

CHAPTER 4

THE FEDERAL HOME LOAN BANK SYSTEM AND THE COMPETITIVENESS OF LOCAL BANKING MARKETS

Introduction

According to the Survey of Consumer Finances and the National Survey of Small Business Finances, local depository institutions provide approximately 90 and 95 percent of the financial services demanded by households and small businesses, respectively (Kwast, 1999). Banking is therefore classified as a local market industry, where local geographic areas are defined to be the relevant markets for banking services and are characterized as either rural counties or metropolitan statistical areas (MSAs).

Financial markets located in rural counties are, on average, smaller, less diversified, more concentrated, and less competitive than those located in MSAs (Woosley et al., 2000). By definition, concentrated industries have firms with large market shares, earning higher profits due to lower unit costs associated with increased product availability and volume and/or the ability to practice monopolistic pricing. Therefore, the potential for prominent local banks to exercise market power in concentrated markets, such as those found in many rural areas, may result in relatively less attractive prices offered to local consumers. The supply of credit may also be more constrained in less competitive markets.

During a period of significant increases in membership to the Federal Home Loan Bank (FHLB) System and extensive growth in System assets, questions have been raised regarding the effect of FHLB participation on local market competition. FHLB membership attainment allows the use of System advances, a low-cost alternative to deposits, to finance potentially profitable loan opportunities as they arise, and so may diminish the reliance of member banks on deposits as a source of funding. Therefore, local areas composed of prominent and influential member banks may have higher deposit concentration levels and fewer local offices because fewer are needed to accumulate deposits. Furthermore, local markets with a large presence of high-market-share banks participating in the FHLB program may exhibit prices that are less attractive to customers,

consistent with the positive traditional market power results found between profitability and various measures of market competition.

This research uses a static market power analysis to evaluate the relationship between FHLB System participation and the competitive structure of local banking markets, as measured by local market deposit concentration and deposit and loan pricing, particularly in highly concentrated markets where price-setting behavior can be fostered. Section 1 briefly assesses the changes to local market structures, summarizes the merger literature relating market concentration to pricing, and describes the potential relationship between FHLB participation and market structure. Section 2 presents the model specifications, the derivation and sources of the data, and the empirical model. Results are discussed in Section 3, and section 4 concludes with a discussion on future areas of research.

1. Changes in the Structure of Local Banking Markets

Regulation and technological advances in banking have increased competition by lowering the barriers to entry into local banking markets, as shown by decreasing average deposit concentration levels over the 1990s. Increased market contestability, resulting from the removal of geographic restrictions of banking organizations and the changing delivery of services via ATMs, credit cards, and online- and phone-banking, allow existing institutions to enter local markets, while simultaneously expanding a local bank's reach beyond its historic geographic boundary. In an evolving financial services industry, local bank structures have undergone massive changes through consolidation and the modification of operations, as commercial banks attempt to perform more efficiently¹ and remain competitive within their respective markets.

Mergers and Acquisitions

Attempts to improve efficiency have resulted in massive consolidation of the banking industry. Advocates of increased merger and acquisition activity claim that consolidation is beneficial to consumers for a variety of reasons. Economies of scale can be achieved by spreading operating costs over more business. Mergers allow existing banks to enter new markets. Mergers also increase average bank size, thereby enhancing the ability of banks to diversify geographically and across products and services, alleviating some risks faced by banks (Hanweck and Schull, 1999). Larger banks and multi-bank holding companies are relatively unconstrained by local demand and deposits, because of their larger, more diversified loan and deposit bases. Access to efficient internal capital markets also allows the allocation of funds to the most profitable markets (Houston and James, 1998).

The aforementioned conjectures are consistent with the *efficient-structure hypothesis* generated by the market-structure performance models of industrial organization. The efficient-structure hypothesis posits that the positive correlation that is observed between market concentration and profitability is due to a positive relationship between market concentration and firm efficiency,

¹ Efficiency is typically measured in two ways. Cost efficiency refers to cost minimization per unit of output, given fixed output quantities and input prices, while profit efficiency incorporates the cost and revenue effects of choosing different outputs to generate a superior set of inputs and outputs (Akhavain et al., 1997).

since more efficient firms grow larger and will therefore dominate markets and secure greater market shares. The increased efficiency generates higher profits for firms, part of which may be passed to consumers in the form of more favorable prices.

An alternative explanation for the positive correlation between market concentration and profits is the traditional one of market power. Mergers between banks located within the same area can supplement a prominent local bank's ability to increase its shares of market deposits and assert market power through prices charged and offered on loans and deposits, thereby restricting the funds used for local endeavors. Therefore, banks with significant market power, i.e. banks with high shares of deposits in concentrated markets, can increase profits without improving efficiency, simply by adjusting prices adversely for consumers. This *structure-performance hypothesis* proposes that high concentration may allow for noncompetitive behavior and monopolistic pricing, thus creating higher profits for the firm and prices that are less favorable for consumers.

Extensive empirical research has been conducted on the impact of bank mergers on local market structure. The results have supported both the efficient-structure and structure-performance hypotheses (see surveys by Berger et al., 1999 and Collender and Shaffer, 2000). Typically, the structure of a market is determined by its levels of competition and market power, which are commonly measured by deposit concentration and loan and deposit pricing. Hannan (1997) and Radecki (1998) find positive, though weak, associations between local concentration and deposit rates, although Hannan (1998) finds little or no relationship between bank fees and services and local market concentration in the 1990s. Turvey, et al. (1999) undertake a survey of studies that evaluate the effect of mergers on market competition. They conclude that there is no evidence to support the hypothesis of post-merger increases in market power, as measured by price changes that affect consumers adversely. Akhavein, et al. (1997) also find no significant increases in market power, as measured by changes in prices after mergers between large banks. Berger (1995) found that the existence of banks with significant market shares does not adversely affect consumer prices, concluding that increases in profitability need not be due to the exercise of market power.

On the other hand, Berger and Hannan (1989) found that banks in more concentrated markets paid lower rates on deposits, suggesting that the structure-performance hypothesis is more important than the efficient-structure hypothesis in explaining the concentration-profitability relationship. Hanweck and Shull (1999) find less competition, as measured by increased concentration and less attractive prices, following consolidation. The interest rates paid on money market accounts in the most concentrated markets were 25 to 100 basis points below those in the least concentrated markets. Cynrak and Hannan (1998) found a positive association between local concentration and rates charged on small business loans. Prager and Hannan (1998) found that banks involved in mergers that significantly increased local market concentration generally reduced the rates they paid on deposits after the mergers. Berger and Hannan (1997), Berger, et al. (1999) and Hannan (1991) also found adverse relationships between local market concentration and the rates that banks paid and charged their customers.

FHLB Participation

A bank may seek alternative, lower-cost sources of non-deposit funds to improve profits. Such a source is the FHLB System, a government-sponsored enterprise (GSE) that extends funds, referred to as advances, to its member institutions. GSEs are implicitly backed by the federal government, which permits the borrowing at rates only slightly higher than those paid by the U.S. Treasury. FHLB participation does not ease market concentration by encouraging entry into markets, since only members can take out advances. However, the subsidized rates of interest may be passed from member banks to consumers in the form of lower rates charged on loans and/or higher rates paid on deposits. FHLB members may then attract additional deposits, gain market shares, and acquire or maintain market power, while extending prices that are more attractive to consumers, consistent with the efficient-structure performance model.

On the other hand, access to FHLB advances may alleviate the need for additional local offices to raise local deposits, thereby increasing the market shares of local banks and sustaining market concentration levels. Consequently, a member bank enjoying market power may be able to retain all the advantages of FHLB System participation and not pass them on to consumers (Collender

and Shaffer, 2000). FHLB funding may give member banks with significant market shares the additional advantage of a low-cost, alternative source of funds with which to elevate profits, retain significant market presence, and exploit customers, consistent with the traditional market power hypothesis. Unlike mergers, the relationship between GSE participation and the competitiveness of local banking markets has been the subject of little research. Evidence supporting the traditional market power hypothesis would be of particular concern, since the price of credit is likely to be excessive in highly concentrated, less competitive markets.

2. Empirical Analysis

Previous research findings suggest statistically significant relationships exist between local market concentration and loan and deposit pricing. This market-level analysis assesses how FHLB membership and advance use may be related to local market concentration, and, given this level of concentration, how active System participation may be related to local market pricing of deposits and loans. Specifically, the following hypotheses are tested:

1. H₀: Extensive FHLB participation in a local market is not related to the market's level of deposit concentration.
2. H₀: FHLB participation has no effect on average loan and deposit pricing within highly concentrated local banking markets.

Model Specifications

Local Market Concentration

The market concentration literature typically features the Herfindahl-Hirschman Index (HHI) of deposit concentration as an over-all measure of the competitive structure of a banking market (Berger, et al., 1999; Milbourn, et al., 1999; Strahan and Weston, 1998; Hanweck and Schull, 1998). The HHI is a market-level measure, where the market is either a rural county or a metropolitan statistical area (MSA) as delineated by the 1993 definitions of the Office of Management and Budget. The HHI is calculated by summing the squares of the market share of deposits held by banks in a market, and then multiplying by 10,000:

$$HHI = \sum_{i=1}^k A_i^2 \times 10,000 \quad \text{where}$$

k = banks serving the market and

A_i = percentage of the market-area deposits controlled by the i^{th} bank.

The HHI takes into account the relative sizes of all banks operating in a particular market and is used by the Department of Justice to identify excessive concentration within banking markets. A value in excess of 1800 classifies a banking market as highly concentrated, while a level less than 1000 classifies a market as unconcentrated. A large HHI indicates that relatively few banks

control a large portion of a market's deposits². As the number of banks decreases, the market shares of the leading banks and the HHI of deposit concentration tend to increase, permitting the remaining banks to exercise market power and increase profitability (Pilloff, 1999).

The HHI level derived for each local banking market is regressed against variables controlling for local market and general economic conditions. The extent of local market participation in the FHLB program will be measured in two ways: first, by the percentage of the market's deposits that are controlled by FHLB members, and second, by the percentage of the market's deposits that are controlled by the subset of FHLB members that are advance users³. Access to a practical and low-cost alternative to deposits, such as advances, could diminish bank reliability on deposits as a source of funding. Therefore, a market with a large presence of FHLB members may have fewer local bank offices for attracting deposits. The use of relatively lower-cost advances may also give member banks the ability to increase shares of market deposits by passing on the cost savings through higher rates for deposits. Therefore, a smaller number of branches for a given level of deposits, or higher shares of deposits held by member banks, should be associated with higher market concentration levels. Hence, a positive relation is expected between FHLB participation in a market and deposit concentration.

The population in a market is used to control for market size, since larger markets are generally associated with greater economic opportunities, which may encourage market entry and reduce concentration. Differences in local lending opportunities are also reflected in per capita income and the growth of the local area, as measured by the annual growth rates of population. More prosperous local markets are more likely to attract entry, thereby reducing deposit concentration. Market growth is typically associated with growth in loan demand. Finally, time dummies are

² To illustrate, a market with three banks each possessing an equal share of the market's deposits, generates an HHI of approximately 3333, a market with two banks each possessing one-half of market deposits generates an HHI of 5000, and a market with a single bank will have an HHI of 10,000. Likewise, in a market with many banks but where one or a few banks hold the majority of market deposits, the HHI will also increase. To illustrate this within the two-bank market scenario, if one bank has a majority of the market deposit shares, say 75 percent, then the resulting HHI value is 6250 as compared to an HHI of 5000 when both banks in the market hold an equal share of the market's deposits.

³ The share of total market deposits held by FHLBank participants is used instead of a variable measuring the percentage of local banks that are members or advance users. A large number of members may exist within a local

included to capture any differences to deposit concentration levels that may be attributed to specific year effects.

Loan and Deposit Pricing

A bank possesses a significant share of a banking market if it holds a large percentage of that market's total deposits, and within a concentrated market, that bank may display price-setting rather than price-taking behavior⁴. Participation in the FHLB program may contribute to a leading bank's ability to retain and exert this market power, in spite of the general increases in competition found in most local banking markets. A member bank may use advances as a low-cost alternative to deposits, and may not compete as aggressively for deposits. A bank can pass the resulting cost savings on to customers in the form of lower rates for loans. Alternatively, such a bank might offer higher rates on deposits, since it is able to simultaneously borrow the low-cost advances. Higher deposit rates would attract deposits and permit the bank to gain market share, develop a more prominent market presence, and exert market power by charging higher rates on its loans.

FHLB membership and access to System funds may thus alter the loan and deposit pricing practices of member banks, particularly in highly concentrated markets, where price-setting behavior is more likely. Markets consisting of a large proportion of influential member banks may exhibit loan and deposit pricing that is more favorable or less favorable to the consumer, depending on the additional effects of participation. Changes in prices can reflect improved efficiency (more attractive prices) and/or the exercise of increased market power (less attractive prices). Thus, the direction of the price changes will determine whether the efficient-structure or structure-performance effect dominates in markets with extensive bank participation in the FHLB program (Akhavein, et al., 1997).

area, but may not have much of an effect on HHI levels if these member banks are relatively small or control a small percentage of market deposits.

⁴ Increases in local market concentration and market share need not affect prices by much if, for example, there exists significant non-bank alternative sources of similar services (Akhavein et al., 1997).

Loan Pricing

Data on the actual interest rates charged by commercial banks on loans are not readily available, so these rates are derived from other available data. The average interest rate charged by a bank is computed as the ratio of interest and fee income to the average amount of loans extended.

This ratio is averaged over all banks in a local market (weighting all banks equally) to derive the average local market loan rate. The difference between the annual change in the average loan rate for the industry and the annual change in the average local market loan rate is regressed against various market control variables to assess the competitive impact of FHLB participation on local market pricing of loans. The structure of the dependant variable allows for a relative market-to-industry comparison, where a negative value suggests that the local market in question saw higher increases in the average rate charged on loans than the industry as a whole during that calendar year. The percentage of the market's total deposits that are controlled by FHLB members and the percentage of deposits controlled by System members that use advances should generate negative and significant effects on the derived measure of loan pricing if FHLB affiliation allows its members to exert market power.

Following the market-structure performance framework from the economics of industrial organization, the HHI of market deposit concentration, a measure of local market structure, is used as a proxy for market power for the market in which the bank is headquartered. The HHI controls for the competitiveness of the local lending market, i.e. price-setting rather than price-taking environment. Markets of higher deposit concentration may foster the exertion of market power, resulting in higher rates charged on loans.

The number of bank branches located in a local market represents the availability of offices and the level of spatial competition within the market. Commercial banks in rural markets are likely located in close proximity to one another, so the distances between these institutions are treated as inconsequential. Markets with more bank offices will have a wider variety of choices for customers and greater competition for banking services. Therefore, the number of bank branches should be inversely related to the average rates charged on loans.

Regional differences in local lending opportunities are captured by the growth of the local area, as measured by the percentage change in local market population, and per capita income. Both measures capture local demand and supply considerations, which can affect the loan rate charged by banks. If these measures are associated with potential demand, then they should be positively correlated with loan pricing. However, growing and/or more prosperous markets may be able to house more competitors which would exert downward pressure on loan rates. Total wages and salaries in the local area control for market cost, where rates charged on loans are likely to increase with these costs. Finally, time dummies are included to capture any differences in loan pricing that may be attributed to year-specific effects.

Deposit Pricing

Data on the actual interest rates paid by commercial banks on deposits are not readily available, so these rates are derived from other available data. The average interest rates paid on deposits are computed as interest cost divided by average daily deposits. This ratio is averaged over all head banks located within a local market to obtain the average local market deposit rate. The difference between the annual changes in the average deposit rate for the entire rural banking industry and the annual changes in the average deposit rates in a market is regressed against various control variables to assess the competitive impact of FHLB participation on local market pricing of deposits.

Traditionally, interest rates offered on deposits have been determined by the following variables that capture differences in local market characteristics and influences of varying local market conditions on bank markets (Berger and Hannan, 1989; Neuberger and Zimmerman, 1990; and Hannan and Prager, 2001). As in the loan pricing analysis, the HHI of market deposit concentration serves as a measure of market power in the local market, and the number of bank branches in the market represents the availability of bank offices in the market. According to the structure-performance hypothesis, less competitive markets, characterized by higher HHI levels or a smaller number of local bank branches, are likely to be associated with lower rates paid on deposits, generating a positive correlation between HHI and the relative change in the market deposit rate. Market size and the growth rate of deposits capture greater local demand and

supply considerations, which will have different effects on the deposit rate offered by banks. Growth in market population can also serve as a proxy for potential demand. Per capita income for a local market controls for factors affecting the supply of funds available to a bank and can take on either sign depending on the elasticity of deposit supply.

In addition to these traditional measures, the share of deposits held by FHLB members and the percentage of deposits controlled by members that use System advances capture the effect of System participation on the deviation of local market deposit rates from the industry average. A market with extensive FHLB participation may exhibit lower changes in deposit rates from the industry average, since System advances alleviate the need for deposits. The availability of advances will thus generate a positive relationship between FHLB participation and relative changes in deposit rates. Alternatively, markets with many members and members that use System advances may display higher average changes in deposit rates, since members can increase deposit shares while simultaneously borrowing low-cost advances. This alternative will result in a negative relationship between System participation and relative changes in deposit rates. Hence, it is unclear how extensive participation in the FHLB program within a local market is related to changes in the average deposit rate paid in the market. Finally, time dummies control for the differences in local deposit pricing that are credited to year-specific effects.

Data

The market-level data set for the years 1992 to 1999 is generated from a variety of sources. FHLB membership data from the Federal Housing Finance Board distinguishes the commercial bank members and which of those members use System advances. Year-end, bank-level Call Report data from the Federal Deposit Insurance Corporation (FDIC) are used to derive the average rates for each head bank office's deposits and loans, while market population, wages and salaries, and per capita income data are made available by the Bureau of Economic Analysis. FDIC Summary of Deposits data provides the location, and the amount, of deposits held by each bank branch, which is used to compute the HHI for local bank market deposit concentration, to track the number of local branches, and to determine a market's level of market deposits.

The Call Report data is reported at the head bank office level and is generated by aggregating branch level data to the bank-headquarter level. Consequently, the data is non-location specific due to the possible existence of branch operations in different regions. On the other hand, market share data is determined by the location of branch deposits within a local area and is therefore, location-specific. In order to use both the Call Report and market share data within the same analysis, only those markets classified as rural counties are evaluated, since local bank branches are likely to operate mainly within the county of their head offices⁵. A county specification in the regression analyses is therefore unnecessary.

The Office of Management and Budget identifies a total of 3088 local markets. The delineation between rural (non-metro or non-MSA) and urban (metro or MSA) markets is based primarily on market population. Table 4.1 shows that the percentage of markets classified as rural has declined from 64 percent in 1992 to just under 59 percent in 1999. In general, rural markets have increasingly become less concentrated as measured by declining average HHI levels, whereas rural markets containing FHLB members have become more concentrated. However, the average HHI level for rural markets containing members remains below the industry average. The average

⁵ In order to evaluate all local banking markets, not just rural counties, a weighted-average of the Herfindahl index for each market in which a head office is located can be computed, using each branch's share of market deposits as the weight.

number of bank branches in rural markets has increased from 9 to 11, while rural markets with System members remains constant at an average of 12 branch banks per local market, over the same time period.

Market-Specific Variables	Year		Entire Sample
	1992	1999	1992-1999
All Rural Markets			
<i>N observations</i>	1978	1819	15,235
<i>Local Market Total Deposits^a</i>	175,016	204,954	186,941
<i>Growth in Market Deposits^b</i>	4.01	4.46	4.69
<i>HHI of Local Market Deposit Concentration</i>	4008	3728	3873
<i>Number of Branches</i>	8.83	11.03	10.12
<i>Local Market Population^a</i>	23,359	24,627	23,923
<i>Growth in Local Market Population^b</i>	0.59	0.16	0.57
<i>Local Markets Losing Population^b</i>	31.55	45.52	33.69
<i>Per Capita Income^a</i>	15,754	20,812	18,035
<i>Average change in market deposit rates from the industry average^b</i>	-0.65	0.40	3.00
<i>Average change in market loan rates from the industry average^b</i>	0.22	0.86	1.81
<i>Member Banks^b</i>	11.41	61.16	37.30
<i>Member Banks that use Advances^b</i>	42.15	69.02	56.13
<i>Share of Market Deposits held by members^b</i>	12.36	65.14	40.25
Rural Markets Containing FHLB Members			
<i>N observations</i>	482	1424	8660
<i>As a Percent of All Rural Markets</i>	24.37	78.28	56.84
<i>Local Market Total Deposits^a</i>	276,916	238,541	243,973
<i>Growth in Market Deposits^b</i>	5.36	4.16	5.03
<i>HHI of Local Market Deposit Concentration</i>	3431	3459	3467
<i>Number of Branches</i>	12.13	12.24	12.30
<i>Local Market Population^a</i>	32,975	26,899	28,452
<i>Growth in Local Market Population^b</i>	0.76	0.23	0.60
<i>Local Markets Losing Population^b</i>	21.58	43.47	31.95
<i>Per Capita Income^a</i>	16,143	21,035	18,794
<i>Average change in market deposit rates from the industry average^b</i>	-0.11	0.57	3.85
<i>Average change in market loan rates from the industry average^b</i>	-0.26	0.996	2.66
<i>Member Banks^b</i>	46.84	78.12	65.62
<i>Member Banks that use Advances^b</i>	42.15	69.02	56.13
<i>Share of Market Deposits held by members^b</i>	50.72	83.20	70.81

Notes : a in thousands.

b in percents.

Table 4.1 Sample Statistics for Rural Markets, 1992-1999

In general, average total deposits have been on the rise in rural markets, but declining in rural markets containing member banks, where total deposits are higher. Although markets with FHLB members are on average larger as measured by market population, their average market size has become smaller, while average market size for all rural markets has risen over the 8-year period. Average per capita income in rural areas has increased over the period and is higher in those rural markets containing FHLB members.

The percentage of rural banks that are FHLB members has increased dramatically, from 11.41 percent in 1992 to 61.16 percent of all banks in 1999, and the percentage of members that are advance users has increased from 42.15 to 69.02 percent. These figures coincide with the general growth in FHLB membership during the 1990s, with the percentage of rural markets containing System participants increasing from less than 25 percent in 1992 to over 78 percent of all rural markets in 1999. The share of total market deposits held by FHLB members also rose, from 12.36 percent to over 65 percent, during this time.

Table 4.2 displays the descriptive statistics of the top and bottom quartiles of market-level participation in the FHLB System. Each rural banking market is ranked according to the percentage of deposits controlled by FHLB members and by System members that use advances, where higher market shares indicate greater market participation in the FHLB program. In the top quartile local markets, member banks control an average of 99 percent of deposits and make up almost 95 percent of the bank population, 60 percent of which use advances. The bottom quartile features no members, and therefore, no advance users and a zero deposit share controlled by FHLB members.

Markets located in the top quartile of FHLB membership are less concentrated and contain an average of 12 bank branches while the bottom quartile averages 7 branches. These top markets are larger, contain more deposits, have higher population and deposit growths, and have higher average per capita incomes. On average, they pay higher rates for deposits as well as charge more for loans than the bottom quartile markets. These descriptive statistics suggest that these markets have more investment opportunities and greater contestability, and therefore, provide

greater use for alternative funding sources which banks use to remain competitive within these top quartile markets.

Quartile	Percent of Market Deposits Held by Member Banks		Percent of Market Deposits Held by Advance Users	
	Bottom	Top	Bottom	Top
Market-Specific Variables				
<i>N observations</i> ^a	6575	3809	2746	2165
<i>Local Market Total Deposits</i> ^b	111,824	243,194	178,224	284,265
<i>Growth in Market Deposits</i> ^c	3.64	7.42	2.96	8.03
<i>HHI of Local Market Deposit Concentration</i>	4409	4119	3730	4144
<i>Number of Branches</i>	7.25	12.12	10.59	12.59
<i>Local Market Population</i> ^b	17,913	29,599	26,029	30,605
<i>Growth in Local Market Population</i> ^c	0.53	0.72	0.75	0.66
<i>Local Markets Losing Population</i> ^c	35.97	30.01	31.43	30.16
<i>Per Capita Income</i> ^b	17,030	19,103	18,089	19,234
<i>Average change in market deposit rates from the industry average</i> ^c	1.88	7.52	3.46	7.67
<i>Average change in market loan rates from the industry average</i> ^c	0.69	5.83	0.96	8.97
<i>Member Banks</i> ^c	0.00	94.55	60.96	90.39
<i>Member Banks that use Advances</i> ^c	0.00	59.88	0.00	95.96
<i>Share of Market Deposits held by members</i> ^c	0.00	98.70	64.07	97.05

Notes: *a* the number of observations are not the same within each quartile due to the placement of tied values.

b in thousands.

c in percents.

Table 4.2 Top and Bottom Quartiles of Market-Level FHLB System Participation

The markets in the top quartile of FHLB participation, as measured by the highest percentage of deposits held by System members that use advances, have a 90 percent membership rate, with 97 percent of deposits controlled by members, and 96 percent of members using advances. The bottom quartile of FHLB participation averages a 61 percent membership rate, 64 percent of deposits held by members, and no members that use advances. The top quartile markets are more concentrated, but contain an average of 2 more branches than the markets in the bottom

quartile. The top quartile markets are also larger, have more deposits, and exhibit higher deposit growth and per capita income, while averaging lower population growth and higher increases in deposit and loan rates.

The descriptive statistics for the top and bottom quartiles of market deposit concentration levels are displayed in Table 4.3. The most highly concentrated rural markets are smaller, contain fewer bank branches, have higher deposit and population growth rates (but have lower per capita income), and exhibit higher increases in deposit rates and lower increases in loan rates than the least concentrated rural markets. This suggests that more concentrated markets may offer relatively more attractive rates to local consumers, supporting the efficiency-structure hypothesis of market power. The top quartile markets also contain a smaller percentage of FHLB members, have members holding a smaller share of deposits in a smaller total deposit environment, but have a higher percentage of members using System advances.

Quartile	<i>HHI of Market Deposit Concentration</i>	
	Bottom	Top
Market-Specific Variables		
<i>N observations</i>	3788	3788
<i>Local Market Total Deposits^a</i>	272,337	88,209
<i>Growth in Market Deposits^b</i>	3.92	5.07
<i>HHI of Local Market Deposit Concentration</i>	1943	6680
<i>Number of Branches</i>	16.68	3.98
<i>Local Market Population^a</i>	37,331	10,460
<i>Growth in Local Market Population^b</i>	0.53	0.64
<i>Local Markets Losing Population^b</i>	31.86	35.08
<i>Per Capita Income^a</i>	19,226	16,868
<i>Average change in market deposit rates from the industry average^b</i>	1.53	3.25
<i>Average change in market loan rates from the industry average^b</i>	4.68	1.19
<i>Member Banks^b</i>	38.67	33.18
<i>Member Banks that use Advances^b</i>	56.08	56.78
<i>Share of Market Deposits held by members^b</i>	44.07	34.13

Notes : *a* in thousands.

b in percents.

Table 4.3 Top and Bottom Quartiles of Rural Market Concentration Levels

Table 4.4 exhibits the descriptive statistics of the extreme quartiles measuring the changes in market deposit rates, where the markets in the top quartile saw the highest increases in deposit rates, relative to the industry average. The top quartile markets are smaller, are more concentrated, have more deposits and higher growth in deposits, and increase loan rates by more than the bottom quartile markets. Both top and bottom quartile markets have similar percentages of FHLB members and of deposits controlled by member banks, although the top quartile markets have more System members using advances.

Market-Specific Variables	<i>Quartile</i>	
	Bottom	Top
<i>N observations</i> ^a	3789	3790
<i>Local Market Total Deposits</i> ^b	179,426	182,204
<i>Growth in Market Deposits</i> ^c	3.02	5.41
<i>HHI of Local Market Deposit Concentration</i>	3993	4030
<i>Number of Branches</i>	10.28	9.73
<i>Local Market Population</i> ^b	24,957	22,746
<i>Growth in Local Market Population</i> ^c	0.62	0.62
<i>Local Markets Losing Population</i> ^c	32.57	32.72
<i>Per Capita Income</i> ^b	18,153	18,040
<i>Average change in market deposit rates from the industry average</i> ^c	-14.33	26.57
<i>Average change in market loan rates from the industry average</i> ^c	-1.19	7.92
<i>Member Banks</i> ^c	38.60	38.74
<i>Member Banks that use Advances</i> ^c	53.39	55.42
<i>Share of Market Deposits held by members</i> ^c	41.61	41.59

Notes : *a* the number of observations are not the same within each quartile due to the placement of tied values.
b in thousands.
c in percents.

Table 4.4 Top and Bottom Quartiles of the Differences Between Market- and Industry-Level Changes in Deposit Rates

Table 4.5 compares the descriptive statistics between the top and bottom quartiles of market loan rate changes, where the top quartile markets have the highest increases in loan rates, relative to the industry average. The top markets are smaller, are more concentrated, have fewer deposits and lower growths in deposits and population, and increase deposit rates by more than the bottom quartile markets. The top markets also have a slightly higher percentage of FHLB members

holding a higher share of deposits. However, both top and bottom quartile markets have similar percentages of advance users among their member banks.

Market-Specific Variables	<i>Quartile</i>	
	Bottom	Top
<i>N observations</i> ^a	3789	3790
<i>Local Market Total Deposits</i> ^b	183,068	169,926
<i>Growth in Market Deposits</i> ^c	5.44	3.26
<i>HHI of Local Market Deposit Concentration</i>	3968	4045
<i>Number of Branches</i>	10.05	9.6
<i>Local Market Population</i> ^b	24,133	23,010
<i>Growth in Local Market Population</i> ^c	0.60	0.53
<i>Local Markets Losing Population</i> ^c	33.07	35.22
<i>Per Capita Income</i> ^b	18,052	18,153
<i>Average change in market deposit rates from the industry average</i> ^c	-2.30	13.10
<i>Average change in market loan rates from the industry average</i> ^c	-9.12	15.94
<i>Member Banks</i> ^c	37.11	38.77
<i>Member Banks that use Advances</i> ^c	54.73	55.40
<i>Share of Market Deposits held by members</i> ^c	40.18	41.75

Notes : *a* the number of observations are not the same within each quartile due to the placement of tied values.
b in thousands.
c in percents.

Table 4.5 Top and Bottom Quartiles of Differences Between Market- and Industry-Level Changes in Loan Rates

Empirical Model

The following analyses evaluate whether the competitive structures of rural communities with a higher percentage of total deposits controlled by FHLB members and by members using advances are affected differently than the communities with lower levels of System influence. Market structure (MS) measures are regressed against variables that control for market characteristics and regional differences:

$$MS_{it} = \alpha + \beta M_{it} + \delta F_{it} + \gamma T_t + v_i + e_{it}$$

where MS_{it} specifies the year-end, time t HHI level in the deposit concentration regression and the difference between the annual change in industry rates and the annual change in local market rates from year-end, time $(t-1)$ to year-end, time t , in the loan and deposit pricing equations. The index i represent the panel of local markets, M_{it} indicates the market-specific controls, and F_{it} measures the presence of FHLB participation within the local market. T_t represents the year indicators, which control for all other macroeconomic factor effects, v_i signifies the time-invariant, market-specific error, and e_{it} represents the regular error term.

Following Prager and Hannan (1998), robust standard error estimators are used with an OLS estimation of a time series using panel data. The deposit and loan rate dependent variables are first-differenced so no market-specific fixed or random effects were expected in the data, and the OLS assumption that the market-specific error from the above specification equals zero for all markets ($v_i = 0$) can not be rejected by standard F-tests. The use of robust standard error estimators relaxes the assumption of independent errors across observations, so the errors are allowed to exhibit panel-level heteroskedasticity. The Stata programming procedure used here also allows for any type of correlation within the observations for each market.

3. Results

Results for the HHI level, deposit pricing, and loan pricing regressions, are displayed in Tables 4.6, 4.7, and 4.8, respectively. Overall F-tests are significant, indicating that each model, as a whole, accounts for considerable variation in each dependant variable used to measure market structure. Results displayed in Table 4.6 suggest that local markets with greater participation in the FHLB System are more highly concentrated. A one-percent increase in the share of deposits controlled by member banks in rural markets corresponds to an increase in HHI deposit concentration levels by more than 500 points. This positive association is stronger and remains highly significant between deposit shares held by System members that use advances and concentration, suggesting FHLB advance accessibility may alleviate the need for deposits and additional bank branches. Deposits are not as aggressively sought after, and are also allocated across fewer local branches, both of which would positively affect concentration.

Additional significant results show that larger markets, higher per capita incomes, and more bank branches are associated with lower deposit concentration, suggesting more economic opportunity and potential demand are positively related to the level of market competition. However, a positive and significant relationship is established between market growth, an additional measure of demand, and concentration. Rural markets are historically smaller and more concentrated than their urban counterparts, although rural counties have, on average, been growing. Rural areas with greater-than-average population growth typically border expanding urban areas. Therefore, entry into rural markets may become or remain unattractive in spite of market growth and increases in demand for loans if neighboring metro areas are highly accessible to rural markets. Hence, higher levels of deposit concentration can be maintained in growing rural communities.

Variable	OLS Parameter Estimate	
	all rural markets	rural markets containing member banks
Intercept	3.6983*** (0.2878)	3.4026*** (0.3703)
Share of Market Deposits held by FHLBank Members	0.0559*** (0.0081)	
Share of Market Deposits held by System Advance Users		0.0773*** (0.0093)
Per Capita Income	-0.2186*** (0.0274)	-0.2184*** (0.0345)
Local Market Population	-0.1199*** (0.0075)	-0.0921*** (0.0093)
Growth in Local Market Population	1.5206*** (0.1918)	1.6014*** (0.2453)
Number of Bank Branches Located in Local Market	-0.0024*** (0.0008)	-0.0022*** (0.0008)
Year 1991 Indicator	-0.0268*** (0.0102)	-0.0216 (0.0170)
Year 1992 Indicator	-0.0212*** (0.0085)	-0.0163 (0.0120)
Year 1993 Indicator	-0.0259*** (0.0075)	-0.0246** (0.0103)
Year 1994 Indicator	-0.0209*** (0.0064)	-0.0148* (0.0084)
Year 1995 Indicator	-0.0250*** (0.0057)	-0.0194** (0.0075)
Year 1996 Indicator	-0.0141*** (0.0041)	-0.0076 (0.0055)
Year 1997 Indicator	-0.0094*** (0.0028)	-0.0035 (0.0038)
Year 1998 Indicator	-0.0042*** (0.0016)	0.0005 (0.0023)
F-test for Overall Model	84.17***	44.46***
R-squared	0.4001	0.3682
Root mean-squared error	0.15975	0.14207
Number of Observations	17135	8782
Number of Clusters (local markets)	2079	1576

Single, double, and triple asteriks () signify significance at the 10, 5, and 1 percent levels, respectively. Robust standard errors in parentheses.

Table 4.6 HHI Levels of Local Market Deposit Concentration

The positive and significant association found between markets with extensive FHLB participation and concentration generates an interest in how the pricing of loans and deposits are affected in these markets. Table 4.7 displays the results relating changes in local rural market deposit rates, relative to the industry, to various market conditions, including participation within the FHLB program. A negative and significant relationship between deposit rate changes and shares of deposits held by FHLB participants (members and members that use advances) suggests that markets under heavier FHLB influence are associated with higher rate increases or lower rate decreases on deposits, when compared to the industry⁶. The relatively more attractive rates offered in these markets suggest that member banks are able to pass the cost savings from borrowing low-cost, System advances on to consumers. In doing so, members are able to attract deposits and increase deposit shares, thereby reinforcing the previous relationship found between extensive FHLB participation in a market and corresponding concentration levels.

Significant estimates associate higher HHI levels and fewer bank branches to greater increases, or smaller decreases, in average market deposit rates, relative to the industry⁷. Therefore, less competitive markets, measured by higher concentration and fewer branches, offer relatively more attractive deposit rates than more competitive markets, providing additional evidence for the efficiency-structure hypothesis of market concentration. Fewer bank branches may result from the closing of inefficient offices and consolidation. Cost savings can be passed on to consumers as higher deposit rates, which would attract deposits and increase concentration.

Additional significant results suggest larger markets and markets with greater deposit growth are related to larger increases in average market deposit rates, relative to increases in industry averages. Banks in rural areas are typically smaller, so they continue to rely heavily on deposits as a funding source, whereas a variety of investment alternatives to deposits exist for consumers.

⁶ Similar results are generated if the variables measuring the share of market deposits held by member banks and by members that use advances are replaced by interaction variables measuring the share of deposits controlled by FHLBank participants in highly concentrated rural markets (HHI levels exceeding 1800). The robustness of these results are likely due to the majority of all rural counties (82 percent) meeting this high concentration classification.

⁷ The number of bank branches located within the local market and the HHI level of deposit concentration are highly and negatively correlated, although the generated estimates and results are robust to the exclusion of the number of branches as an explanatory variable.

Therefore, markets with large populations may generate more demand for deposits than a supply of deposits, creating upward pressure on deposit rates. Finally, markets offering higher rates are more likely to accumulate deposits.

The OLS estimate displayed in Table 4.8 suggests that markets with heavy FHLB influence are associated with higher increases in average loan rates relative to increases in the average rates of the industry. However, this result is insignificant at the 10 percent significance level, and therefore, fails to reject the concerns related to adverse loan pricing by FHLB participants. The sole significant result in the loan pricing equation indicates that more highly concentrated markets are associated with loan rate changes that are less favorable to the consumer, which is consistent with the structure-performance hypothesis of market concentration. However, a definite conclusion cannot be attained regarding the association between extensive FHLB participation in a market and the market's pricing of loans.

Variable	OLS Parameter Estimate	
	all rural markets	rural markets containing member banks
Intercept	0.3898* (0.2124)	0.5575 (0.4505)
Share of Market Deposits held by FHLBank Members	-0.0243*** (0.0088)	
Share of Market Deposits held by System Advance Users		-0.0418*** (0.0141)
HHI of Market Deposit Concentration	-0.0673*** (0.0157)	-0.0977*** (0.0321)
Number of Bank Branches in the Local Market	0.0010* (0.0006)	0.0016 (0.0012)
Growth in Local Market Deposits	-0.0445** (0.0202)	-0.0453 (0.0298)
Per Capita Income	-0.0176 (0.0181)	-0.0171 (0.0373)
Local Market Population	-0.0193*** (0.0061)	-0.0353** (0.0144)
Growth in Local Market Population	-0.2902 (0.2715)	-0.6928 (0.4824)
Year 1992 Indicator	-0.0024 (0.0075)	-0.0021 (0.0090)
Year 1993 Indicator	-0.0113 (0.0085)	0.0032 (0.0075)
Year 1994 Indicator	-0.0101* (0.0059)	-0.0025 (0.0066)
Year 1995 Indicator	-0.0208 (0.0138)	-0.0237 (0.0219)
Year 1996 Indicator	0.0043 (0.0075)	0.0470*** (0.0086)
Year 1997 Indicator	-0.2097*** (0.0207)	-0.2616*** (0.0267)
Year 1998 Indicator	-0.0053 (0.0068)	-0.0066 (0.0092)
F-test for Overall Model	17.55***	8.49***
R-squared	0.0331	0.0525
Root mean-squared error	0.3886	0.4472
Number of Observations	15026	7201
Number of Clusters (local markets)	1979	1468

Single, double, and triple asteriks () signify significance at the 10, 5, and 1 percent levels, respectively. Robust standard errors in parentheses.

Table 4.7 Changes in Local Market Rates Paid on Deposits

Variable	OLS Parameter Estimate	
	all rural markets	rural markets containing member banks
Intercept	0.4571 (0.3802)	0.8557 (0.7240)
Share of Market Deposits held by FHLBank Members	-0.0357 (0.0320)	
Share of Market Deposits held by System Advance Users		-0.0864 (0.0901)
HHI of Market Deposit Concentration	-0.0256* (0.0141)	-0.0081 (0.0356)
Number of Bank Branches in the Local Market	-0.0018 (0.0020)	-0.0017 (0.0017)
Per Capita Income	-0.0422 (0.0317)	-0.0717 (0.0555)
Local Market Total Wages and Salaries	0.0005 (0.0036)	-0.0065 (0.0116)
Growth in Local Market Population	-0.0540 (0.2957)	-0.0653 (0.4341)
Year 1992 Indicator	274024 (0.0316)	-0.0384 (0.0500)
Year 1993 Indicator	-0.0302 (0.0284)	-0.0344 (0.0453)
Year 1994 Indicator	-0.0177 (0.0208)	-0.0322 (0.0362)
Year 1995 Indicator	-0.0218 (0.0185)	-0.0408 (0.0358)
Year 1996 Indicator	-0.0381 (0.1038)	-0.0918 (0.1680)
Year 1997 Indicator	-0.0635*** (0.0090)	-0.0757*** (0.0200)
Year 1998 Indicator	-0.0062 (0.0086)	-0.0119 (0.0145)
F-test for Overall Model	40.69***	31.46***
R-squared	0.0005	0.0008
Root mean-squared error	1.4016	1.846
Number of Observations	15026	8591
Number of Clusters (local markets)	1979	1566

Single, double, and triple asteriks () signify significance at the 10, 5, and 1 percent levels, respectively. Robust standard errors in parentheses.

Table 4.8 Changes in Local Market Rates Charged on Loans

4. Summary

The 1990s saw significant increases in commercial bank membership in the Federal Home Loan Bank (FHLB) System and extensive growth in FHLB assets. Concerns regarding the relationship between FHLB participation in local banking markets and market competition have surfaced, particularly in highly concentrated areas, such as rural communities, where price-setting behavior can more likely be observed. Robust standard error estimators are used in an OLS estimation of a time series using panel data to evaluate the relationship between FHLB System participation and the competitive structure of rural markets, as measured by deposit concentration and loan and deposit pricing.

More concentrated rural markets are related to FHLB participants controlling higher shares of market deposits. System advances are an attractive alternative source of funding that may alleviate the need for deposits and additional bank branches, particularly with the high brick-and-mortar costs associated with traditional methods of retail deposit collection. Statistics reveal that the average number of local bank branches located in rural markets containing FHLB members has been stable over the 1990s, despite general growths in population and decreases in concentration. High market shares banks in more concentrated markets also may become members and use advances to further retain market influence.

Additional significant results suggest that member banks in rural markets with a greater portion of total deposits controlled by FHLB participants are able to pass cost savings from borrowing low-cost System advances on to consumers by offering relatively more attractive rates for deposits. More attractive deposit pricing generates market share gains for FHLB member banks, which reinforces the positive relation found between member deposit shares and local market concentration. Fewer bank branches and higher concentration are also significantly related to larger increases in market deposit rates than average, suggesting consolidation results in efficiency gains that are passed on to consumers. However, results from the loan pricing regression fail to reject the concerns related to adverse loan pricing by FHLB participants.

Overall, no conclusive evidence supports the advantages of membership being retained by influential member banks or the exploitation of prices in highly concentrated areas of extensive FHLB participation. In fact, evidence suggests that consumers, particularly depositors, have been relatively better off in rural markets with more FHLB participation. As members, small private sector banks are able to better compete with government-sponsored retail competitors, such as the Farm Credit System lending associations, making rural markets more contestable, and thereby, benefiting borrowers, savers, and rural development.

However encouraging, these results were generated by evaluating a period displaying high economic conditions: low unemployment, low inflation, and low interest rates. Beginning in 1999, the final year of the analysis, the economy began to weaken and has since entered a different macroeconomic environment with potentially less-agreeable credit conditions, produced by near-record levels of household indebtedness and general economic uncertainty. Due to the poor performance of equity markets, consumers may be returning to retail deposits, although members may use advances as an alternative to core deposits, to the detriment of savers.

During the 1990s, extensive consolidation occurred in the banking industry. The current analysis also shows that areas of extensive FHLB participation exhibited more attractive deposit rates and higher concentration. Therefore, local member banks retained or enhanced existing market power by attracting deposits. The loan pricing regression results suggest that higher levels of concentration are significantly affiliated with less attractive pricing of loans for consumers. During the current period of economic uncertainty, members with high deposit shares may charge high rates when supporting local economic interests, or may export rural deposits to fund urban investments, which are typically perceived to generate higher returns or to be affiliated with lower risk. Hence, the continued analysis of highly concentrated markets and markets containing high levels of influential FHLB participation remains warranted, since the mispricing and misallocation of credit would be detrimental to local community investment and development.