related Assets-to-Asset Ratio		0.2067	0.1278	0.0000	0.9233
Loan-to-Asset Ratio		0.5617	0.1494	0.0001	1.1332
Agricultural Loans-to-Total Assets		0.0604	0.0904	0.0000	0.7361
Commercial & Industrial Loans-to-Total Assets		0.0947	0.0711	0.0000	0.9423
Small Business Loans-to-Total Assets [b]	66397	0.0554	0.0683	0.0000	3.0163
Household Loans-to-Total Assets		0.0860	0.0665	0.0000	0.9488
Real Estate Loan-to-Total Assets		0.3111	0.1472	0.0000	0.9604
Net Interest Margin [c]	59005	0.0454	0.0103	-0.0342	0.4763
Return-on-Assets		0.0098	0.0223	-1.4615	5.0510
Return-on-Equity		0.1046	0.6986	-200.2807	16.7692
Nonperforming Loans-to-Total Loan Ratio		0.0137	0.0218	0.0000	0.8654
Net Chargeoffs-to-Average Asset Ratio	90903	0.0033	0.0171	-3.5000	2.3143
Asset/Liability Maturity Gap-to-Asset Ratio [d]	82212	0.1927	0.1462	-0.3309	0.8454
Loan-to-Core Deposit Ratio	89917	0.7737	7.0914	0.0000	2065.52
Market-Specific					
HHI of Local Market Deposit Concentration	90195	2442.87	1549.33	484.9126	10000
Percentage Change in Local Market Population [e]	82640	0.0082	0.0148	-0.1692	0.2345
Local Market Per Capita Income [e]	82640	20323.61	5845.41	6043.00	81665.00
Bank Located in Rural Area Dummy Variable		0.5904	0.4918	0.0000	1.0000

Table 3.4 Sample Statistics for Panel of Small Banks, 1991-1999

Explanatory Variables	n	mean	std dev	min	max
n=90,928 unless otherwise noted					
FHLB System-Specific					
FHLB Member Dummy Variable		0.2750	0.4762	0.0000	1.0000
District 1-Boston		0.0136	0.1157	0.0000	1.0000
District 2-New York		0.0197	0.1388	0.0000	1.0000
District 3-Pittsburgh		0.0348	0.1832	0.0000	1.0000
District 4-Atlanta		0.1276	0.3337	0.0000	1.0000
District 5-Cincinnati		0.0763	0.2654	0.0000	1.0000
District 6-Indianapolis		0.0391	0.1938	0.0000	1.0000
District 7-Chicago		0.1295	0.3357	0.0000	1.0000
District 8-Des Moines		0.1822	0.3860	0.0000	1.0000
District 9-Dallas		0.1584	0.3651	0.0000	1.0000
District 10-Topeka		0.1465	0.3536	0.0000	1.0000
District 11-San Francisco		0.0371	0.1889	0.0000	1.0000
District 12-Seattle		0.0354	0.1847	0.0000	1.0000
FHLB Member-Specific	31591				
Advance Use Dummy Variable		0.5593	0.4965	0.0000	1.0000
Oustanding Advances [a]		3597	20532	0.0000	3332764
Advance-to-Asset Ratio		0.0269	0.0443	0.0000	2.5542
Advance Use During the First Year of Membership Dummy		0.0623	0.2417	0.0000	1.0000

Notes: * Less than $500 million in total assets.

a in thousands

b Small business loan data begins in 1993.

c Data on held-to-maturity and available-for-sale securities does not exist prior to 1994.

d Data on long-term liabilities does not exist for 1996.

e Data from the Bureau of Economic Analysis is available through 1999.

Table 3.4 Small banks, continued

Average small bank assets are $88 million, compared to average assets of $5.8 billion for the large bank subgroup. Growth rates for large banks exceed those of the small by almost 40 percent. The majority of small banks are located in rural counties, whereas only 8 percent of all large banks are located outside of metropolitan-statistical areas. Over one-half of all large banks are FHLB members compared to 27.5 percent of the small bank population. Additionally, a larger proportion of large members, 78 percent versus 56 percent, use advances, and large banks hold 5.7 percent of their assets in advances, surpassing the 2.7 percent average holdings of small members.

Explanatory Variables	n	mean	std dev	min	max
n=6111 unless otherwise noted					
Bank-Specific					
Total Assets [a]		5834696	22762466	500074	584284000
Bank Growth Rate	6068	0.4896	17.4544	-0.7599	1352.42
Capital-to-Asset Ratio		0.0824	0.0278	-0.0571	0.8788
Loan Loss Provision-to-Asset Ratio	6110	0.0034	0.0061	-0.0225	0.2149
Core Deposit-to-Asset Ratio	6075	0.6759	0.1591	0.0000	1.7972
Other Borrowed Money-to-Asset Ratio		0.1149	0.1098	0.0000	0.9465
Use of other Borrowed Money Dummy Variable		0.9694	0.1722	0.0000	1.0000
Bank Holding Company Affiliation Dummy Variable		0.9665	0.1801	0.0000	1.0000
Merger-Involvement Dummy Variable		0.2384	0.4262	0.0000	1.0000
Federal Funds sold-to-Asset Ratio		0.0375	0.0617	0.0000	0.8534
Exporter of Funds Dummy Variable		0.7946	0.4040	0.0000	1.0000
Mortgage Related Assets-to-Asset Ratio		0.2588	0.1542	0.0000	0.9812
Loan-to-Asset Ratio		0.6149	0.1464	0.0008	0.9908
Agricultural Loans-to-Total Assets		0.0071	0.0172	0.0000	0.2383
Commercial & Industrial Loans-to-Total Assets		0.1345	0.0896	0.0000	0.8884
Small Business Loans-to-Total Assets [b]	4914	0.0567	0.0405	0.0000	0.4728
Household Loans-to-Total Assets		0.1042	0.0913	0.0000	0.9397
Real Estate Loan-to-Total Assets		0.3334	0.1509	0.0000	0.9483
Net Interest Margin [c]	4352	0.0441	0.0115	0.0000	0.1858
Return-on-Assets	6110	0.0112	0.0103	-0.1393	0.4392
Return-on-Equity		0.1419	0.2157	-12.1901	4.0000
Nonperforming Loans-to-Total Loan Ratio		0.0130	0.0194	0.0000	0.6408
Net Chargeoffs-to-Average Asset Ratio	6109	0.0051	0.0880	-0.2241	0.1737
Asset/Liability Maturity Gap-to-Asset Ratio [d]	5499	0.2493	0.1560	-0.2996	0.8649
Loan-to-Core Deposit Ratio	6072	4.4175	213.5468	0.0000	16596.12
Market-Specific					
HHI of Local Market Deposit Concentration	5932	1770.22	924.45	484.91	7660.94
Percentage Change in Local Market Population [e]	5338	0.0071	0.0114	-0.0388	0.0760
Local Market Per Capita Income [e]	5338	26749	0.2816	9907	81665
Bank Located in Rural Area Dummy Variable		0.0813	0.2734	0.0000	1.0000

Table 3.5 Sample Statistics for Panel of Large Banks, 1991-1999

Explanatory Variables	n	mean	std dev	min	max
n=6111 unless otherwise noted					
FHLB System-Specific					
FHLB Member Dummy Variable		0.5119	0.4999	0.0000	1.0000
District 1-Boston		0.0475	0.2126	0.0000	1.0000
District 2-New York		0.1003	0.3004	0.0000	1.0000
District 3-Pittsburgh		0.0810	0.2729	0.0000	1.0000
District 4-Atlanta		0.1721	0.3775	0.0000	1.0000
District 5-Cincinnati		0.0926	0.2899	0.0000	1.0000
District 6-Indianapolis		0.0632	0.2433	0.0000	1.0000
District 7-Chicago		0.1033	0.3043	0.0000	1.0000
District 8-Des Moines		0.0614	0.2400	0.0000	1.0000
District 9-Dallas		0.0980	0.2974	0.0000	1.0000
District 10-Topeka		0.0419	0.2004	0.0000	1.0000
District 11-San Francisco		0.0902	0.2864	0.0000	1.0000
District 12-Seattle		0.0471	0.2119	0.0000	1.0000
FHLB Member-Specific	3128				
Advance Use Dummy Variable		0.7785	0.4154	0.0000	1.0000
Oustanding Advances [a]		147715	455603	0.0000	6650540
Advance-to-Asset Ratio		0.0567	0.5544	0.0000	30.848
Advance Use During the First Year of Membership Dummy		0.0627	0.2424	0.0000	1.0000

*Notes: * At least $500 million in total assets.*

a in thousands

b Small business loan data begins in 1993.

c Data on held-to-maturity and available-for-sale securities does not exist prior to 1994.

d Data on long-term liabilities does not exist for 1996.

e Data from the Bureau of Economic Analysis is available through 1999.

Table 3.5 Large banks, continued

Small banks have higher average capital ratios and invest a smaller amount of assets in loans than large banks, potentially indicating more conservative management practices, more limited lending opportunities, binding limits-to-one borrower constraints, or the effects of their differing ownership structures. On the other hand, as scale increases, banks can attain the same degree of protection against financial distress with a lower capital ratio since loan portfolios and deposit bases have become more diversified so fewer resources (less capital) is required to manage risk (Hughes and Mester, 1998). While large banks hold, on average, more business and small business, individual, and real estate loans, as well as all types of mortgage-related assets, after scaling by bank size, small banks extend a considerably higher proportion of their assets to agricultural loans: 6 percent compared to only 76 basis points. Small banks also export a higher

percentage of their assets into the federal funds market, possibly indicating fewer lending opportunities due to smaller scale, relatively limited products, and constricted geographical reach.

On average, small banks were earning slightly higher net interest margins during this period (9 basis points higher), although returns-on-assets (98 basis points) and returns-on-equity (10.5 percent) both lagged those earned by large banks (1.12 percent and 14.2 percent, respectively). Small bank loan portfolios are of slightly better quality than those of the large with respect to net charge-offs, but are worse when measured by non-performing loan ratios. Asset/liability maturity gaps are collectively shorter for small banks, making up 19.3 percent of total assets compared to 25 percent for larger banks. Large bank loans exceed core deposit holdings by an average of 442 percent, compared to 77 percent at small banks. Finally, small banks are located in considerably more concentrated markets, with HHIs of 2443, whereas large banks are located in markets with averages of 1770[12].

Referring to Tables 3.6 and 3.7, banks located in rural counties are considerably smaller than banks in metropolitan-statistical areas (MSAs, metro areas). Rural banks average $78 million in total assets, compared to $920 million for metro banks, with over 99 percent of all rural banks classified as small. Banks located in MSAs are growing at rates two and half times as fast as rural banks. Average capital ratios are 48 basis points higher at rural banks, at 10.2 percent. Banks headquartered in MSAs contribute a greater portion of their assets to mortgage-related assets, business loans, small business loans and real estate loans, but rural banks invest more than 7 percent more of their assets in agricultural loans than metro banks.

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[12] The Department of Justice classifies markets with Herfindahl indexes in excess of 1800 as highly concentrated.

Explanatory Variables	n	mean	std dev	min	max
n=54180, unless otherwise noted					
Bank-Specific					
Total Assets [a]		77621	154000	793	9179222
Bank Growth Rate		0.0760	0.3993	-0.9823	71.1964
Small Bank Dummy Variable		0.9908	0.0953	0.0000	1.0000
Capital-to-Asset Ratio		0.1023	0.0376	-0.0170	0.9421
Loan Loss Provision-to-Asset Ratio		0.0021	0.0048	-0.0545	0.5128
Core Deposit-to-Asset Ratio	53930	0.7743	0.0811	0.0742	6.0379
Other Borrowed Money-to-Asset Ratio		0.0210	0.0409	0.0000	0.4824
Use of other Borrowed Money Dummy Variable		0.4979	0.5000	0.0000	1.0000
Bank Holding Company (BHC) Affiliation Dummy Variable		0.8530	0.3541	0.0000	1.0000
Merger-Involvement Dummy Variable		0.0209	0.1429	0.0000	1.0000
Federal funds sold-to-Asset Ratio		0.0455	0.0531	0.0000	0.8224
Exporter of Funds Dummy Variable		0.8233	0.3814	0.0000	1.0000
Mortgage Related Assets-to-Asset Ratio		0.1977	0.1255	0.0000	0.9038
Loan-to-Asset Ratio		0.5512	0.1468	0.0002	1.1097
Agricultural Loans-to-Total Assets		0.0893	0.1016	0.0000	0.7361
Commercial & Industrial Loans-to-Total Assets		0.0809	0.0553	0.0000	0.6423
Small Business Loans-to-Total Assets [b]	39671	0.0379	0.0553	0.0000	3.0163
Household Loans-to-Total Assets		0.0895	0.0589	0.0000	0.7338
Real Estate Loans-to-Total Assets		0.2827	0.1389	0.0000	0.9119
Net Interest Margin [c]	35516	0.0443	0.0090	0.0000	0.4763
Return-on-Assets		0.0110	0.0107	-1.4615	0.8190
Return-on-Equity		0.1165	0.1273	-6.4490	16.7692
Nonperforming Loans-to-Total Loan Ratio		0.0140	0.0218	0.0000	0.8108
Net chargeoffs-to-Average Asset Ratio	54177	0.0028	0.0074	-0.1226	0.3781
Asset/Liability Maturity Gap-to-Asset Ratio [d]	48925	0.1950	0.1422	-0.2076	0.8129
Loan-to-Core Deposit Ratio	53930	0.7159	0.2130	0.0000	3.5788
Market-Specific					
HHI of Local Market Deposit Concentration	54029	3097.85	1641.09	484.91	10000.00
Percentage Change in Local Market Population [e]	49465	0.0048	0.0140	-0.1692	0.2345
Local Market Per Capita Income [e]	49465	17953.96	3491.03	6043.00	59632.00

Table 3.6 Sample Statistics for Banks Located in Rural Counties, 1991-1999

Explanatory Variables	n	mean	std dev	min	max
FHLB System-Specific	54180				
FHLB Member Dummy		0.3403	0.4738	0.0000	1.0000
District 1-Boston		0.0067	0.0815	0.0000	1.0000
District 2-New York		0.0065	0.0806	0.0000	1.0000
District 3-Pittsburgh		0.0296	0.1694	0.0000	1.0000
District4-Atlanta		0.1042	0.3056	0.0000	1.0000
District 5-Cincinnati		0.0898	0.2860	0.0000	1.0000
District 6-Indianapolis		0.0401	0.1963	0.0000	1.0000
District 7-Chicago		0.1149	0.3189	0.0000	1.0000
District 8-Des Moines		0.2271	0.4190	0.0000	1.0000
District 9-Dallas		0.1605	0.3671	0.0000	1.0000
District 10-Topeka		0.1775	0.3821	0.0000	1.0000
District 11-San Francisco		0.0048	0.0691	0.0000	1.0000
District 12-Seattle		0.0385	0.1923	0.0000	1.0000
FHLB Member-Specific	18438				
Advance Use Dummy		0.5956	0.4908	0.0000	1.0000
Outstanding advances [a]		4562	29420	0.0000	3332764
Advance-to-Asset Ratio		0.0290	0.0435	0.0000	0.8375
Advance Use During the First Year of Membership Dummy		0.0689	0.2533	0.0000	1.0000

Notes : *a* in thousands.

b Small business data begins in 1993.

c Data on held-to-maturity and available-for-sale securities does not exist prior to 1994.

d Data on long-term liabilities does not exist for 1996.

e Data from the Bureau of Economic Analysis is available through 1999.

Table 3.6 Rural Banks, continued

Rural banks earn net interest margins that are 30 basis points lower than those received by metro banks, although on average, returns-on-assets are 17 basis points higher and returns-on-equity are 2.2 percent higher for banks located in rural areas. According to the percentage of loans in non-performing status, the quality of rural bank loan portfolios is 8 basis points worse than the performance of metro bank portfolios. However, the net charge-off measure suggests that the quality of rural bank loan portfolios is better than that of metro banks by 14 basis points. Rural banks have lower loan-to-core deposit ratios, averaging 71.6 percent, and are typically located in highly concentrated markets (an HHI of 3098), whereas metro banks are found in markets classified as only moderately concentrated (an HHI of 1507).

Explanatory Variables	n	mean	std dev	min	max
n=42,859 unless otherwise noted					
Bank-Specific					
Total Assets [a]		919617	8824405	1581	584284000
Bank Growth Rate	41848	0.1945	6.6582	-0.9967	1352.42
Small Bank Dummy Variable		0.8690	0.3374	0.0000	1.0000
Capital-to-Asset Ratio		0.0976	0.0598	-0.0751	0.9908
Loan Loss Provision-to-Asset Ratio	42858	0.0032	0.0065	-0.1857	0.3126
Core Deposit-to-Asset Ratio	42067	0.7571	0.1209	0.0000	2.7718
Other Borrowed Money-to-Asset Ratio		0.0379	0.0715	0.0000	0.9465
Use of other Borrowed Money Dummy Variable		0.6004	0.4898	0.0000	1.0000
Bank Holding Company Affiliation Dummy Variable		0.8208	0.3836	0.0000	1.0000
Merger-Involvement Dummy Variable		0.0537	0.2255	0.0000	1.0000
Federal Funds sold-to-Asset Ratio		0.0572	0.078	0.0000	0.9798
Exporter of Funds Dummy Variable		0.8342	0.3719	0.0000	1.0000
Mortgage Related Assets-to-Asset Ratio		0.2255	0.1344	0.0000	0.9812
Loan-to-Asset Ratio		0.5826	0.1517	0.0001	1.1332
Agricultural Loans-to-Total Assets		0.0163	0.0417	0.0000	0.5583
Commercial & Industrial Loans-to-Total Assets		0.1177	0.0863	0.0000	0.9423
Small Business Loans-to-Total Assets [b]	31640	0.0776	0.073	0.0000	0.6210
Household Loans-to-Total Assets		0.0841	0.0788	0.0000	0.9488
Real Estate Loan-to-Total Assets		0.3501	0.1496	0.0000	0.9604
Net Interest Margin [c]	27841	0.0466	0.0117	-0.0342	0.385
Return-on-Assets	42858	0.0084	0.0303	-1.3830	5.0510
Return-on-Equity		0.0950	1.0107	-200.2807	15.3469
Nonperforming Loans-to-Total Loan Ratio		0.0132	0.0214	0.0000	0.8653
Net Chargeoffs-to-Average Asset Ratio	42835	0.0042	0.0237	-3.5000	2.3143
Asset/Liability Maturity Gap-to-Asset Ratio [d]	38786	0.198	0.1537	-0.3309	0.8649
Loan-to-Core Deposit Ratio	42059	1.3739	81.8022	0.0000	16596.12
Market-Specific					
HHI of Local Market Deposit Concentration	42098	1507.48	667.1496	484.9126	10000
Percentage Change in Local Market Population [e]	38513	0.0124	0.0143	-0.0552	0.1335
Local Market Per Capita Income [e]	38513	24257.75	7242.40	9907	81665

Table 3.7 Sample Statistics for Banks Located in Metro Areas, 1991-1999

Explanatory Variables	n	mean	std dev	min	max
n=42,859 unless otherwise noted					
FHLB System-Specific					
FHLB Member Dummy Variable		0.3799	0.4854	0.0000	1.0000
District 1-Boston		0.0271	0.1623	0.0000	1.0000
District 2-New York		0.0477	0.2132	0.0000	1.0000
District 3-Pittsburgh		0.0479	0.2136	0.0000	1.0000
District 4-Atlanta		0.1635	0.3699	0.0000	1.0000
District 5-Cincinnati		0.0614	0.2401	0.0000	1.0000
District 6-Indianapolis		0.0412	0.1988	0.0000	1.0000
District 7-Chicago		0.1442	0.3513	0.0000	1.0000
District 8-Des Moines		0.1082	0.3106	0.0000	1.0000
District 9-Dallas		0.1472	0.3543	0.0000	1.0000
District 10-Topeka		0.0924	0.2897	0.0000	1.0000
District 11-San Francisco		0.0854	0.2795	0.0000	1.0000
District 12-Seattle		0.0331	0.1789	0.0000	1.0000
FHLB Member-Specific	16281				
Advance Use Dummy Variable		0.5602	0.4964	0.0000	1.0000
Oustanding Advances [a]		30193	207341	0.0000	6650540
Advance-to-Asset Ratio		0.0303	0.2467	0.0000	30.8480
Advance Use During the First Year of Membership Dummy		0.0549	0.2278	0.0000	1.0000

Notes: a in thousands

b Small business loan data begins in 1993.

c Data on held-to-maturity and available-for-sale securities does not exist prior to 1994.

d Data on long-term liabilities does not exist for 1996.

e Data from the Bureau of Economic Analysis is available through 1999.

Table 3.7 Metro Banks, continued

Tables 3.8, 3.9, 3.10, and 3.11 (see Appendix C) display the summary statistics for FHLB member banks, non-member banks, member banks with outstanding System advance balances, and member banks that do not use advances, respectively. While these statistics are interesting, the remainder of the section focuses on the discussion of Table 3.12, which compares the mean values of member bank performance before and after: a) membership attainment and b) advance use.

Explanatory Variables	Membership		Advance Use	
	Before	**After**	**Before**	**After**
N observations	27450	34719	8378	20103
Bank-Specific				
Total Assets [a]	236936	400036	200244	560317
Bank Growth Rate	0.1203	0.1418	0.1265	0.1515
Small Bank Dummy Variable	0.9616	0.9099	0.9501	0.8789
Capital-to-Asset Ratio	0.0999	0.0941	0.0958	0.0910
Loan Loss Provision-to-Asset Ratio	0.0027	0.0022	0.0022	0.0022
Core Deposit-to-Asset Ratio	0.7900	0.7412	0.7760	0.7194
Other Borrowed Money-to-Asset Ratio	0.0149	0.0508	0.0199	0.0748
Use of other Borrowed Money Dummy Variable	0.4450	0.7916	0.5439	0.9964
Bank Holding Company Affiliation Dummy Variable	0.8710	0.8987	0.8933	0.9212
Merger-Involvement Dummy Variable	0.0326	0.0481	0.0344	0.0596
Federal funds sold-to-Asset Ratio	0.0504	0.0329	0.0376	0.0251
Exporter of Funds Dummy Variable	0.8641	0.7448	0.8021	0.6886
Mortgage Related Assets-to-Asset Ratio	0.1874	0.2712	0.2600	0.2852
Loan-to-Asset Ratio	0.5547	0.6251	0.6115	0.6385
Agricultural Loans-to-Total Assets	0.0639	0.0420	0.0395	0.0444
Commercial & Industrial Loans-to-Total Assets	0.0964	0.1053	0.1046	0.1054
Small Business Loans-to-Total Assets [b]	0.0525	0.0659	0.0661	0.0659
Household Loans-to-Total Assets	0.0862	0.0846	0.0852	0.0838
Real Estate Loans-to-Total Assets	0.2975	0.3814	0.3712	0.3922
Net Interest Margin [c]	0.0456	0.0451	0.0465	0.0442
Return-on-Assets	0.0092	0.0108	0.0107	0.0111
Return-on-Equity	0.1070	0.1253	0.1222	0.1301
Nonperforming Loans-to-Total Loan Ratio	0.0147	0.0097	0.0105	0.0094
Net Chargeoffs-to-Average Asset Ratio	0.0037	0.0024	0.0025	0.0023
Asset/Liability Maturity Gap-to-Asset Ratio [d]	0.1532	0.2623	0.2156	0.2863
Loan-to-Core Deposit Ratio	0.7155	0.9281	0.8199	1.0125
Market-Specific				
HHI of Local Market Deposit Concentration	2432.91	2390.41	2380.60	2412.25
Percentage Change in Local Market Population [e]	0.0084	0.0082	0.0089	0.0075
Local Market Per Capita Income [e]	19422.89	22268.00	21815.87	22414.88
Bank Located in Rural Area Dummy Variable	0.5942	0.5311	0.5136	0.5462

Table 3.12 Comparing Summary Statistics Before and After Participation, 1991-1999

| | Membership | | Advance Use | |
	Before	After	Before	After
FHLB System-Specific				
District 1-Boston	0.0132	0.0253	0.0301	0.0262
District 2-New York	0.0191	0.0228	0.0267	0.0224
District 3-Pittsburgh	0.0297	0.0563	0.0646	0.0589
District4-Atlanta	0.1426	0.1421	0.1480	0.1331
District 5-Cincinnati	0.0770	0.1119	0.0810	0.1334
District 6-Indianapolis	0.0408	0.0552	0.0579	0.0566
District 7-Chicago	0.1319	0.1090	0.1055	0.1051
District 8-Des Moines	0.2013	0.1655	0.1609	0.1762
District 9-Dallas	0.1266	0.1262	0.1179	0.1108
District 10-Topeka	0.1453	0.1130	0.1153	0.1197
District 11-San Francisco	0.0381	0.0279	0.0351	0.0192
District 12-Seattle	0.0336	0.0466	0.0582	0.0409
FHLB Member-Specific				
Outstanding Advances	0	16581	0	28637
Advance-to-Asset Ratio	0	0.0296	0	0.0511
Advance Use During the First Year of Membership	0	0.0623	0	0.1076
Number of Member Years	0	3.6990	2.8370	4.2879
Member for over 3 Years	0	0.4552	0.2998	0.5638

Notes: *a* in thousands.

b Small business data begins in 1993.

c Data on held-to-maturity and available-for-sale securities does not exist prior to 1994.

d Data on long-term liabilities does not exist for 1996.

e Data from the Bureau of Economic Analysis is available through 1999.

Table 3.12 Sample Statistics Comparison, continued

The values in the first 2 columns of Table 3.12 are derived by evaluating the subset of just member banks. The first column pertains to member behavior prior to obtaining FHLB membership, and the second to the mean values after joining their respective FHLB. Likewise, the last 2 columns in Table 12 display the mean values of all members that ultimately borrow from the FHLB System. Column 3 exhibits the averages for these member banks prior to using advances, and column 4 are mean assessments after advance use.

Before membership attainment and advance use, member banks were considerably smaller, on average, than after joining and using System funds. Banks grew an average of 69 percent after obtaining membership and members 180 percent after borrowing advances. While financial

institutions were continuously growing during this time period, members were growing 2.2 percent faster than non-members, with an average annual growth rate of 14.2 percent, and members were growing even more rapidly after they began using advances, at a rate of 15.2 percent. Average capital ratios and core deposits, as percentages of total assets, decreased after banks became members and after members began using advances, although average loan-to-core deposit ratios rose substantially after membership attainment and advance use. These ratios indicate that additional loans were funded by non-core deposit alternatives, such as System advances.

Banks increased average percentages of assets invested in loans, particularly in business loans and real estate loans, after becoming members and further increased these shares after using advances. Membership increased the extension of small business loans by 1.4 percent, while banks extended 2.2 percent more of assets to agricultural loans prior to membership, and the eventual use of advances increased the agricultural loan share by 40 basis points. Mortgage-related assets increased as a percentage of total assets after membership, from 18.7 to 27 percent, and after advance use, from 26 to 28.5 percent. The quality of loan portfolios improved and fewer banks export funds into the federal funds market after membership attainment and advance use, which decreased the percentage of exported assets from 5 percent to 3.3 percent for eventual members, and from 3.8 percent to 2.5 percent for eventual advance users.

Average return-on-assets and return-on-equity improved with membership and advance use. Maturity gaps lengthened, due to investments in mortgage-related securities and longer-term assets, such as real estate lending. Markets containing banks that become members are less concentrated after these banks attain membership, although local markets become more concentrated after members begin using advances.

Quartile Rankings of Select Performance Measures

The FHLB members and advance users in the sample are ranked into quartiles according to various measures of bank health (see Table 3.13). The level of capital held by a bank, scaled by total assets, represents one dimension of the relative financial condition of the bank, where higher levels signify the ability to withstand risk and have historically contributed to the prevention of bank failures. FHLB members and members that use advances have the weakest presence (19 and 16 percent, respectively) in the top quartile of capital holdings, with their greatest occurrence taking place in the second to lowest quartile. This latter quartile exhibits average loan-to-asset ratios and return-on-assets at their maximum of 59.7 percent and 1.1 percent, respectively, while loan portfolio quality is at its best with an average non-performing loan-to-total loan ratio of 1.24 percent. Banks located in the bottom quartile of capital holdings have the worst performing loan portfolios with an average non-performing loan-to-total loan ratio of 1.6 percent, and generate the lowest returns-on-assets at 78 basis points.

The principle assets held by banks are securities and loans, especially by small banks. Asset portfolios with a relatively high proportion of loans have traditionally been key causes of bank failure due to the relative riskier nature of loans over securities. Members and advance users make up their greatest share in the highest quartile of loan-to-asset ratios and are only weakly represented in the bottom quartile, indicating their relatively riskier asset portfolio positions. On the other hand, members and advance users have the weakest presence in the uppermost quartile of loan portfolio quality, as measured by the percentage of total loans in non-performing status. Member banks and members that use advances are represented the most in the second quartile, where average loan-to-asset ratios and returns-on-assets are at their highest levels. Therefore, as the amount of loans held by member banks and advance users increases, the quality of loan portfolios and bank profitability have been, on average, improving.

Finally, members and advance users have fairly equal distributions across the quartiles of returns-on-assets, although they are represented the least in the lowest profit quartile. Members and advance users earning the highest returns are found in the third quartile, where average loan-to-asset ratios are at their high and average non-performing loan ratios are at their low.

Total Observations = 97039

	Capital-to-Asset Ratio				Loan-to-Asset Ratio				Nonperforming Loans Ratio				Returns-on-Assets			
	Quartiles				Quartiles				Quartiles				Quartiles			
	Bottom	2nd	3rd	Top	Bottom	2nd	3rd	Top	Bottom	2nd	3rd	Top	Bottom	2nd	3rd	Top
Status of FHLB Participation:																
Members	9248	9948	8957	6566	3956	7327	10241	13195	8942	10709	9373	5695	7211	8981	9475	9052
as a percent of all members	0.27	0.29	0.26	0.19	0.11	0.21	0.29	0.38	0.26	0.31	0.27	0.16	0.21	0.26	0.27	0.26
Advance Users	5826	6068	4980	3217	1923	3861	5725	8603	4882	6575	5577	3058	3952	5425	5647	5069
as a percent of all users	0.29	0.30	0.25	0.16	0.10	0.19	0.28	0.43	0.24	0.33	0.28	0.15	0.20	0.27	0.28	0.25
Average Percentages of:																
Capital-to-Assets	6.7	8.3	9.9	15.2	11.8	10.0	9.4	9.0	11.4	9.5	9.5	9.6	10.3	9.2	9.7	10.9
Loan-to-Assets	59.1	59.7	57.0	50.1	36.0	53.5	62.9	73.7	54.5	58.6	58.0	55.0	55.7	56.5	57.0	56.8
Nonperforming loans-to-Loans	1.6	1.24	1.28	1.34	1.6	1.4	1.3	1.2	0.07	0.46	1.1	3.8	2.0	1.3	1.1	1.1
Return-on-average assets	0.78	1.1	1.1	0.98	0.95	1.00	1.00	0.98	0.90	1.2	1.1	0.77	-0.06	0.96	1.2	1.8

Table 3.13 Quartile Rankings of FHLB Participants, 1991-1999

4. Results

Initially, the static bank performance regressions were run within a random-effects model specification in order to evaluate changes in individual bank behavior after membership attainment and advance use, as well as comparing performance across various subgroups of banks, such as members to non-members and advance users to non-users. Using the Breusch & Pagan Lagrangian multiplier test, the null hypothesis that the variance components are equal to zero is rejected, implying that variances across banks do indeed differ (heteroscedasticity), and the model passes the test for random effects. Conversely, under the assumption of a correctly specified model, Hausman's specification test rejects the hypotheses that the random effects in the original models are uncorrelated with the explanatory variables[13].

Therefore, the analyses are completed as fixed-effects models, evaluating the changes in bank and member bank behavior subsequent to attaining FHLB membership and to using System funds, given various bank operating decisions, local banking market structure and concurrent economic conditions. Within this model, individual banks seeking FHLB membership are held as controls for their own behavior after attaining membership, and member bank performance prior to advance use serves as a control for performance after using System funds. Hence, the comparison of performance across various subgroups of banks cannot be performed within the

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[13] Since Hausman's specification test is a global test, its rejection suggests that not all of the explanatory variables in the regression are random effects and the original random-effects models constraining *all* betas between-bank and within-bank to be the same are incorrect. Therefore, within the random-effects models in Stata, individual tests are performed to determine which of the effects are different.

Each explanatory variable is decomposed into its between- and fixed-effects components (the average for each banking unit, and the difference between that unit's observed value and its average, respectively). The models are rerun with these components to obtain the between- and fixed-effects estimators (B and β, respectively) and each explanatory variable is individually tested to determine whether its B = β. An insignificant result suggests the random-effects estimator can not be rejected (could not reject the equality of the estimates for the fixed- and between-effects), it was included as such. If an individual test returns a significant result, then the between- and fixed-effects are not the same and the random-effects estimator is invalid and its between- and fixed-effects components were used in the analysis instead. Therefore, one does not have to assume the cross-sectional and within-bank effects are the same for *all* explanatory variables within each random-effects model.

After conferring with Stata Technicians and Statisticians about these results and the potential extended capabilities of Stata, it was of general consensus that the results produced by this method were 'suspicous', and in their opinion, the fixed effects regression was the best option.

Additionally, a mixed fixed-and random-effects model was attempted in SAS, although the memory requirements to run this computationally intensive model greatly exceed the memory capacity of available computers, despite various attempts to conserve memory and to reduce computing time. Mixed fixed- and random-effects models are appropriate if the objective is to generate the mean outcome of a specific factor over the population of other factors. Factors thought to contribute the random effects should be drawn randomly from the relevant populations.

fixed-effects specification. Initially, overall membership and advance use effects are evaluated against various bank performance measures. Additional interaction variables are then included to determine if the effects are consistent across regions, market structures, and bank types.

• LENDING

The static asset portfolio-share regressions incorporate the effects of funding and asset decisions on loan and other asset investments held in portfolio, given bank-specific characteristics, local banking market structure, and economic conditions.

Mortgage-Related Assets

Results from the regressions with no interaction variables in Table 3.14 indicate that the FHLB System mission of supporting residential mortgage lending has been upheld. The statistically significant result reveals that member banks invest a higher percentage (almost 4.5 percent more) of total assets in mortgage-related assets (MRAs) than their pre-member days. Additionally, members increasing advance-to-asset ratios by 100 basis points have, on average, mortgage-related asset ratios that are 78 basis points higher. The percent of assets invested in mortgage-related securities increases by an average of over 1-percent for each accumulated year of membership. Hence, greater reliance on advances as a funding source and experience with FHLB membership significantly contribute to the support of residential-mortgage lending.

Are the behaviors related to FHLB membership and advance use consistent across different regions, market structures, and bank types? The results from the inclusion of these additional interaction variables are provided in the second portion of Table 3.14. Collectively, small banks that become members increase MRA holdings by 2 percent, while bank holding company affiliated banks becoming members increase MRA ratios by 5.8 percent. Hence, small bank members affiliated with bank-holding companies are associated with an average 3.3 percent higher MRA ratio. MRA ratios also increase regardless of whether the market in which the bank is primarily located is classified as highly concentrated, unconcentrated, or if it is experiencing negative population growth. Banks becoming members in every FHLB region increase MRA holdings, although at varying degrees.

| | *No Interactions* | | *With Interactions* | |
Variable	**all banks**	**all members**	**all banks**	**all members**
Intercept	-1.3237***	1.1517***	-1.3418***	1.1300***
	(-48.88)	(10.73)	(-49.37)	(10.51)
Size of Bank	-0.0056***	-0.0133***	-0.0051***	-0.0130***
	(-4.72)	(-5.33)	(-4.25)	(-5.20)
Small Bank[b] Dummy Variable	-0.0268***	-0.0100***	-0.0096***	0.0082
	(-10.91)	(-2.81)	(-3.07)	(1.62)
Rural County Location Dummy Variable	0.0090***	-0.0172***	0.0104***	-0.0166***
	(3.15)	(-2.74)	(3.62)	(-2.65)
HHI of market deposit concentration	0.0073	-0.0052	0.0044	-0.0068
	(1.01)	(-0.41)	(0.61)	(-0.53)
Capital Ratio	0.0473***	-0.0364	0.0347**	-0.0402
	(3.30)	(-1.09)	(2.42)	(-1.20)
BHC Affiliation Dummy Variable	-0.0389***	0.0030	-0.0428***	-0.0048
	(-10.65)	(0.42)	(-11.46)	(-0.62)
Growth Rate of Bank	-0.00003	0.0007	-0.00003	0.0007
	(-0.63)	(0.58)	(-0.61)	(0.62)
Growth Rate of Local Market Population	0.1261***	0.0221	0.1418***	0.0250
	(4.64)	(0.41)	(5.10)	(0.44)
Local Market Per Capita Income	0.1515***	-0.0841***	0.1514***	-0.0833***
	(49.77)	(-7.87)	(49.70)	(-7.79)
Core Deposits-to-Total Asset Ratio	0.0021	-0.0100	0.0035	-0.0090
	(0.40)	(-0.85)	(0.66)	(-0.76)
Other Borrowed Money-to-Total Asset Ratio	0.2036***	0.1716***	0.1988***	0.1691***
	(23.12)	(11.20)	(22.58)	(11.03)
Merger Involvement Dummy Variable	0.0051***	0.0037	0.0045***	0.0036
	(3.55)	(1.63)	(3.16)	(1.59)
Loan Loss Provisions-to-Total Asset Ratio	-0.8725***	-1.6924***	-0.8770***	-1.6648***
	(-15.06)	(-10.68)	(-15.16)	(-10.51)
Return-on-Average Assets	-0.0728***	-0.8808***	-0.0709***	-0.8694***
	(-5.12)	(-8.12)	(-4.99)	(-8.02)
Nonperforming Loans-to-Total Loan Ratio	-0.1356***	-0.1752***	-0.1290***	-0.1693***
	(-9.10)	(-3.80)	(-8.68)	(-3.67)
Federal Funds Sold-to-Total Asset Ratio	-0.1118***	-0.1861***	-0.1121***	-0.1871***
	(-18.55)	(-13.89)	(-18.64)	(-13.95)
Gross Total Loan-to-Asset Ratio	0.2411***	0.1881***	0.2404***	0.1891***
	(63.40)	(23.60)	(63.17)	(23.70)
FHLB Member or Advance Use Dummy Variable	0.0244***	0.0010	0.0447***	0.0219***
	(29.16)	(0.80)	(7.40)	(2.74)
Advances-to-Total Asset Ratio		0.0078***		0.0083***
		(3.46)		(3.66)
Number of Member Years		0.0106***		0.0105***
		(19.20)		(18.95)

Table 3.14 Mortgage-Related Asset-to-Total Asset Ratio Fixed-Effects Estimates

	No Interactions		With Interactions	
FHLB Member or Advance User…	all banks	all members	all banks	all members
--classified as a small bank			-0.0247***	-0.0207***
			(-8.55)	(-4.74)
--affiliated with a bank-holding company			0.0129***	0.0099**
			(5.60)	(2.48)
--located in a highly concentrated local market[c]			0.0024*	0.0005
			(1.87)	(0.25)
--located in an unconcentrated local market[d]			-0.0058***	-0.0046
			(-2.61)	(-1.32)
--located in a local market that is losing population[e]			0.0041***	0.0009
FHLB Member or Advance User located in:			(3.54)	(0.56)
District 2 - New York			0.0146**	-0.0125
			(2.18)	(-1.36)
District 3 - Pittsburgh			0.0034	-0.0048
			(0.58)	(-0.67)
District 4 - Atlanta			-0.0196***	-0.0160**
			(-3.66)	(-2.38)
District 5 - Cincinnati			-0.0051	-0.0049
			(-0.93)	(-0.71)
District 6 - Indianapolis			-0.0228***	0.0023
			(-3.89)	(0.31)
District 7 - Chicago			-0.0115**	-0.0149**
			(-2.14)	(-2.18)
District 8 - Des Moines			-0.0160***	-0.0092
			(-3.06)	(-1.42)
District 9 - Dallas			0.0150***	-0.0081
			(2.78)	(-1.20)
District 10 - Topeka			-0.0148***	-0.0177***
			(-2.76)	(-2.63)
District 11 - San Francisco			-0.0402***	0.0031
			(-6.26)	(0.34)
District 12 - Seattle			-0.0308***	-0.0258***
			(-4.97)	(-3.36)
sigma (u)	0.1098	0.1183	0.1088	0.1179
sigma (e)	0.0639	0.0606	0.0637	0.0605
rho (fraction of variance due to u_i)	0.7467	0.7922	0.7447	0.7915
Corr(u_i, Xb)	-0.1848	-0.1611	-0.1656	-0.1507
Number of Observations	86676	28498	86676	28498
Number of Individual Banks	12393	6414	12393	6414
F-test that all $u_i = 0$	16.18***	13.85***	15.34***	12.72***
R-squared: Within	26.46%	13.74%	26.97%	14.04%
Between	9.73%	2.38%	10.50%	2.78%
Overall	12.19%	3.31%	13.10%	3.91%

Notes: *Single, double, and triple asteriks (*) signify significance at the 10, 5, and 1 percent levels, respectively.
t-values in parentheses.
a Commercial & industrial loans not exceeding $1 million. *b* Banks with total assets not exceeding $500 million.
c,d HHI of local market deposit concentration in excess of 1800, or less than 1000.
e Defined as a local market experiencing negative population growth.

Table 3.14 Mortgage-Related Assets, continued

The result generated from member advance use on MRA ratios is positive but insignificant from the no-interactions regressions. Conversely, significant results are generated once the additional explanatory variables are added. Specifically, small members increase their assets invested in mortgage-related securities by 12 basis points after they begin borrowing System funds, and members affiliated with BHCs increase their MRA ratios by 3.2 percent after using advances.

Loan-to-Asset Ratios

Does access to FHLB funding increase lending or are FHLB advances used to replace costlier sources of funds? The statistically significant, non-interaction results in Table 3.15 indicate that after joining an FHLB, a bank realizes a loan-to-asset ratio that is, on average, 2.1 percent higher than its pre-membership levels. Additionally, a member that previously did not use advances increases loan-to-asset ratios by 1.1 percent once System funds are utilized. As the number of member years increases, loan-to-asset ratios also increase, by almost 1 percent a year. On the other hand, as bank size increases, loan-to-asset ratios decrease by a greater amount for member banks participating in the FHLB System.

How are these differences distributed across the various classifications of banks and members located in different regions and markets? The results for small banks that become members and small members that begin to use advances are positive, but insignificant, as are the negative results generated on the BHC-affiliated members and advance users. Regardless of the type of market in which it's located, a bank decreases its asset investment in loans after attaining its membership status, although at a lower rate in highly concentrated markets. Additionally, the only statistically significant result in the advance use category states that members located in highly concentrated markets also decrease loan-to-assets after using advances.

The statistically significant FHLB district interaction dummy results show that banks and members in most districts increase loan-to-asset holdings after joining and using advances. The exceptions include banks that become members in the Boston and San Francisco districts, as well as for those members who begin using advances in the Boston district. Ultimately, these results suggest that FHLB members invest a higher proportion of their asset portfolios in loans and fund these additional loans with System advances. Increases in loan investment may represent riskier

behavior, since banks with higher loan-to-asset ratios have relatively riskier asset portfolios and have increased exposure to potential credit quality problems.

	No Interactions		With Interactions	
Variable	**all banks**	**all members**	**all banks**	**all members**
Intercept	-1.1865***	0.8674***	-1.1681***	0.8693
	(-46.04)	(9.59)	(-45.18)	(9.60)
Size of Bank	-0.0040***	-0.0181***	-0.0023**	-0.0178***
	(-3.44)	(-8.60)	(-2.00)	(-8.45)
Small Bank[b] Dummy Variable	0.0244***	0.0086***	0.0216***	0.0028
	(10.29)	(2.86)	(7.14)	(0.65)
Rural County Location Dummy Variable	0.0080***	-0.0107**	0.0076***	-0.0106**
	(2.88)	(-2.01)	(2.76)	(-2.00)
HHI of market deposit concentration	-0.0397***	-0.0424***	-0.0374***	-0.0432***
	(-5.69)	(-3.94)	(-5.35)	(-3.98)
Capital Ratio	-0.2101***	-0.1196***	-0.2145***	-0.1177***
	(-15.18)	(-4.22)	(-15.51)	(-4.15)
BHC Affiliation Dummy Variable	-0.0141***	-0.0089	-0.0142***	-0.0047
	(-4.00)	(-1.45)	(-3.94)	(-0.73)
Growth Rate of Bank	-0.00003	-0.0007	-0.00003	-0.0008
	(-0.54)	(-0.80)	(-0.57)	(-0.80)
Growth Rate of Local Market Population	0.0362	0.0859*	0.0521*	0.0944*
	(1.38)	(1.87)	(1.94)	(1.96)
Local Market Per Capita Income	0.1921***	0.0027	0.1884***	0.0023
	(67.34)	(0.30)	(65.94)	(0.26)
Core Deposits-to-Total Asset Ratio	-0.1054***	-0.0969***	-0.1017***	-0.0955***
	(-20.80)	(-9.79)	(-20.11)	(-9.65)
Other Borrowed Money-to-Total Asset Ratio	-0.1033***	-0.1463***	-0.0985***	-0.1425***
	(-12.16)	(-11.34)	(-11.61)	(-11.04)
Merger Involvement Dummy Variable	-0.0025*	0.0010	-0.0025*	0.0008
	(-1.84)	(0.52)	(-1.80)	(0.42)
Loan Loss Provisions-to-Total Asset Ratio	2.2804***	3.1344***	2.1979***	3.1083***
	(41.24)	(23.71)	(39.81)	(23.53)
Return-on-Average Assets	0.1375***	1.2458***	0.1424***	1.2409***
	(10.01)	(13.66)	(10.42)	(13.61)
Nonperforming Loans-to-Total Loan Ratio	-0.1936***	-0.2923***	-0.1980***	-0.3021***
	(-13.49)	(-7.51)	(-13.83)	(-7.77)
Federal Funds Sold-to-Total Asset Ratio	-0.4499***	-0.5047***	-0.4503***	-0.5061***
	(-80.66)	(-46.75)	(-80.99)	(-46.89)
FHLB Member or Advance Use Dummy Variable	0.0212***	0.0105***	-0.0185***	-0.0113*
	(26.39)	(9.87)	(-3.17)	(-1.68)
Advances-to-Total Asset Ratio		-0.0008		-0.0012
		(-0.44)		(-0.64)
Number of Member Years		0.0097***		0.0096***
		(20.86)		(20.72)

Table 3.15 Loan-to-Asset Ratio Fixed-Effects Estimates

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	No Interactions		With Interactions	
FHLB Member or Advance User…	all banks	all members	all banks	all members
--classified as a small bank			0.0003	0.0055
			(0.09)	(1.50)
--affiliated with a bank-holding company			-0.0002	-0.0055
			(-0.10)	(-1.62)
--located in a highly concentrated local market[c]			0.0052***	0.0032**
			(4.08)	(1.97)
--located in an unconcentrated local market[d]			-0.0036*	-0.0010
			(-1.67)	(-0.35)
--located in a local market that is losing population[e]			0.0021*	0.0005
FHLB Member or Advance User located in:			(1.86)	(0.37)
District 2 - New York			0.0029	0.0012
			(0.45)	(0.15)
District 3 - Pittsburgh			0.0222***	0.0027
			(3.91)	(0.45)
District 4 - Atlanta			0.0223***	0.0206***
			(4.33)	(3.63)
District 5 - Cincinnati			0.0344***	0.0223***
			(6.52)	(3.76)
District 6 - Indianapolis			0.0374***	0.0263***
			(6.62)	(4.23)
District 7 - Chicago			0.0390***	0.0130**
			(7.52)	(2.25)
District 8 - Des Moines			0.0437***	0.0267***
			(8.65)	(4.90)
District 9 - Dallas			0.0411***	0.0280***
			(7.94)	(4.92)
District 10 - Topeka			0.0578***	0.0223***
			(11.18)	(3.92)
District 11 - San Francisco			-0.0183***	0.0052
			(-2.95)	(0.68)
District 12 - Seattle			0.0458***	0.0195***
			(7.66)	(3.02)
sigma (u)	0.1296	0.1143	0.1297	0.1145
sigma (e)	0.0617	0.0512	0.0614	0.0511
rho (fraction of variance due to u_i)	0.8154	0.8330	0.8167	0.8339
Corr(u_i, Xb)	-0.0738	-0.1081	-0.0690	-0.1190
Number of Observations	86676	28498	86676	28498
Number of Individual Banks	12393	6414	12393	6414
F-test that all $u_i = 0$	24.85***	18.23***	24.39***	17.43***
R-squared: Within	25.17%	21.67%	25.79%	22.02%
Between	11.99%	2.26%	11.87%	2.16%
Overall	12.21%	4.64%	12.19%	4.40%

Notes: *Single, double, and triple asteriks (*) signify significance at the 10, 5, and 1 percent levels, respectively.
t-values in parentheses.
a Commercial & industrial loans not exceeding $1 million.
b Banks with total assets not exceeding $500 million.
c,d HHI of local market deposit concentration in excess of 1800, and less than 1000, respectively.
e Defined as a local market experiencing negative population growth.

Table 3.15 Loan-to-Asset Ratios, continued

Loan Types

Since FHLB members use advances to extend more loans, what types of loans are funded? The association between the percent of assets invested in real estate loans, business and small business loans, and agricultural loans to FHLB membership and advance use are presented and discussed in the following sections.

a. Real Estate Loans

From the no-interaction regressions in Table 3.16, banks collectively increase holdings of real estate loans by 2.3 percent of total assets after becoming an FHLB member, and by almost 1 percent after using System advances, consistent with the FHLB mission of supporting mortgage lending. Additionally, as a member accrues additional membership years, its real estate loan-to-asset ratio increases by almost 1 percent per year. In general, banks collectively increase real estate holdings as they accumulate additional assets, while members hold a relatively lower percentage of their assets in real estate loans as they grow.

The interaction regressions describe the distribution of the above real estate loan increases. Small banks decrease real estate loan ratios by 76 bps after obtaining FHLB membership, whereas small banks in highly concentrated markets decrease these ratios by slightly less (48 bps). Banks located in the Boston and San Francisco districts experience negative and significant decreases on their real estate loan holdings after membership attainment, while banks located in the other significant regions increase real estate loan investments. The negative results may reflect the real estate recessions that occurred in Boston and southern California, which dropped home prices during the 1990s. The significant results from the advance use equation suggest that real estate loan-to-asset ratios are positively associated with advance use in highly concentrated markets and in all significant FHLB districts.

| | No Interactions | | With Interactions | |
Variable	all banks	all members	all banks	all members
Intercept	-1.3513***	0.7145***	-1.3330***	0.7067
	(-63.39)	(8.81)	(-62.31)	(8.71)
Size of Bank	0.0088***	-0.0076***	0.0099***	-0.0074***
	(9.24)	(-4.02)	(10.36)	(-3.92)
Small Bank[b] Dummy Variable	0.0162***	0.0077***	0.0077***	0.0039
	(8.31)	(2.86)	(3.09)	(1.01)
Rural County Location Dummy Variable	0.0028	-0.0175***	0.0024	-0.0173***
	(1.24)	(-3.69)	(1.06)	(-3.66)
HHI of market deposit concentration	-0.0270***	-0.0426***	-0.0249***	-0.0429***
	(-4.70)	(-4.42)	(-4.32)	(-4.42)
Capital Ratio	-0.1353***	-0.0700***	-0.1370***	-0.0701***
	(-11.86)	(-2.75)	(-12.01)	(-2.76)
BHC Affiliation Dummy Variable	-0.0043	-0.0090	-0.0050*	-0.0062
	(-1.46)	(-1.64)	(-1.70)	(-1.06)
Growth Rate of Bank	-0.00003	-0.0002	-0.00003	-0.0002
	(-0.71)	(-0.22)	(-0.76)	(-0.19)
Growth Rate of Local Market Population	0.0308	0.0725*	0.0416*	0.0719*
	(1.43)	(1.76)	(1.88)	(1.67)
Local Market Per Capita Income	0.1694***	-0.0110	0.1671***	-0.0105
	(71.86)	(-1.36)	(70.76)	(-1.29)
Core Deposits-to-Total Asset Ratio	-0.0553***	-0.0744***	-0.0534***	-0.0731***
	(-13.22)	(-8.38)	(-12.78)	(-8.24)
Other Borrowed Money-to-Total Asset Ratio	-0.0502***	-0.1013***	-0.0461***	-0.0983***
	(-7.17)	(-8.75)	(-6.59)	(-8.50)
Merger Involvement Dummy Variable	-0.0014	0.0006	-0.0012	0.0004
	(-1.19)	(0.34)	(-1.04)	(0.21)
Loan Loss Provisions-to-Total Asset Ratio	1.0811***	2.2005***	1.0299***	2.1832***
	(23.54)	(18.49)	(22.46)	(18.37)
Return-on-Average Assets	0.0534***	0.9664***	0.0568***	0.9599***
	(4.73)	(11.82)	(5.04)	(11.75)
Nonperforming Loans-to-Total Loan Ratio	-0.0838***	-0.1515***	-0.0888***	-0.1634***
	(-7.08)	(-4.34)	(-7.52)	(-4.69)
Federal Funds Sold-to-Total Asset Ratio	-0.3007***	-0.3993***	-0.3007***	-0.4009***
	(-64.64)	(-40.93)	(-64.80)	(-41.14)
Commercial & Industrial Loans-to-Asset Ratio	-0.3251***	-0.4841***	-0.3306***	-0.4865***
	(-55.71)	(-43.57)	(-56.72)	(-43.85)
Individual Loans-to-Asset Ratio	-0.2114***	-0.3526***	-0.2130***	-0.3516***
	(-33.06)	(-27.59)	(-33.38)	(-27.55)
Agricultural Loans-to-Asset Ratio	-0.1792***	-0.2952***	-0.1743***	-0.2870***
	(-18.24)	(-12.11)	(-17.78)	(-11.79)
FHLB Member or Advance Use Dummy Variable	0.0226***	0.0093***	-0.0175***	-0.0089
	(34.18)	(9.75)	(-3.64)	(-1.47)
Advances-to-Total Asset Ratio		0.0026		0.0022
		(1.51)		(1.29)
Number of Member Years		0.0099***		0.0098***
		(23.77)		(23.58)

Table 3.16 Real Estate Loans-to-Loan Ratio Fixed-Effects Estimates

Member or Advance User…	No Interactions		With Interactions	
	all banks	**all members**	**all banks**	**all members**
--classified as a small bank			0.0099***	0.0031
			(4.26)	(0.93)
--affiliated with a bank-holding company			0.0013	-0.0036
			(0.73)	(-1.19)
--located in a highly concentrated local market[c]			0.0038***	0.0035**
			(3.69)	(2.36)
--located in an unconcentrated local market[d]			-0.0025	0.0002
			(-1.44)	(0.07)
--located in a local market that is losing population[e]			0.0009	-0.0003
FHLB Member or Advance User located in:			(1.00)	(-0.25)
District 2 - New York			-0.0028	-0.0070
			(-0.52)	(-1.01)
District 3 - Pittsburgh			0.0189***	-0.00002
			(4.04)	(-0.00)
District 4 - Atlanta			0.0191***	0.0160***
			(4.51)	(3.16)
District 5 - Cincinnati			0.0296***	0.0223***
			(6.82)	(4.22)
District 6 - Indianapolis			0.0311***	0.0293***
			(6.67)	(5.26)
District 7 - Chicago			0.0289***	0.0116**
			(6.76)	(2.25)
District 8 - Des Moines			0.0307***	0.0219***
			(7.36)	(4.49)
District 9 - Dallas			0.0263***	0.0227***
			(6.16)	(4.45)
District 10 - Topeka			0.0418***	0.0157***
			(9.81)	(3.08)
District 11 - San Francisco			-0.0099*	0.0029
			(-1.93)	(0.42)
District 12 - Seattle			0.0429***	0.0219***
			(8.71)	(3.78)
sigma (u)	0.1228	0.1143	0.1236	0.1149
sigma (e)	0.0508	0.0458	0.0506	0.0457
rho (fraction of variance due to u_i)	0.8538	0.8616	0.8563	0.8633
Corr(u_i, Xb)	0.0376	0.1097	0.0296	0.1010
Number of Observations	86676	28498	86676	28498
Number of Individual Banks	12393	6414	12393	6414
F-test that all $u_i = 0$	29.62***	20.70***	28.63***	19.66***
R-squared: Within	28.72%	27.50%	29.20%	27.89%
Between	21.08%	21.41%	19.99%	20.53%
Overall	21.26%	23.07%	20.34%	22.09%

Notes: *Single, double, and triple asteriks (*) signify significance at the 10, 5, and 1 percent levels, respectively.

t-values in parentheses.

a   Commercial & industrial loans not exceeding $1 million.

b   Banks with total assets not exceeding $500 million.

c,d   HHI of local market deposit concentration in excess of 1800, and less than 1000, respectively.

e   Defined as a local market experiencing negative population growth.

Table 3.16 Real Estate Loans, continued

b. Business and Small Business Loans

Small banks have historically lent a greater proportion of their total assets to small business purposes. Does FHLB participation affect funds available for small business funding?

First, from the no-interaction results in Table 3.17, the proportions of assets invested toward small business loans decrease, by 40 bps and 1.4 percent for banks and member banks, respectively, as they become larger. Comparatively, banks and members decrease all commercial and industrial (C&I) loan holdings (refer to Table 18) by 10 bps and 80 bps, respectively, as size increases, but mostly at the detriment of small business loans. These results most likely represent the general shift away from business lending since larger, highly rated corporations have significantly increased their use of commercial paper and other credit market sources for loanable funds (Spong and Sullivan, 1999).

Conversely, a bank increases its holdings of small business loans and C&I loans after membership attainment by 49 bps and 35 bps, respectively, and by 25 bps and 30 bps after advance use. Additionally, small business loans and C&I loans increase by 34 bps and 25 bps, respectively, per additional year of membership in the FHLB System, suggesting that FHLB participation has an overall positive effect on a bank's business loan investment.

As seen in the regression results involving the interaction variables in Table 3.17, a small bank that becomes a member to an FHLB decreases small business loan holdings by 1.12 percent of its assets. Therefore, the increase in small business lending found in the above no-interaction regression suggests large banks increase lending for small business purposes after membership attainment. Additionally, each of the significant results related to the FHLB districts shows a negative association between small business loan-to-asset ratios and attaining membership. No significant results are generated for the effect of members who begin using advances in the various FHLB regions, although small members that begin to borrow System funds are associated with a more positive effect on their investment in small business loans, especially if located within a highly concentrated market.

Variable	No Interactions		With Interactions	
	all banks	all members	all banks	all members
Intercept	-0.6500***	0.0900	-0.6367***	0.0907
	(-34.71)	(1.61)	(-33.81)	(1.62)
Size of Bank (log of total assets)	-0.0040***	-0.0135***	-0.0034***	-0.0131***
	(-4.97)	(-10.06)	(-4.22)	(-9.74)
Small Bank[b] Dummy Variable	0.0168***	0.0135***	0.0076***	0.0058**
	(11.17)	(7.35)	(3.66)	(2.17)
Rural County Location Dummy Variable	-0.0058**	-0.0085**	-0.0054**	-0.0086**
	(-2.34)	(-2.45)	(-2.18)	(-2.49)
HHI of market deposit concentration	-0.0069	-0.0122*	-0.0068	-0.0143**
	(-1.48)	(-1.83)	(-1.44)	(-2.13)
Capital Ratio	0.1450***	-0.0361**	0.1465***	-0.0333*
	(15.26)	(-2.04)	(15.42)	(-1.88)
BHC Affiliation Dummy Variable	0.0150***	0.0201***	0.0139***	0.0210***
	(6.30)	(5.49)	(5.58)	(5.36)
Growth Rate of Bank	-0.0012***	-0.0011**	-0.0013***	-0.0012**
	(-4.08)	(-1.97)	(-4.53)	(-2.11)
Growth Rate of Local Market Population	-0.0725***	-0.0607**	-0.0613***	-0.0863***
	(-4.10)	(-2.12)	(-3.36)	(-2.89)
Log (Local Market Per Capita Income)	0.0647***	0.0138**	0.0636***	0.0139**
	(31.48)	(2.50)	(30.88)	(2.52)
Core Deposits-to-Total Asset Ratio	0.0995***	-0.0197***	0.0994***	-0.0185***
	(30.13)	(-3.21)	(30.11)	(-3.02)
Other Borrowed Money-to-Total Asset Ratio	0.0670***	-0.0290***	0.0682***	-0.0277***
	(12.47)	(-3.68)	(12.68)	(-3.52)
Merger Involvement Dummy Variable	-0.0028***	-0.0030***	-0.0027***	-0.0030**
	(-3.14)	(-2.62)	(-3.00)	(-2.59)
Loan Loss Provisions-to-Total Asset Ratio	0.5318***	0.7689***	0.5160***	0.7639***
	(11.64)	(8.93)	(11.30)	(8.88)
Return-on-Average Assets	0.1025***	0.2967***	0.1066***	0.2931***
	(4.54)	(5.25)	(4.72)	(5.19)
Nonperforming Loans-to-Total Loan Ratio	-0.0373***	-0.0720***	-0.0399***	-0.0760***
	(-3.58)	(-2.96)	(-3.82)	(-3.12)
Federal Funds Sold-to-Total Asset Ratio	-0.0347***	-0.0654***	-0.0345***	-0.0665***
	(-9.12)	(-9.57)	(-9.09)	(-9.73)
Real Estate Loan-to-Asset Ratio	-0.0173***	-0.0479***	-0.0182***	-0.0486***
	(-5.77)	(-10.62)	(-6.04)	(-10.77)
Individual Loans-to-Asset Ratio	-0.0526***	-0.0658***	-0.0524***	-0.0657***
	(-9.51)	(-7.33)	(-9.47)	(-7.32)
Agricultural Loans-to-Asset Ratio	-0.0313***	-0.0560***	-0.0283***	-0.0546***
	(-3.71)	(-3.29)	(-3.36)	(-3.21)
FHLB Member or Advance Use Dummy Variable	0.0049***	0.0025***	-0.0231***	-0.0068
	(9.04)	(3.84)	(-5.49)	(-1.55)
Advances-to-Total Asset Ratio		0.0002		0.0001
		(0.20)		(0.10)
Number of Member Years		0.0034***		0.0033***
		(11.31)		(11.15)

Table 3.17 Small Business Loans-to-Asset Ratio Fixed-Effects Estimates

Member or Advance User…	No Interactions		With Interactions	
	all banks	**all members**	**all banks**	**all members**
--classified as a small bank			0.0119***	0.0089***
			(6.02)	(3.81)
--affiliated with a bank-holding company			0.0019	-0.0003
			(1.28)	(-0.13)
--located in a highly concentrated local market[c]			0.0001	0.0025**
			(0.15)	(2.41)
--located in an unconcentrated local market[d]			-0.0021	-0.0017
			(-1.56)	(-0.95)
--located in a local market that is losing population[e]			0.0008	-0.0025***
FHLB Member or Advance User located in:			(1.12)	(-3.01)
District 2 - New York			0.0137***	0.0011
			(2.90)	(0.23)
District 3 - Pittsburgh			0.0143***	0.0002
			(3.30)	(0.06)
District 4 - Atlanta			0.0146***	0.0014
			(3.89)	(0.36)
District 5 - Cincinnati			0.0119***	0.0009
			(3.05)	(0.23)
District 6 - Indianapolis			0.0164***	0.0044
			(3.87)	(1.04)
District 7 - Chicago			0.0152***	0.0022
			(4.04)	(0.59)
District 8 - Des Moines			0.0149***	0.0028
			(4.04)	(0.79)
District 9 - Dallas			0.0220***	-0.00003
			(5.75)	(-0.01)
District 10 - Topeka			0.0159***	-0.0014
			(4.24)	(-0.37)
District 11 - San Francisco			-0.0044	-0.0066
			(-1.02)	(-1.33)
District 12 - Seattle			0.0200***	-0.0069
			(4.40)	(-1.61)
sigma (u)	0.0577	0.0612	0.0578	0.0612
sigma (e)	0.0324	0.0294	0.0323	0.0294
rho (fraction of variance due to u_i)	0.7610	0.8122	0.7620	0.8125
Corr(u_i, Xb)	-0.0386	-0.1959	-0.0312	-19.18
Number of Observations	62273	26218	62273	26218
Number of Individual Banks	11207	6289	11207	6289
F-test that all $u_i = 0$	13.90***	12.62***	13.68***	12.30***
R-squared: Within	5.43%	5.13%	5.74%	5.38%
Between	8.34%	1.36%	8.06%	1.26%
Overall	7.94%	1.42%	7.86%	1.40%

Notes: *Single, double, and triple asteriks (*) signify significance at the 10, 5, and 1 percent levels, respectively.

t-values in parentheses.

a Commercial & industrial loans not exceeding $1 million.

b Banks with total assets not exceeding $500 million.

c,d HHI of local market deposit concentration in excess of 1800, and less than 1000, respectively.

e Defined as a local market experiencing negative population growth.

Table 3.17 Small Business Loans, continued

Similar to the small business loan results from Table 3.17, the interaction results on C&I loans in Table 3.18 reveal a negative association with membership status in the districts of Boston, New York, Pittsburgh, and San Francisco. Contrary to the small business loan results, C&I loan holdings increase in the remaining districts displaying significant results, ranging from 15 bps for banks becoming members in Atlanta and 1.1 percent for those in Topeka. Again, a significant result is not generated for the advance use variable, although each significant FHLB district variable is positive, suggesting members in these districts experience a positive relation between advance use and their holdings of business loans.

Variable	No Interactions		With Interactions	
	all banks	all members	all banks	all members
Intercept	-0.3242***	0.1213**	-0.3161***	0.1215**
	(-24.14)	(2.57)	(-23.46)	(2.57)
Size of Bank	-0.001**	-0.0080***	-0.0008	-0.0079***
	(-2.56)	(-7.29)	(-1.35)	(-7.13)
Small Bank[b] Dummy Variable	0.0112***	0.0059***	0.0101***	0.0047**
	(9.28)	(3.75)	(6.61)	(2.12)
Rural County Location Dummy Variable	0.0037***	0.0020	0.0038***	0.0020
	(2.64)	(0.72)	(2.68)	(0.74)
HHI of market deposit concentration	-0.0181***	-0.0052	-0.0159***	-0.0058
	(-5.11)	(-0.93)	(-4.49)	(-1.02)
Capital Ratio	-0.0831***	-0.0879***	-0.0837***	-0.0856***
	(-11.82)	(-5.95)	(-11.91)	(-5.79)
BHC Affiliation Dummy Variable	-0.0022	-0.0089***	-0.0016	-0.0062*
	(-1.21)	(-2.79)	(-0.88)	(-1.81)
Growth Rate of Bank	-0.00004	-0.0005	-0.00004	-0.0005
	(-1.44)	(-1.04)	(-1.47)	(-1.06)
Growth Rate of Local Market Population	-0.0030	0.0276	-0.0031	0.0268
	(-0.23)	(1.15)	(-0.23)	(1.07)
Local Market Per Capita Income	0.0533***	0.0191***	0.0517***	0.0187***
	(35.80)	(4.07)	(34.65)	(3.98)
Core Deposits-to-Total Asset Ratio	-0.0523***	-0.0535***	-0.0509***	-0.0523***
	(-20.34)	(-10.37)	(-19.82)	(-10.12)
Other Borrowed Money-to-Total Asset Ratio	-0.0738***	-0.0763***	-0.0717***	-0.0744***
	(-17.14)	(-11.35)	(-16.64)	(-11.06)
Merger Involvement Dummy Variable	-0.0032***	-0.0013	-0.0032***	-0.0013
	(-4.62)	(-1.31)	(-4.50)	(-1.33)
Loan Loss Provisions-to-Total Asset Ratio	0.7910***	1.0199***	0.7600***	1.0146***
	(28.00)	(14.70)	(26.92)	(14.63)
Return-on-Average Assets	0.0032***	0.2713***	0.0054	0.2750***
	(0.46)	(5.69)	(0.78)	(5.77)
Nonperforming Loans-to-Total Loan Ratio	-0.0555***	-0.0948***	-0.0586***	-0.0979***
	(-7.61)	(-4.68)	(-8.05)	(-4.83)
Federal Funds Sold-to-Total Asset Ratio	-0.1101***	-0.1363***	-0.1113***	-0.1371***
	(-37.75)	(-23.45)	(-38.24)	(-23.57)
Real Estate Loans-to-Asset Ratio	-0.1234***	-0.1637***	-0.1256***	-0.1649***
	(-55.71)	(-43.57)	(-56.72)	(-43.85)
Agricultural Loans-to-Asset Ratio	-0.0102*	-0.0366**	-0.0063	-0.0347**
	(-1.67)	(-2.57)	(-1.04)	(-2.44)
Individual Loans-to-Asset Ratio	-0.0600***	-0.0926***	-0.0621***	-0.0928***
	(-15.15)	(-12.29)	(-15.68)	(-12.32)
FHLB Member or Advance Use Dummy Variable	0.0035***	0.0030***	-0.0153***	-0.0026
	(8.62)	(5.44)	(-5.16)	(-0.74)
Advances-to-Total Asset Ratio		-0.0011		-0.0014
		(-1.15)		(-1.42)
Number of Member Years		0.0025***		0.0025***
		(10.27)		(10.26)

Table 3.18 Commercial and Industrial Loans-to-Asset Ratio Fixed-Effects Estimates

Member or Advance User...	No Interactions		With Interactions	
	all banks	all members	all banks	all members
--classified as a small bank			0.0001	0.0010
			(0.09)	(0.50)
--affiliated with a bank-holding company			-0.0020*	-0.0038**
			(-1.75)	(-2.18)
--located in a highly concentrated local market[c]			-0.0002	0.0007
			(-0.33)	(0.83)
--located in an unconcentrated local market[d]			-0.0052***	-0.0041***
			(-4.80)	(-2.68)
--located in a local market that is losing population[e]			-0.00004	-0.0002
FHLB Member or Advance User located in:			(-0.07)	(-0.27)
District 2 - New York			0.0149***	0.0063
			(4.56)	(1.57)
District 3 - Pittsburgh			0.0123***	0.00003
			(4.26)	(0.01)
District 4 - Atlanta			0.0168***	0.0081***
			(6.42)	(2.76)
District 5 - Cincinnati			0.0180***	0.0101***
			(6.74)	(3.29)
District 6 - Indianapolis			0.0204***	0.0103***
			(7.09)	(3.17)
District 7 - Chicago			0.0259***	0.0087***
			(9.82)	(2.89)
District 8 - Des Moines			0.0261***	0.0111***
			(10.18)	(3.90)
District 9 - Dallas			0.0246***	0.0113***
			(9.34)	(3.82)
District 10 - Topeka			0.0263***	0.0080***
			(10.02)	(2.70)
District 11 - San Francisco			-0.0063**	0.0017
			(-2.00)	(0.43)
District 12 - Seattle			0.0173***	0.0039
			(5.68)	(1.17)
sigma (u)	0.0671	0.0652	0.0674	0.0654
sigma (e)	0.0313	0.0267	0.0312	0.0266
rho (fraction of variance due to u_i)	0.8212	0.8566	0.8237	0.8580
Corr(u_i, Xb)	-0.0678	-0.1421	-0.0916	-0.1590
Number of Observations	86676	28498	86676	28498
Number of Individual Banks	12393	6414	12393	6414
F-test that all $u_i = 0$	23.62***	19.47***	23.34***	19.00***
R-squared: Within	7.73%	10.96%	8.28%	11.21%
Between	7.17%	4.03%	6.30%	3.65%
Overall	5.35%	4.56%	4.82%	4.22%

Notes: *Single, double, and triple asteriks (*) signify significance at the 10, 5, and 1 percent levels, respectively.

t-values in parentheses.

a Commercial & industrial loans not exceeding $1 million.

b Banks with total assets not exceeding $500 million.

c,d HHI of local market deposit concentration in excess of 1800, and less than 1000, respectively.

e Defined as a local market experiencing negative population growth.

Table 3.18 Commercial and Industrial Loans, continued

c. Agricultural Loans

From the non-interaction results of Table 3.19, a bank increasing in size decreases holdings of agricultural loans, as does an FHLB member as it accumulates additional years of membership. The overall results on the effect of attaining membership to an FHLB and of advance use on agricultural loan ratios are insignificant, suggesting the research fails to reject the implication that FHLB participation, in general, affects agricultural lending. However, the interaction results show a statistically significant increase in agricultural loan investment amongst small banks becoming FHLB members, further increasing if these small banks are located in either highly concentrated or unconcentrated markets, although the increase is greatest in competitive markets. Areas suffering from a loss of population are also associated with higher agricultural loan ratios. Significant decreases in agricultural loan holdings occur for banks becoming members in the Des Moines district, and for members that begin using advances in highly concentrated markets or within the districts of Chicago, Des Moines, and Seattle. Agricultural loan demand may not be strong in areas where government payments and subsidies issued to farmers are relatively high.

Variable	No Interactions		With Interactions	
	all banks	all members	all banks	all members
Intercept	0.1139***	0.1012***	0.1085***	0.1018***
	(13.98)	(4.53)	(13.25)	(4.54)
Size of Bank	-0.0034***	0.00001	-0.0037***	-0.00002
	(-9.69)	(0.03)	(-10.44)	(-0.03)
Small Bank[b] Dummy Variable	-0.0035***	-0.0028***	-0.0021**	-0.0018*
	(-4.80)	(-3.82)	(-2.27)	(-1.66)
Rural County Location Dummy Variable	0.0032***	0.0053***	0.0032***	0.0054***
	(3.78)	(4.07)	(3.71)	(4.10)
HHI of market deposit concentration	-0.0002	-0.0029	-0.0010	-0.0029
	(-0.11)	(-1.11)	(-0.47)	(-1.07)
Capital Ratio	0.0155***	0.0318***	0.0145***	0.0316***
	(3.63)	(4.54)	(3.39)	(4.51)
BHC Affiliation Dummy Variable	-0.0030***	-0.0051***	-0.0026**	-0.0056***
	(-2.79)	(-3.36)	(-2.32)	(-3.44)
Growth Rate of Bank	-7.07e-06	-0.0007***	-6.55e-06	-0.0007***
	(-0.45)	(-3.10)	(-0.42)	(-3.12)
Growth Rate of Local Market Population	0.0121	0.0088	0.0153*	0.0144
	(1.50)	(0.78)	(1.85)	(1.21)
Local Market Per Capita Income	0.0001	-0.0045**	0.0008	-0.0046**
	(0.12)	(-2.02)	(0.90)	(-2.06)
Core Deposits-to-Total Asset Ratio	-0.0068***	-0.0012	-0.0071***	-0.0014
	(-4.38)	(-0.51)	(-4.55)	(-0.59)
Other Borrowed Money-to-Total Asset Ratio	-0.0109***	-0.0137***	-0.0112***	-0.0142***
	(-4.17)	(-4.30)	(-4.30)	(-4.45)
Merger Involvement Dummy Variable	0.0009**	0.0017***	0.0008*	0.0017***
	(2.04)	(3.63)	(1.94)	(3.70)
Loan Loss Provisions-to-Total Asset Ratio	0.1232***	0.1402***	0.1272***	0.1423***
	(7.18)	(4.25)	(7.40)	(4.31)
Return-on-Average Assets	0.0111***	0.1298***	0.0104**	0.1304***
	(2.63)	(5.75)	(2.47)	(5.77)
Nonperforming Loans-to-Total Loan Ratio	0.0037	0.0012	0.0048	0.0030
	(0.84)	(0.13)	(1.08)	(0.31)
Federal Funds Sold-to-Total Asset Ratio	-0.0408***	-0.0304***	-0.0402***	-0.0299***
	(-22.98)	(-10.95)	(-22.65)	(-10.74)
Commercial & Industrial Loans-to-Asset Ratio	-0.0037*	-0.0082**	-0.0023	-0.0078**
	(-1.67)	(-2.57)	(-1.04)	(-2.44)
Individual Loans-to-Asset Ratio	-0.0053**	-0.0160***	-0.0046*	-0.0161***
	(-2.206)	(-4.48)	(-1.91)	(-4.51)
Real Estate Loans-to-Asset Ratio	-0.0249***	-0.0224***	-0.0243***	-0.0218***
	(-18.24)	(-12.11)	(-17.78)	(-11.79)
FHLB Member or Advance Use Dummy Variable	-0.0001	0.00004	0.0031*	0.0023
	(-0.48)	(0.16)	(1.72)	(1.38)
Advances-to-Total Asset Ratio		-0.0002		-0.0001
		(-0.33)		(-0.14)
Number of Member Years		-0.0004***		-0.0004***
		(-3.10)		(-3.11)

Table 3.19 Agricultural Loans-to-Asset Ratio Fixed-Effects Estimates

| | *No Interactions* | | *With Interactions* | |
Member or Advance User…	**all banks**	**all members**	**all banks**	**all members**
--classified as a small bank			-0.0019**	-0.0011
			(-2.17)	(-1.24)
--affiliated with a bank-holding company			-0.0008	0.0004
			(-1.17)	(0.53)
--located in a highly concentrated local market[c]			0.0008**	-0.0008**
			(2.00)	(-2.02)
--located in an unconcentrated local market[d]			0.0018***	-0.0006
			(2.74)	(-0.80)
--located in a local market that is losing population[e]			0.0003	0.0006*
FHLB Member or Advance User located in:			(0.73)	(1.88)
District 2 - New York			0.0007	0.0003
			(0.37)	(0.14)
District 3 - Pittsburgh			0.0003	0.0006
			(0.20)	(0.42)
District 4 - Atlanta			0.0005	-0.0006
			(0.32)	(-0.43)
District 5 - Cincinnati			-0.0012	-0.0014
			(-0.75)	(-0.94)
District 6 - Indianapolis			-0.0017	-0.0018
			(-0.96)	(-1.16)
District 7 - Chicago			-0.0026	-0.0025*
			(-1.62)	(-1.77)
District 8 - Des Moines			-0.0045***	-0.0023*
			(-2.90)	(-1.72)
District 9 - Dallas			-0.0018	-0.0010
			(-1.12)	(-0.72)
District 10 - Topeka			-0.0012	0.0006
			(-0.78)	(0.46)
District 11 - San Francisco			0.0039**	-0.0010
			(2.02)	(-0.54)
District 12 - Seattle			0.0035*	-0.0038**
			(1.92)	(-2.40)
sigma (u)	0.0806	0.0712	0.0808	0.0713
sigma (e)	0.0189	0.0126	0.0189	0.0126
rho (fraction of variance due to u_i)	0.9478	0.9696	0.9481	0.9697
Corr(u_i, Xb)	0.4917	0.3901	0.4638	0.3750
Number of Observations	86676	28498	86676	28498
Number of Individual Banks	12393	6414	12393	6414
F-test that all $u_i = 0$	84.61***	76.27***	83.00***	69.57***
R-squared: Within	1.70%	3.13%	1.87%	3.32%
Between	30.76%	23.99%	27.82%	23.02%
Overall	29.26%	20.36%	26.63%	19.16%

Notes: *Single, double, and triple asteriks (*) signify significance at the 10, 5, and 1 percent levels, respectively.

t-values in parentheses.

a Commercial & industrial loans not exceeding $1 million.

b Banks with total assets not exceeding $500 million.

c,d HHI of local market deposit concentration in excess of 1800, and less than 1000, respectively.

e Defined as a local market experiencing negative population growth.

Table 3.19 Agricultural Loans, continued

- PROFITABILITY

FHLB membership and the use of advances affects bank returns, given the availability of other sources of funds, and existing bank, market, and economic conditions. Return-on-average assets (ROAA) is a performance measure used to evaluate the relative effectiveness of a bank's ability to use its assets to generate profits. As seen from the no-interaction regression results in Table 3.20, on average, a bank increases ROAA by a statistically significant 5 bps after attaining membership status, and by another 2 bps after using advances, although returns suffer slightly as member banks accrue additional membership years. Therefore, the positive relationships between membership and advance use on ROAA suggest banks participating in the FHLB System have relatively stronger financial conditions.

Banks can potentially increase return-on-average equity (ROAE) ratios by increasing leverage positions through generating more debt, given existing ROAA levels. The no-interaction results of Table 3.21 show banks attaining membership in the System generate negative, although insignificant, effects on ROAE, although member banks that begin using advances increase ROAE by 19 bps. Member banks may have improved ROAE by increasing leverage positions with the use of System advances.

From the interaction results of Tables 3.20 and 3.21, statistically significant results suggest that banks becoming members in highly concentrated markets generate higher ROAA, and small members increase ROAE by 60 bp after using System advances. Additionally, the use of advances by member banks affiliated with bank-holding companies are associated with higher levels of profitability, as measured by ROAA or ROAE, while advance use by members in markets losing population generates negative pressure on these same measures. The significant FHLB regional results reveal banks becoming members in either the Boston or Pittsburgh districts enjoy higher ROAA, whereas members who begin using advances, regardless of the district, suffer negative effects on ROAAs and ROAE.

| | No Interactions | | With Interactions | |
Variable	all banks	all members	all banks	all members
Intercept	0.1451***	0.0711***	0.0019	-0.0179***
	(42.37)	(8.03)	(-0.28)	(-2.69)
Size of Bank	-0.0031***	-0.0022***	-0.0014***	0.0006***
	(-22.97)	(-10.50)	(-4.67)	(3.65)
Small Bank[b] Dummy Variable	-0.0009***	-0.0012***	0.0021**	0.00005
	(-3.55)	(-4.08)	(2.54)	(0.16)
Rural County Location Dummy Variable	-0.0002	0.0009	0.0006	0.0020***
	(-0.52)	(1.56)	(0.81)	(5.18)
HHI of market deposit concentration	0.0006***	0.0009***	0.0049***	0.0011
	(2.89)	(3.22)	(2.63)	(1.39)
Capital Ratio	0.0008	-0.0007	0.0708***	0.0192***
	(0.53)	(-0.29)	(19.79)	(9.67)
BHC Affiliation Dummy Variable	-0.0009**	-0.0010*	0.0002	0.0004
	(-2.01)	(-1.74)	(0.16)	(0.80)
Growth Rate of Bank	0.0005***	0.0022***	-0.00001	-0.0006***
	(13.42)	(25.98)	(-0.79)	(-9.01)
Growth Rate of Local Market Population	-0.0008	-0.0015	0.0073	0.0025
	(-0.29)	(-0.34)	(1.01)	(0.71)
Local Market Per Capita Income	-0.0084***	-0.0023***	0.0013*	0.0017**
	(-23.69)	(-2.78)	(1.71)	(2.59)
Merger Involvement Dummy Variable	0.0048***	0.0039***	-0.0008**	-0.0006***
	(33.24)	(22.81)	(-2.04)	(-3.98)
Loan Loss Provisions-to-Total Asset Ratio	0.2410***	0.4265***	-0.7855***	-0.6792***
	(31.10)	(33.30)	(-53.57)	(-78.07)
Nonperforming Loans-to-Total Loan Ratio	-0.0121***	-0.0112***	-0.0150***	-0.0304***
	(-6.99)	(-3.05)	(-3.90)	(-10.66)
Gross Loan-to-Asset Ratio	0.0239***	0.0224***	0.0116***	0.0067***
	(57.77)	(36.59)	(12.30)	(14.34)
FHLB Member or Advance Use Dummy Variable	-0.0003***	-0.0004***	0.0035**	-0.0005
	(-3.06)	(-4.02)	(2.27)	(-1.06)
Advances-to-Total Asset Ratio		-0.0001		0.00003
		(-0.47)		(0.19)
Number of Member Years		-0.0005***		-0.0001***
		(-11.75)		(-4.13)
Member or Advance User…				
--classified as a small bank			-0.0012	0.0004
			(-1.64)	(1.59)
--affiliated with a bank-holding company			-0.0002	0.0008***
			(-0.27)	(3.11)
--located in a highly concentrated local market[c]			-0.0009**	8.71e-06
			(-2.55)	(0.07)
--located in an unconcentrated local market[d]			-0.0001	0.0003
			(-0.17)	(1.43)
--located in a local market that is losing population[e]			-0.0004	-0.0002*
			(-1.17)	(-1.82)

Table 3.20 Return-on-Average Assets Fixed-Effects Estimates

	No Interactions		With Interactions	
	all banks	**all members**	**all banks**	**all members**
FHLB Member or Advance User located in:				
District 2 - New York			0.0004	-0.0003
			(0.21)	(-0.51)
District 3 - Pittsburgh			-0.0009***	-0.0008*
			(-0.57)	(-1.84)
District 4 - Atlanta			0.00002	-0.0002
			(0.01)	(-0.57)
District 5 - Cincinnati			-0.0011	-0.0005
			(-0.81)	(-1.07)
District 6 - Indianapolis			-0.0013	-0.0003
			(-0.84)	(-0.75)
District 7 - Chicago			-0.0020	-0.0008*
			(-1.41)	(-1.84)
District 8 - Des Moines			-0.0017	-0.0003
			(-1.22)	(-0.66)
District 9 - Dallas			-0.0020	-0.0011***
			(-1.47)	(-2.65)
District 10 - Topeka			-0.0015	0.0002
			(-1.06)	(0.39)
District 11 - San Francisco			0.0019	0.0003
			(1.15)	(0.49)
District 12 - Seattle			0.0006	0.0002
			(0.37)	(0.37)
sigma (u)	0.0091	0.0078	0.0186	0.0060
sigma (e)	0.0047	0.0042	0.0165	0.0038
rho (fraction of variance due to u_i)	0.7870	0.7791	0.5598	0.7200
Corr(u_i, Xb)	-0.3123	-0.1646	-0.1052	-0.0381
Number of Observations	53666	24708	86678	28499
Number of Individual Banks	10814	6309	12393	6414
F-test that all $u_i = 0$	11.73***	9.45***	3.54***	6.87***
R-squared: Within	5.62%	25.70%	5.67%	25.87%
Between	7.92%	14.26%	7.18%	14.02%
Overall	5.47%	17.27%	5.08%	17.08%

Notes: *Single, double, and triple asteriks (*) signify significance at the 10, 5, and 1 percent levels, respectively.

t-values in parentheses.

a Commercial & industrial loans not exceeding $1 million.

b Banks with total assets not exceeding $500 million.

c HHI of local market deposit concentration in excess of 1800.

d HHI of local market deposit concentration less than 1000.

e Defined as a local market experiencing negative population growth.

Table 3.20 Return-on-Average Assets, continued

Variable	No Interactions		With Interactions	
	all banks	all members	all banks	all members
Intercept	0.4808**	-0.2548***	0.4880**	-0.2266***
	(2.30)	(-2.94)	(2.31)	(-2.60)
Size of Bank	0.0444***	0.0124***	0.0436***	0.0125***
	(4.55)	(6.16)	(4.43)	(6.20)
Small Bank[b] Dummy Variable	0.0168	0.0043	0.0069	-0.0006
	(0.82)	(1.47)	(0.27)	(-0.14)
Rural County Location Dummy Variable	0.0086	0.0270***	0.0083	0.0263***
	(0.36)	(5.28)	(0.35)	(5.15)
HHI of market deposit concentration	0.0402	0.0176*	0.0402	0.0178*
	(0.67)	(1.70)	(0.67)	(1.70)
Capital Ratio	0.0913	-0.2900***	0.0985	-0.2911
	(0.80)	(-11.12)	(0.86)	(-11.16)
BHC Affiliation Dummy Variable	-0.0133	0.0018	-0.0153	-0.0046
	(-0.44)	(0.31)	(-0.49)	(-0.74)
Growth Rate of Bank	-0.00004	0.0025***	-0.00004	0.0024***
	(-0.08)	(2.66)	(-0.08)	(2.61)
Growth Rate of Local Market Population	0.2573	0.0686	0.2514	0.0377
	(1.14)	(1.54)	(1.09)	(0.81)
Local Market Per Capita Income	-0.0946***	0.0226**	-0.0935***	0.0207**
	(-3.79)	(2.59)	(-3.73)	(2.37)
Merger Involvement Dummy Variable	-0.0097	0.0004	-0.0094	0.0004
	(-0.82)	(0.24)	(-0.79)	(0.24)
Loan Loss Provisions-to-Total Asset Ratio	-11.4344***	-8.8584***	-11.4052***	-8.8407***
	(-24.30)	(-77.59)	(-24.18)	(-77.40)
Nonperforming Loans-to-Total Loan Ratio	-0.3124**	-0.4387***	-0.3108**	-0.4415***
	(-2.53)	(-11.71)	(-2.51)	(-11.78)
Gross Loan-to-Asset Ratio	0.1325***	0.0757***	0.1349***	0.0758***
	(4.39)	(12.30)	(4.46)	(12.30)
FHLB Member or Advance Use Dummy Variable	-0.0032	0.0019**	-0.0018	-0.0070
	(-0.47)	(1.97)	(-0.04)	(-1.07)
Advances-to-Total Asset Ratio		0.0023		0.0027
		(1.27)		(1.49)
Number of Member Years		-0.0026***		-0.0025***
		(-2.94)		(-5.55)
Member or Advance User…				
--classified as a small bank			0.0156	0.0060*
			(0.65)	(1.69)
--affiliated with a bank-holding company			0.0049	0.0119***
			(0.26)	(3.64)
--located in a highly concentrated local market[c]			-0.0040	0.0014
			(-0.37)	(0.86)
--located in an unconcentrated local market[d]			0.0033	0.0032
			(0.18)	(1.12)
--located in a local market that is losing population[e]			-0.0011	-0.0023*
			(-0.11)	(-1.71)

Table 3.21 Return-on-Average Equity Fixed-Effects Estimates

	No Interactions		With Interactions	
	all banks	**all members**	**all banks**	**all members**
FHLB Member or Advance User located in:				
District 2 - New York			-0.0043	-0.0070
			(-0.08)	(-0.94)
District 3 - Pittsburgh			-0.0166	-0.0117**
			(-0.34)	(-2.00)
District 4 - Atlanta			-0.0116	-0.0055
			(-0.26)	(-1.01)
District 5 - Cincinnati			-0.0171	-0.0089
			(-0.38)	(-1.56)
District 6 - Indianapolis			-0.0184	-0.0080
			(-0.38)	(-1.34)
District 7 - Chicago			-0.0243	-0.0131**
			(-0.54)	(-2.34)
District 8 - Des Moines			-0.0200	-0.0050
			(-0.46)	(-0.95)
District 9 - Dallas			-0.0306	-0.0193***
			(-0.68)	(-3.50)
District 10 - Topeka			-0.0183	-0.0023
			(-0.41)	(-0.41)
District 11 - San Francisco			0.0095	-0.0016
			(0.18)	(-0.21)
District 12 - Seattle			-0.0117	-0.0048
			(-0.23)	(-0.77)
sigma (u)	0.9694	0.0616	0.9694	0.0618
sigma (e)	0.5305	0.0494	0.5305	0.0494
rho (fraction of variance due to u_i)	0.7695	0.6088	0.7695	0.6108
Corr(u_i, Xb)	-0.0119	-0.0580	-0.0118	-0.0660
Number of Observations	86678	28499	86678	28499
Number of Individual Banks	12393	6414	12393	6414
F-test that all $u_i = 0$	6.40***	5.09***	6.40***	4.96***
R-squared: Within	0.96%	24.81%	0.97%	25.00%
Between	1.31%	20.36%	1.30%	19.90%
Overall	1.05%	20.35%	1.04%	20.03%

Notes: *Single, double, and triple asteriks (*) signify significance at the 10, 5, and 1 percent levels, respectively.

t-values in parentheses.

a Commercial & industrial loans not exceeding $1 million.

b Banks with total assets not exceeding $500 million.

c HHI of local market deposit concentration in excess of 1800.

d HHI of local market deposit concentration less than 1000.

e Defined as a local market experiencing negative population growth.

Table 3.21 Return-on-Average Equity, continued

• INTEREST RATE RISK

Relatively longer maturity gaps between long-term assets and liabilities suggest greater susceptibility to changes in interest rates, potentially causing wide variations in bank net interest income. From the no-interaction results of Table 3.22, maturity gaps as a percentage of total assets increase an average of 54 bps after a bank becomes an FHLB member. Since mortgage-related assets tend to have longer maturities, and recalling that investment in mortgage-related securities and real estate lending increases subsequent to membership attainment and advance use, a relatively higher level of interest rate risk, as measured by lengthened maturity gaps, is correlated with FHLB participation.

Results associating maturity gaps and advance use are negative but insignificant, whereas positive and significant results indicate increasing the level of advances taken and accumulating experience with the FHLB System through additional membership years generates larger maturity gaps, thereby increasing the interest rate risk exposure to a member bank. However, the statistically significant results for the sample of only member banks reveal smaller maturity gaps are associated with increased investment in mortgage-related assets. This result implies members, as a whole, are able to better match the liabilities of assets and liabilities held in portfolio, thereby lessening exposure to interest rate risk.

The interaction regression results suggest small banks and small member banks have levels of interest rate risk that are positively related to becoming members and to using System advances. Additionally, interest rate risk also increases for banks and member banks in markets that lose population, although gaps shorten with banks becoming members in unconcentrated markets. Affiliated banks have maturity gaps that shorten after attaining membership status, although affiliated members lengthen their gaps after the use of advances.

Variable	No Interactions		With Interactions	
	all banks	all members	all banks	all members
Intercept	-4.5121***	-0.8921***	-4.5091***	-0.9027***
	(-123.75)	(-6.23)	(-123.11)	(-6.29)
Size of Bank	0.0327***	0.0142***	0.0320***	0.0152***
	(20.49)	(4.35)	(19.96)	(4.66)
Small Bank[b] Dummy Variable	-0.0071**	-0.0044	-0.0106**	-0.0161**
	(-2.147)	(-0.95)	(-2.50)	(-2.35)
Rural County Location Dummy Variable	0.0521***	0.0386***	0.0505***	0.0387***
	(13.81)	(4.68)	(13.39)	(4.70)
HHI of market deposit concentration	0.0352***	0.0140	0.0312***	0.0118
	(3.64)	(0.83)	(3.22)	(0.69)
Capital Ratio	-0.2310***	-3584***	-0.2209***	-0.3503***
	(-11.87)	(-8.14)	(-11.35)	(-7.95)
BHC Affiliation Dummy Variable	0.0112**	-0.0421***	0.0158***	-0.0507***
	(2.25)	(-4.05)	(3.12)	(-4.64)
Growth Rate of Bank	0.0001	0.0007	0.0001	0.0005
	(0.78)	(0.47)	(0.81)	(0.30)
Growth Rate of Local Market Population	-0.6731***	-0.4003***	-0.5754***	-0.3524
	(-18.15)	(-5.40)	(-15.19)	(-4.54)
Local Market Per Capita Income	0.4540***	0.1127***	0.4540***	0.1140***
	(110.12)	(7.90)	(109.96)	(7.98)
Core Deposits-to-Total Asset Ratio	-0.1538***	-0.1209***	-0.1522***	-0.1181***
	(-21.97)	(-7.69)	(-21.76)	(-7.51)
Other Borrowed Money-to-Total Asset Ratio	0.1648***	0.1364***	0.1620***	0.1364***
	(13.81)	(6.69)	(13.57)	(6.68)
Merger Involvement Dummy Variable	-0.0039**	-0.0021	-0.0040**	-0.0018
	(-2.02)	(-0.69)	(-2.06)	(-0.58)
Loan Loss Provisions-to-Total Asset Ratio	0.5287***	0.5972***	0.5655***	0.5937***
	(7.08)	(2.89)	(7.58)	(2.87)
Return-on-Average Assets	0.0430**	0.2308	0.0394**	0.2313
	(2.34)	(1.63)	(2.15)	(1.63)
Federal Funds Sold-to-Total Asset Ratio	-0.2371***	-0.3534***	-0.2329***	-0.3500***
	(-29.06)	(-19.65)	(-28.59)	(-19.45)
Mortgage-Related Assets-to-Total Asset Ratio	0.0251***	-0.0242***	0.0260***	-0.0251***
	(5.12)	(-2.76)	(5.29)	(-2.86)
Gross Loan-to-Asset Ratio	-0.0954***	-0.1561***	-0.0903***	-0.1523***
	(-18.26)	(-14.71)	(-17.27)	(-14.33)
FHLB Member or Advance Use Dummy Variable	0.0054***	-0.0021	0.0089	-0.0171
	(4.72)	(-1.23)	(1.09)	(-1.60)
Advances-to-Total Asset Ratio		0.0073***		0.0076***
		(2.61)		(2.69)
Number of Member Years		0.0295***		0.0293***
		(40.02)		(39.61)

Table 3.22 Long-Term Asset/Liability Maturity Gap Fixed-Effects Estimates

Member or Advance User…	No Interactions		With Interactions	
	all banks	**all members**	**all banks**	**all members**
--classified as a small bank			0.0087**	0.0160***
			(2.24)	(2.69)
--affiliated with a bank-holding company			-0.0142***	0.0134**
			(-4.58)	(2.49)
--located in a highly concentrated local market[c]			-0.0004	'-0.0009
			(-0.23	(-0.33)
--located in an unconcentrated local market[d]			-0.0069**	-0.0070
			(-2.30)	(-1.48)
--located in a local market that is losing population[e]			0.0174***	0.0050**
FHLB Member or Advance User located in:			(10.89)	(2.27)
District 2 - New York			0.0375***	0.0225*
			(4.15)	(1.82)
District 3 - Pittsburgh			0.0174**	0.0035
			(2.19)	(0.37)
District 4 - Atlanta			0.0029	-0.0210**
			(0.40)	(-2.36)
District 5 - Cincinnati			0.0127*	-0.0027
			(1.73)	(-0.29)
District 6 - Indianapolis			0.0013	-0.0164*
			(0.16)	(-1.67)
District 7 - Chicago			0.0009	-0.0046
			(0.12)	(-0.50)
District 8 - Des Moines			-0.0182**	-0.0214**
			(-2.57)	(-2.51)
District 9 - Dallas			-0.0210***	-0.0143
			(-2.90)	(-1.61)
District 10 - Topeka			-0.0107	-0.0142
			(-1.48)	(-1.59)
District 11 - San Francisco			0.0435***	-0.0043
			(5.02)	(-0.36)
District 12 - Seattle			0.0033	-0.0242**
			(0.40)	(-2.39)
sigma (u)	0.1488	0.1429	0.1493	0.1426
sigma (e)	0.0819	0.0748	0.0816	0.0747
rho (fraction of variance due to u_i)	0.7676	0.7848	0.7699	0.7845
Corr(u_i, Xb)	-0.6342	-0.2650	-0.6372	-0.2658
Number of Observations	77607	24547	77607	24547
Number of Individual Banks	12389	6380	12389	6380
F-test that all $u_i = 0$	8.72***	8.63***	8.62***	8.45***
R-squared: Within	42.89%	54.36%	43.25%	54.52%
Between	3.65%	1.38%	3.76%	1.62%
Overall	9.55%	16.78%	9.72%	17.31%

Notes: *Single, double, and triple asteriks (*) signify significance at the 10, 5, and 1 percent levels, respectively.

t-values in parentheses.

a Commercial & industrial loans not exceeding $1 million.

b Banks with total assets not exceeding $500 million.

c,d HHI of local market deposit concentration in excess of 1800, and less than 1000, respectively.

e Defined as a local market experiencing negative population growth.

Table 3.22 Long-Term Maturity Gaps, continued

• LIQUIDITY

The FHLB System provides a potential source of funds for members through the use of advances or the pledging of existing loans as collateral for advances. Significant non-interaction results from Table 3.23 reveal banks and member banks, in general, increase loan-to-core deposit ratios subsequent to becoming a member and to using advances. Given that core deposit levels have been diminishing over the 1990s, and coupled with the previous results of increasing loan-to-asset ratios among FHLB members, these results suggest that bank participation in the FHLB program permits the extension of loans without accumulating additional core deposits to fund them. The accrual of additional membership years also has a positive effect on loan-to-core deposit ratios.

The interaction regression results reveal banks in highly concentrated markets or in markets losing population experience a decline in loan-to-core deposit ratios after becoming members, as do members that begin using advances in highly concentrated markets. These results are fairly intuitive since, by definition, banks in highly concentrated markets hold relatively large portions of the markets' deposits, and markets experiencing negative population growth realize a decrease in the availability of local profitable lending opportunities.

Variable	No Interactions		With Interactions	
	all banks	all members	all banks	all members
Intercept	-5.7079***	-0.3866*	-5.6494***	-0.3869*
	(-90.55)	(-1.92)	(-89.04)	(-1.92)
Size of Bank	0.0154***	-0.0096**	0.0190***	-0.0088*
	(5.12)	(-2.04)	(6.27)	(-1.86)
Small Bank[b] Dummy Variable	0.0424***	0.0133**	0.0350***	0.0090
	(6.80)	(1.99)	(4.39)	(0.94)
Rural County Location Dummy Variable	0.0252***	-0.0012	0.0234***	-0.0013
	(3.47)	(-0.10)	(3.22)	(-0.11)
HHI of market deposit concentration	-0.1113***	-0.0465*	-0.1115***	-0.0525**
	(-6.07)	(-1.93)	(-6.07)	(-2.16)
Capital Ratio	0.8250***	1.0806***	0.8113***	1.0846***
	(22.92)	(17.64)	(22.53)	(17.71)
BHC Affiliation Dummy Variable	-0.0200**	-0.0369***	-0.0172*	-0.0324**
	(-2.16)	(-2.69)	(-1.81)	(-2.22)
Growth Rate of Bank	0.0001	0.0092***	0.0001	0.0091***
	(0.50)	(4.28)	(0.46)	(4.24)
Growth Rate of Local Market Population	-0.1688**	-0.0298	-0.1019	0.0219
	(-2.45)	(-0.29)	(-1.44)	(0.20)
Local Market Per Capita Income	0.5115***	0.0048	0.5024***	0.0040
	(68.91)	(0.24)	(67.45)	(0.20)
Other Borrowed Money-to-Total Asset Ratio	0.9581***	0.8952***	0.9654***	0.9010***
	(46.75)	(36.65)	(47.08)	(36.89)
Merger Involvement Dummy Variable	0.0027	0.0071*	0.0029	0.0067
	(0.74)	(1.66)	(0.78)	(1.57)
Loan Loss Provisions-to-Total Asset Ratio	5.6168***	7.1180***	5.4265***	7.0870***
	(38.67)	(24.10)	(37.35)	(24.02)
Return-on-Average Assets	0.0379	2.5496***	0.0497	2.5603***
	(1.04)	(12.50)	(1.36)	(12.57)
Nonperforming Loans-to-Total Loan Ratio	-0.4505***	-0.4775***	-0.4541***	-0.4983***
	(-11.95)	(-5.49)	(-12.06)	-(5.73)
Federal Funds Sold-to-Total Asset Ratio	-0.5505***	-0.4163***	-0.5517***	-0.4197***
	(-37.46)	(-17.24)	(-37.62)	(-17.40)
FHLB Member or Advance Use Dummy Variable	0.0421***	0.0167***	-0.0414***	-0.0358**
	(19.94)	(7.01)	(-2.70)	(-2.37)
Advances-to-Total Asset Ratio		0.0040		0.0024
		(0.94)		(0.579)
Number of Member Years		0.0262***		0.0260***
		(25.43)		(25.22)

Table 3.23 Loan-to-Core Deposit Ratio Fixed-Effects Estimates

	No Interactions		With Interactions	
FHLB member or advance user…	**all banks**	**all members**	**all banks**	**all members**
--classified as a small bank			0.0042	0.0036
			(0.57)	(0.43)
--affiliated with a bank-holding company			-0.0108*	-0.0072
			(-1.84)	(-0.95)
--located in a highly concentrated local market[c]			0.0162***	0.0104***
			(4.89)	(2.84)
--located in an unconcentrated local market[d]			-0.0043	-0.0059
			(-0.76)	(-0.90)
--located in a local market that is losing population[e]			0.0106***	0.0045
FHLB Member or Advance User located in:			(3.59)	(1.46)
District 2 - New York			0.0540***	0.0406**
			(3.18)	(2.34)
District 3 - Pittsburgh			0.0357**	-0.0016
			(2.40)	(-0.12)
District 4 - Atlanta			0.0396***	0.0514***
			(2.92)	(4.06)
District 5 - Cincinnati			0.0641***	0.0595***
			4.61.73)	(4.50)
District 6 - Indianapolis			0.0663***	0.0633***
			(4.46)	(4.55)
District 7 - Chicago			0.0932***	0.0527***
			(6.83)	(4.08)
District 8 - Des Moines			0.0913**	0.0562***
			(6.87)	(4.62)
District 9 - Dallas			0.0918***	0.0725***
			(6.74)	(5.70)
District 10 - Topeka			0.1215***	0.0537***
			(8.93)	(4.22)
District 11 - San Francisco			-0.0188	0.0161
			(-1.15)	(0.94)
District 12 - Seattle			0.0920***	0.0218
			(5.85)	(1.51)
sigma (u)	0.3752	0.2559	0.3755	0.2562
sigma (e)	0.1621	0.1144	0.1616	0.1142
rho (fraction of variance due to u_i)	0.8428	0.8333	0.8437	0.8342
Corr(u_i, Xb)	-0.1102	-0.0612	-0.1094	-0.0674
Number of Observations	86652	28498	86652	28498
Number of Individual Banks	12389	6414	12389	6414
F-test that all $u_i = 0$	25.17***	17.43***	25.00***	17.09***
R-squared: Within	25.88%	31.90%	26.27%	32.24%
Between	13.38%	6.41%	13.24%	6.26%
Overall	13.05%	10.25%	13.00%	10.03%

Notes: *Single, double, and triple asteriks (*) signify significance at the 10, 5, and 1 percent levels, respectively.

t-values in parentheses.

a Commercial & industrial loans not exceeding $1 million.

b Banks with total assets not exceeding $500 million.

c,d HHI of local market deposit concentration in excess of 1800, and less than 1000, respectively.

e Defined as a local market experiencing negative population growth.

Table 3.23 Loan-to-Core Deposit Ratios, continued

• QUALITY OF LOAN PORTFOLIOS

Since FHLB participation is associated with increases in loan-to-asset ratios, there exists the possibility of increased credit quality problems for System members. Loans extended to marginal or sub-par borrowers may increase the risk of non-payment or delayed future payments on loans, referred to as credit risk.

The negative and significant result from the no-interaction regression in Table 3.24 suggests banks can alleviate credit risk, as measured by the percentage of loans in non-performing status, by becoming FHLB members. Although the result from Table 3.25 displays a positive relationship between membership attainment and net charge-offs, an alternative measure of credit risk, this finding is statistically insignificant. Regardless of the credit quality measure used, the negative and significant results suggest member banks that begin using advances have slightly better performing loan portfolios, although increasing membership years is associated with increasing net charge-offs.

The additional interaction variables show that small banks becoming members generate negative, although statistically insignificant, results, with respect to both measures of credit risk. Similarly, small members that begin using advances generate positive but insignificant results for both measures. Member banks that use advances in concentrated markets enjoy better credit quality, as measured by a 35-bp decrease in non-performing loan ratios and a 2.5 percent drop in net charge-offs, possibly because these members are able to select the best loan opportunities in the market. On the other hand, banks and member banks in unconcentrated markets or markets that are losing population also experience lower credit risk, as measured by lower percentages of non-performing loans, after joining and using advances. Therefore, regardless of the market type or FHLB district in which the member is located, results suggest that System participation is positively and significantly associated with loan portfolio quality, as measured by lower non-performing loan and loan charge-off ratios. Concern over credit risk problems associated with the use of FHLB System funds is not substantiated by this research.

Variable	No Interactions		With Interactions	
	all banks	**all members**	**all banks**	**all members**
Intercept	0.1586***	0.0660***	0.1599***	0.0668***
	(25.64)	(4.24)	(25.66)	(4.29)
Size of Bank	-0.0010***	0.0007**	-0.0009***	0.0008**
	(-3.51)	(1.98)	(-3.08)	(2.12)
Small Bank[b] Dummy Variable	0.0011*	0.0010*	0.0013*	0.0005
	(1.79)	(1.90)	(1.66)	(0.70)
Rural County Location Dummy Variable	0.0011	-0.0011	0.0009	-0.0011
	(1.57)	(-1.18)	(1.29)	(-1.20)
HHI of market deposit concentration	-0.0092***	-0.0062***	-0.0086***	-0.0066***
	(-5.15)	(-3.35)	(-4.83)	(-3.53)
Capital Ratio	-0.0098***	0.0060	-0.0087**	0.0057
	(-2.86)	(1.29)	(-2.53)	(1.21)
BHC Affiliation Dummy Variable	0.0028***	0.0003	0.0032***	0.0002
	(3.15)	(0.26)	(3.51)	(0.19)
Growth Rate of Bank	-0.00002	-0.0005***	-0.00002	-0.0005***
	(-1.39)	(-2.98)	(-1.39)	(-3.03)
Growth Rate of Local Market Population	-0.0810***	-0.0373***	-0.0832***	-0.0437***
	(-12.09)	(-4.69)	(-12.11)	(-5.25)
Local Market Per Capita Income	-0.0129***	-0.0057***	-0.0132***	-0.0057***
	(-17.45)	(-3.64)	(-17.79)	(-3.67)
Loan Loss Provisions-to-Total Asset Ratio	0.9593***	0.6569***	0.9565***	0.6548***
	(69.45)	(28.95)	(69.17)	(28.86)
Return-on-Average Assets	-0.0140***	-0.1687***	-0.0137***	-0.1699***
	(-3.99)	(-10.68)	(-3.92)	(-10.76)
Gross Loan-to-Asset Ratio	-0.0149***	-0.0099***	-0.0152***	-0.0101***
	(-16.64)	(-8.94)	(-16.93)	(-9.16)
FHLB Member or Advance Use Dummy Variable	-0.0007***	-0.0005***	-0.0025*	-0.0044***
	(-3.32)	(-3.09)	(-1.71)	(-3.75)
Advances-to-Total Asset Ratio		-0.0001		-0.0002
		(-0.17)		(-0.54)
Number of Member Years		-00001		0.00001
		(-0.19)		(-0.15)
Member or Advance User…				
--classified as a small bank			-0.0006	0.0004
			(-0.89)	(0.58)
--affiliated with a bank-holding company			-0.0012**	0.0002
			(-2.11)	(0.40)
--located in a highly concentrated local market[c]			0.0001	0.0009***
			(0.26)	(3.17)
--located in an unconcentrated local market[d]			-0.0016***	0.0011**
			(-2.90)	(2.14)
--located in a local market that is losing population[e]			-0.0007**	-0.0006***
			(-2.34)	(-2.71)

Table 3.24 Nonperforming Loan-to-Total Loan Ratio Fixed-Effects Estimates

	No Interactions		With Interactions	
	all banks	**all members**	**all banks**	**all members**
FHLB Member or Advance User located in:				
District 2 - New York			-0.0011	0.0008
			(-0.67)	(0.60)
District 3 - Pittsburgh			0.0027*	0.0016
			(1.88)	(1.52)
District 4 - Atlanta			0.0048***	0.0026***
			(3.62)	(2.61)
District 5 - Cincinnati			0.0049***	0.0033***
			(3.63)	(3.21)
District 6 - Indianapolis			0.0050***	0.0041***
			(3.47)	(3.79)
District 7 - Chicago			0.0063***	0.0036***
			(4.72)	(3.60)
District 8 - Des Moines			0.0054***	0.0031***
			(4.15)	(3.28)
District 9 - Dallas			0.0003	0.0024**
			(0.24)	(2.41)
District 10 - Topeka			0.0035***	0.0035***
			(2.61)	(3.55)
District 11 - San Francisco			-0.0026	0.0001
			(-1.61)	(0.06)
District 12 - Seattle			0.0039**	0.0032***
			(2.52)	(2.83)
sigma (u)	0.0189	0.0099	0.0190	0.0100
sigma (e)	0.0158	0.0089	0.0157	0.0088
rho (fraction of variance due to u_i)	0.5896	0.5567	0.5933	0.5600
Corr(u_i, Xb)	-0.0291	0.0568	-0.0556	0.0267
Number of Observations	86678	28499	86678	28499
Number of Individual Banks	12393	6414	12393	6414
F-test that all $u_i = 0$	5.90***	4.46***	5.90***	4.41***
R-squared: Within	9.58%	7.98%	9.80%	8.24%
Between	13.85%	9.50%	12.60%	8.34%
Overall	8.69%	9.60%	7.93%	8.59%

Notes: *Single, double, and triple asteriks (*) signify significance at the 10, 5, and 1 percent levels, respectively.

t-values in parentheses.

a Commercial & industrial loans not exceeding $1 million.

b Banks with total assets not exceeding $500 million.

c HHI of local market deposit concentration in excess of 1800.

d HHI of local market deposit concentration less than 1000.

e Defined as a local market experiencing negative population growth.

Table 3.24 Nonperforming Loans, continued

Variable	No Interactions		With Interactions	
	all banks	all members	all banks	all members
Intercept	0.0124***	0.0143***	0.0125***	-0.3869*
	(2.68)	(2.65)	(2.69)	(-1.92)
Size of Bank	-0.0009***	-0.0006***	-0.0008***	-0.0088*
	(-4.03)	(-4.86)	(-3.87)	(-1.86)
Small Bank[b] Dummy Variable	-0.0002	-0.0001	-0.0001	0.0090
	(-0.41)	(-0.73)	(-0.17)	(0.94)
Rural County Location Dummy Variable	0.0001	0.0007**	-0.00002	-0.0013
	(0.13)	(2.24)	(-0.03)	(-0.11)
HHI of market deposit concentration	-0.0010	-0.0018***	-0.0010	-0.0525**
	(-0.74)	(-2.77)	(-0.73)	(-2.16)
Capital Ratio	0.0080***	-0.0013	0.0083***	1.0846***
	(3.11)	(-0.77)	(3.21)	(17.71)
BHC Affiliation Dummy Variable	0.0012*	-0.0003	0.0014**	-0.0324**
	(1.82)	(-0.83)	(2.05)	(-2.22)
Growth Rate of Bank	-7.66e-06	-0.0002***	-7.63e-06	0.0091***
	(-0.79)	(-4.33)	(-0.79)	(4.24)
Growth Rate of Local Market Population	-0.0280***	-0.0116***	-0.0262***	0.0219
	(-5.61)	(-4.20)	(-5.12)	(0.20)
Local Market Per Capita Income	0.0002	-0.0001	0.0002	0.0040
	(0.42)	(-0.25)	(0.30)	(0.20)
Loan Loss Provisions-to-Total Asset Ratio	1.0889***	0.9085***	1.0881***	7.0870***
	(93.71)	(115.57)	(93.54)	(24.02)
Return-on-Average Assets	-0.0190***	-0.0591***	-0.0186***	2.5603***
	(-2.68)	(-10.80)	(-2.62)	(12.57)
Gross Loan-to-Asset Ratio	-0.0095***	-0.0074***	-0.0096***	-0.4197***
	(-14.21)	(-19.40)	(-14.28)	(-17.40)
FHLB Member or Advance Use Dummy Variable	0.0001	-0.0001**	-0.0014	-0.0358**
	(0.35)	(-2.30)	(-1.27)	(-2.37)
Advances-to-Total Asset Ratio		-0.00002		-0.00004
		(-0.21)		(-0.37)
Number of Member Years		0.0001***		0.0001***
		(4.81)		(4.63)
FHLB Member or Advance User…				
--classified as a small bank			-0.0002	0.0036
			(-0.34)	(0.43)
--affiliated with a bank-holding company			-0.0006	-0.0072
			(-1.35)	(-0.95)
--located in a highly concentrated local market[c]			0.0002	0.0104***
			(0.70)	(2.84)
--located in an unconcentrated local market[d]			-0.0002	-0.0059
			(-0.52)	(-0.90)
--located in a local market that is losing population[e]			0.0002	0.0045
			(0.88)	(1.46)

Table 3.25 Net-Chargeoffs Fixed-Effects Estimates

	No Interactions		With Interactions	
	all banks	all members	all banks	all members
FHLB Member or Advance User located in:				
District 2 - New York			0.0010	-0.0002
			(0.81)	(-0.54)
District 3 - Pittsburgh			0.0027**	0.0004
			(2.49)	(1.01)
District 4 - Atlanta			0.0021**	0.0004
			(2.16)	(1.14)
District 5 - Cincinnati			0.0020**	0.0005
			(2.02)	(1.54)
District 6 - Indianapolis			0.0025**	0.0003
			(2.35)	(0.79)
District 7 - Chicago			0.0026***	0.0007**
			(2.61)	(2.01)
District 8 - Des Moines			0.0023**	0.0003
			(2.41)	(0.97)
District 9 - Dallas			0.0010	0.0006*
			(0.97)	(1.77)
District 10 - Topeka			0.0019*	0.0004
			(1.92)	(1.07)
District 11 - San Francisco			0.0010	-0.0002
			(0.89)	(-0.39)
District 12 - Seattle			0.0027**	0.0007*
			(2.36)	(1.68)
sigma (u)	0.0168	0.0057	0.0168	0.0057
sigma (e)	0.0117	0.0031	0.0117	0.0031
rho (fraction of variance due to u_i)	0.6727	0.7758	0.6729	0.7761
Corr(u_i, Xb)	0.0224	0.0654	0.0217	0.0644
Number of Observations	86658	28499	86658	28499
Number of Individual Banks	12390	6414	12390	6414
F-test that all $u_i = 0$	4.23***	4.19***	4.24***	4.18***
R-squared: Within	14.63%	47.15%	14.66%	47.20%
Between	12.62%	24.81%	12.56%	24.71%
Overall	15.09%	43.55%	15.02%	43.40%

Notes: *Single, double, and triple asteriks (*) signify significance at the 10, 5, and 1 percent levels, respectively.

t-values in parentheses.

a Commercial & industrial loans not exceeding $1 million.

b Banks with total assets not exceeding $500 million.

c HHI of local market deposit concentration in excess of 1800.

d HHI of local market deposit concentration less than 1000.

e Defined as a local market experiencing negative population growth.

Table 3.25 Net-Chargeoffs, continued

5. Summary

Risk-related concerns associated with commercial bank participation in the Federal Home Loan Bank (FHLB) System arose due to the System's involvement in the thrift debacle of the 1980s. Commercial bank performance under the FHLB program is evaluated using panel data, spanning the years 1991 through 1999, in a fixed-effects model specification. Results reveal significant relationships between membership attainment and the use of advances on various measures of bank performance.

Overall member participation in the FHLB program encourages investment in real estate lending and mortgage-related assets (MRA), while small banks also increased MRA investment after attaining membership and using advances. Residential mortgage lending increases suggest FHLB member compliance to the primary mission of the System. Additionally, bank liquidity is enhanced by participation in the FHLB System and increases with the accumulation of membership years, signifying that member banks fund loans with sources other than core deposits. Regulators remain concerned that the use of sources, such as System advances, may adversely affect small savers if commercial banks begin to compete less aggressively for deposits.

Loan investments are positively and significantly related to FHLB participation, indicating that risk profiles of bank asset portfolios have increased with membership attainment. While all members contributed a large portion of lending increases toward real estate loans, small banks also increased agricultural loan holdings after joining the System. Commercial and industrial loans, including small business loans, also increased after FHLB participation, particularly by small members that began using advances. The significant results associating increases in small bank lending to FHLB participation suggests that small banks may have been liquidity constrained prior to joining the System. The persistent negative results associated with member bank loan investment in the FHLB districts of Boston and San Francisco may reflect the ongoing effects of inconsistent housing and real estate markets that have plagued the Boston and southern California regions since the 1980s. Despite riskier asset portfolios, loan portfolio quality has generally improved with commercial bank participation in the FHLB program. Therefore,

concerns about credit risk problems associated with increased lending from FHLB participation were not supported by this analysis.

Overall profitability, as measured by returns-on-average assets or returns-on-average equity, is positively related to becoming an FHLB member and to using System advances, suggesting banks become financially stronger after participating in the FHLB program. However, raising additional capital against advances is not required, so significant increases in returns-on-average equity associated with the use of advances by members (and small members) may only indicate higher leverage positions associated with FHLB participation.

Exposure to interest rate risk, as measured by long-term asset/liability maturity gaps, increased after membership attainment and as members increased the amount of advances borrowed. Therefore, investments in longer-lived assets that were affiliated with FHLB membership, such as mortgage-related lending, resulted from short-term funding, such as federal funds or short-term advances. Long-term advances were not used to lengthen liability durations to offset the growth in long-term assets.

The evaluation of bank performance under the FHLB program during the 1990s suggests no previous cause for concern. System advances enhanced member bank liquidity, were used to fund appropriate investments, loan quality improved, and members earned higher returns during the analysis period. However, the economy during the 1990s was characterized by favorable conditions, such as low interest rates, that contributed to the almost decade-long expansion. The ensuing indebtedness of the economy and the increased mismatches in long-term asset and liability maturities held in member bank portfolios have fueled market and financial risks by raising interest rate risk, thus making the banking industry more susceptible to rising rates.

Results from this analysis are likely to change under current economic conditions beset by uncertainty. Currently, interest rates are at a historic low and federal budget deficits run the risk of increasing rates, thereby mounting concerns about the resulting quality of member bank loan portfolios and the lack of interest rate risk management by member banks. This research suggests little change in liability duration occurred to offset growth in long-term assets, although

increased usage of longer-term FHLB advances may stave off impending problems associated with rising rates. The level of System advances borrowed continues to expand, while deposit insurance funds remain at risk if troubled FHLB members are using System advances, due to the subordinated position of insured deposits to FHLB liens on the assets of failed institutions. Hence, the continued evaluation of the FHLB System and the performance of its members remain an important area of research.