

Banking Market Conditions And Deposit Interest Rates

Richard J. Rosen
Federal Reserve Bank of Chicago
Chicago, IL 60604
Financial Institutions Center
Wharton School
Philadelphia, PA 19104
rosen@frbchi.org

September 2005

JEL Classification Numbers: G21, G28, L11, K21

Key words: Banks, Size Structure, Deposits, Interest Rates, Antitrust Policy, Market Concentration

Abstract: This paper addresses the impact of market conditions on bank deposit interest rates. Using data for 1988-2003, we find that rates are affected by market size structure (defined as the distribution of market shares of banks of different sizes whether or not the market share is achieved entirely in that local market) in addition to the effects of market concentration and multimarket bank presence noted in earlier work. There is also evidence that banks compete more aggressively in their home markets than in other markets. But, the effects of market conditions on deposit rates depend not only on the characteristics of banks in a market but also on the type of market. Market structure appears to matter less in rural markets than in urban markets. Finally, we argue that it is important to control for MSA fixed effects when predicting how deposit rates change with market characteristics. We give several examples where a cross-sectional regression yields counterintuitive predictions while a fixed-effects regression does not. These findings have implications for antitrust policy in banking.

The participants in seminars at the Federal Reserve Bank of Chicago and the Norges Bank and presentations at the Financial Management Association meetings and the International Industrial Organization Conference provided helpful comments. These views in this paper are those of the author and may not represent the views of the Federal Reserve Bank of Chicago or the Federal Reserve System.

Please address correspondence to Richard Rosen, Federal Reserve Bank of Chicago, phone 312-322-6368, fax 312-294-6262, and email rosen@frbchi.org.

Banking Market Conditions and Deposit Interest Rates

I. Introduction

This paper addresses the relationship between conditions in local banking markets and the interest rates offered by banks on deposits. This is a timely question because banking has been in a period of rapid change in recent years. The last two decades saw the most mergers in the history of banking. In large part because of the merger activity, the average size of a bank tripled during that period. At the same time as banks were getting larger, local banking market concentration stayed roughly constant.¹ This suggests that a main effect of the merger wave on local markets was to replace smaller banks with larger banks. We explore how the growing presence of larger banks affects deposit rates and competitive conditions within markets.

There are two main goals of this paper. First, a number of studies have examined whether different facets of market structure affect bank pricing, including deposit rate setting. We integrate the different facets into a single framework, to see how they interact. The second purpose of this paper is methodological. Most previous work in this area uses a cross-sectional approach, looking across markets to draw conclusions on the effects of market structure on bank pricing. Here, we argue that for many questions of interest, it is preferable to examine how markets evolve over time using a fixed-effects model rather than to look across markets as a cross-sectional approach does.

Most depositors look for a bank in their local market (Amel and Starr-McCluer, 2002). Thus, the distribution of banks in a local market may affect deposit pricing. We focus on three aspects of the structure of a local banking market. The first, market concentration, is the traditional backbone of antitrust analysis. An analysis based on this would predict little impact on deposit rates from a rapid increase in average bank size that left local market concentration essentially unchanged. Alternatively, the increase in bank size might affect deposit rates if regional or large nationwide organizations compete in different ways than small, local institutions, even when the different organizations have similar local market shares. As one test of this, we examine whether deposit interest rates are affected by the *market size structure* of a local market, defined as the distribution of market shares of banks of different sizes whether or not the market share is

¹ After dropping markets with fewer than five banks, the average Herfindahl was 0.223 in 1988 and 0.224 in 2003.

achieved entirely in that local market (Berger, et al., 2005). Finally, although banking markets are generally local in nature (Amel and Starr-McCluer, 2002), there is evidence that multimarket banks compete differently than banks that operate primarily in a single market (e.g., Cohen and Mazzeo, 2004; Hannan and Prager, 2004; Park and Pennacchi, 2005). One contribution of this paper is that we show that market size structure and the presence of multimarket banks have distinct effects on bank deposit rates.

We examine interest rates on interest-bearing checking (NOW) accounts at banks in the United States over the period 1988-2003. NOWs are among the most widely held deposit products, with over 70 percent of depositors having a checking account at their primary financial institution (Amel and Starr-McCluer, 2002). They are often the main factor depositors consider when selecting a bank, and thus are likely to be a prime focus of competition among banks.

Our goal is to determine how deposit interest rates offered by a bank in a local market are affected by changes in the structure of the market and bank-specific factors. This offers a potential contribution both to our understanding of how prices are set and to antitrust regulation of banks. Antitrust regulators are concerned with how changes in market conditions affect depositors. Traditionally, antitrust analysis focuses on the effect on deposit rates of market concentration, often measured by the Herfindahl-Hirschmann index (HHI). As an application, bank mergers are subject to different levels of scrutiny depending on the pre-merger HHI in each local market the banks operate in and how much the merger would affect each HHI. The results in this paper suggest that the focus of antitrust analysis be broadened since some markets react to changes differently than others.

It turns out that the recommendations of how to account for factors beyond the HHI depend on how the analysis is done. One reason that regulators analyze market conditions is to predict how changes in a particular market affect prices (e.g., interest rates) in that market. One way to do this is by looking across markets with different structures at a given point in time. This is the approach taken by previous studies of deposit pricing, which either analyzed data from different years in separate regressions (e.g., Hannan and Prager, 2004) or used pooled data (e.g., Biehl, 2002). We argue that for many questions, it is better to form a panel and use fixed-effect

regressions.² By controlling for local market fixed effects, we have the ability to look explicitly at how markets evolve over time. Cross-sectional approaches implicitly assume that their control variables are sufficient to account for differences across markets. We show that this is not always the case, and that the coefficients on some variables have different signs in fixed-effect regressions than in cross-sectional regressions.

When looking at all banks, we find that more concentrated markets are associated with lower deposit interest rates. This is consistent with earlier literature (e.g., Berger and Hannan, 1989). However, this is only part of how market structure affects deposit rates.

We find that the size structure of a market impacts deposit rates. Moving market share from small banks (less than \$1 billion in total assets) or mid-size banks (between \$1 billion and \$20 billion in total assets) to mega-banks (greater than \$20 billion in total assets) generally *decreases* rates *at all banks* in the market. When deposit share moves from small or mega-banks to mid-size banks, deposit rates generally *increase* at all banks in the market. Thus, size structure traces out an inverse-V shape in bank size. We can view size structure as indicating how banks affect competition as a function of their overall size (as opposed to their footprint in a local market). So, markets with a larger share of mega-banks are less competitive than other markets while those with a larger share of mid-size banks are more competitive, all else equal (where this all else includes traditional measures of market structure such as the HHI). It is worth noting that this does not mean that mid-size banks necessarily offer higher deposit rates than banks of other sizes. Once we control for market structure, we find mid-size and mega-banks offer lower deposit rates than small banks, consistent with prior work (e.g., Hannan and Prager, 2004).

The share of deposits held by multimarket banks also affects deposit pricing. As banks increase in size, the number of markets they operate in often increases. If banks set a single interest rate across many markets, such as within a state (Radecki, 1998), then pricing in any single market may not be as responsive to conditions in that market. Controlling for MSA fixed effects, we find that increasing the multimarket bank deposit share leads to *higher* deposit rates at all banks in the market. This multimarket effect operates in addition to the effects of size structure. This result is different from the finding in prior studies (e.g., Hannan and Prager, 2004;

² One other paper used a panel data approach, with a focus on bank interest rates in Europe (Corvoisier and Gropp, 2002).

Park and Pennacchi, 2005), and the difference is due to our fixed-effect approach. When we use a pooled time series, we find that markets with a greater share of multimarket banks have lower deposit rates than other markets. We believe that this reflects missing control variables in the cross sectional regressions.

We also find that banks do not compete with the same intensity in all markets. Shifting deposit rates in a local market to banks that make that market their home from banks that do not increases deposits at all banks in the market. There is also other evidence consistent with banks competing more aggressively in markets where they have a greater share of their deposits.

Additionally, we examine whether urban and rural markets respond to the same factors. We find that there are some differences, the most notable of which is that deposit rates at banks in rural markets seem less responsive to market structure. Deposit rates at rural banks are not significantly affected by changes in market concentration or the presence of multimarket banks.

The remainder of the paper is as follows. The next section briefly discusses the background on why deposit rates might differ and reviews the literature. Section III describes the data and sets out the hypotheses. The main empirical results are presented in Section IV. The fifth section presents several robustness tests. Finally, the last section offers some concluding comments.

II. Background

There are a number of reasons why deposit rates might differ across markets and banks. The traditional approach to examining the impact of market structure on deposit interest rates is to focus on market concentration (see Gilbert and Zaretsky, 2003, for a more extensive survey of the literature). The structure-conduct-performance paradigm that lies at the root of antitrust analysis implies that as competition diminishes, prices increase (Tirole, 1988). A number of papers have tested the paradigm using data on bank deposits and loans. Previous work in this area typically found that banks in more concentrated markets offer lower interest rates on deposits (e.g., Berger and Hannan, 1989) and higher interest rates on loans (e.g., Hannan, 1991). This may be true even when market concentration is changing because of mergers (Prager and Hannan, 1998), although not all studies agree (Akhavien, et. al, 1997, find no effects of mergers on pricing).

The way a bank competes and the deposit rates it offers may depend on the size and structure of the bank. Large banks may be able to exploit economies of scale and scope to achieve lower

cost structures. For example, large banks may have funding or investment options not available to smaller institutions (Park and Pennacchi, 2005). While this suggests that large banks may set different rates than small banks, the direction of the difference is unclear. Large banks may have higher deposit rates than small banks because they have better investment options, but it also may be that they rely less on deposit for funding, allowing them to offer lower rates.

Another reason that large banks may set rates differently than small banks is that there may be organizational diseconomies in large institutions. Consistent with this, recent studies find that large banks operating in many markets often set a single deposit rate in all markets rather than optimizing in each market (Radecki, 1998). Interest rates for these banks may be related to conditions in a particular local market, but they are unlikely to be tied to local conditions as closely as for banks operating only in that market.

Deposit rates may differ across banks, even within a market, for other reasons as well. Bank depositors may be reluctant to switch banks for small differences in interest rates (Rosen, 2002). So, banks that are recent entrants to a market may find it difficult to attract new customers (Berger and Dick, 2003). To increase market share, they may have to offer higher deposit rates. If most entry is by large banks, then bank size might partially proxy for entry.

Overall, there is reason to believe that bank size may impact the deposit rates set by banks and the way banks compete. The reasons cited above affect not only the relative deposit rates at large and small banks, but also the average deposit rates in a market. When large, multimarket banks compete differently than other banks there is an external effect, since the other banks price at least partially in response to prices at the large banks. Three recent papers have examined the external effects of large and multimarket banks.

Hannan and Prager (2004) and Park and Pennacchi (2005) examined multimarket banks. These studies modeled and found that deposit rates tend to be inversely related to the local market share of multimarket banks. They offered several possible explanations for this finding having to do with funding advantages and with organization and efficiency issues. Several of these explanations, such as funding advantages and diseconomies of scale or scope, are not specific to banks operating in many markets. Funding advantages have to do with access to wholesale markets, which is in turn, partially a function of bank size. Economies of scale and scope are a function of the size and product mix of a bank, not the number of markets it operates in. They

could exist at any large bank. In this paper, we attempt to isolate the impact of banks that operate in multiple markets after controlling for the effects of bank size.

There is evidence of a direct external effect from large bank presence. Berger, et al. (2005) showed that market size structure matters in small business loan pricing. In markets with a bigger share of large banks, small business loan rates are lower, all else equal. Since multimarket banks are generally larger than single-market banks, it is possible that the results in the multimarket studies reflect the presence of large banks or that those in the size structure paper come from the presence of multimarket banks. The papers also do their empirical work on liabilities in one case and assets in the other. So, the results may reflect differences between the asset and liability sides of bank balance sheets (Park and Pennacchi, 2005). But, they may reflect differences between bank size and bank geographic scope (i.e., operating in multiple markets). One contribution of this paper is that we control for both the local market shares of large banks and of multimarket banks. Thus, we can distinguish between the two different external effects.

Banks may compete differently in their home markets and in other markets they consider key. If deposit rate setting is done partially based on soft information and if a bank sets the same deposit rate across different markets, then it is possible that the bank will be more responsive to conditions in its key markets than in other markets. The reasons a bank may set a single interest rate across markets -- organizational diseconomies and other issues with transmitting soft information -- may lead also lead the bank to only respond to its competition in markets where it has a sufficient share of its business. This would lead the bank, in general, to compete more aggressively in its major markets than elsewhere. This is the first study to consider whether banks compete differently in some markets than in others. This allows us to trace a more complete picture of the external effects of size structure.

III. Data and methodology

We want to examine the relationship between bank deposit interest rates and competitive conditions in a banking market. To test this relationship, we need to define what a banking market is and develop measures of competitive conditions. This section defines the scope of our analysis and explains the sample we use.

Regulatory authorities typically assume that banks compete for deposits primarily in their local market (Amel and Starr-McCluer, 2002). The local market is defined as a Metropolitan Statistical Area (MSA) or, for banks not in an MSA, a county. Consistent with previous literature, we adopt this definition of markets for our analysis (see, e.g., Berger and Hannan, 1989, and Hannan and Prager, 2004).³

When evaluating market structure, regulators typically look at measures of local market concentration including the Herfindahl-Hirschmann index (HHI), which is defined as the sum of the squared market shares of all banks in a local market. We use the HHI as our measure of market concentration.

One objective of this paper is to see whether banking market size structure (henceforth, size structure) should be examined in addition to the HHI. Size structure is meant to capture the idea that larger banks may compete in different ways than smaller banks. The size structure of a banking market is measured using the relative proportions of banks of different asset sizes (see Berger, et al., 2005). To define size structure, we divide banks into three size classes: small banks (less than \$1 billion in total assets), mid-size banks (between \$1 billion and \$20 billion in total assets), and mega-banks (greater than \$20 billion in total assets).⁴ The size classes roughly correspond to community banks, regional banks, and super-regional or national banks. Let SIZE SMALL, SIZE MID and SIZE MEGA be dummies variables corresponding to our three size classes of banks. We also use the size classes to define our size structure variable: SIZE STR SMALL is the proportion of deposits in a local market held by small banks, with SIZE STR MID and SIZE STR MEGA defined similarly (where we include assets held outside the local market to classify banks).

Banks may compete for deposits locally, but they can operate in multiple markets. There is a potential issue with this since the interest rate data are only provided at the aggregate bank level. This means that we do not know the interest rate in every market a bank operates in. However, to the extent that banks operate in multiple markets, they generally have the vast majority of their deposits in their home market (defined as the market where the bank has the greatest amount of deposits). Over 80 percent of banks have at least 90 percent of their deposits in their home

³ The evidence that banks may set the same interest rate in many local markets within the same state means that it may be more appropriate to use larger geographic areas to define markets (Radecki, 1998, and Biehl, 2002). To the extent that this is true, it should add noise to our results.

⁴ All data are 2003 dollars.

market and fewer than five percent have more than half of all deposits outside their home market. For these reasons, we focus on the deposit rate a bank offers in its home market for our analysis. Thus, we include a single observation for each bank in our regressions, with control variables based on the banks home market.⁵ We assume that the deposit rate offered in the home market is equal to the average rate for the bank.

Concentrating on banks' home markets gives an accurate estimate of deposit rates for the majority of banks that are geographically concentrated, but may not for other banks. For this reason, some studies restrict their samples to banks operating primarily in a single market (e.g., Hannan and Prager, 2004). Yet, while only a minority of banks operates in multiple markets, those banks have a disproportionate share of total deposits. The 13% of banks with over 25% of deposits outside their home market control 50% of all bank deposits. Therefore, to make statements about how changes in market structure affect depositors in a market, we feel it is important include these multimarket banks in our main analysis. We recognize that our estimates of deposit rates in a particular market are based in part on rates offered outside that market. However, there is evidence that multimarket banks tend to offer the same deposit rates at their markets within a state (Radecki, 1998). This suggests that our estimates of deposit rates should be fairly accurate even for multimarket banks. Nonetheless, after presenting the main results for the full sample, we separate banks that operate primarily in a single market from those with extensive operations in multiple markets. We also briefly examine offices outside banks' home markets.

Multimarket banks may compete differently than single-market banks (Cohen and Mazzeo, 2004; Hannan and Prager, 2004; Park and Pennacchi, 2005), possibly because these banks set a single interest rate for each deposit product across all markets. If this is true, then it is possible that size structure is capturing the effects of multimarket banks since many banks, including most mega-banks, operate in multiple markets. To test whether the size structure of a market has an effect independent of whether mega-banks operate in many markets, we define MULTIMARKET SHARE as the share of deposits in a local market at banks that have at least 25 percent of their

⁵ We use all bank deposits in a market to calculate our market structure variables.

deposits outside that market (whether or not the local market is the bank's home market). The results are not sensitive to the exact cutoff for a multimarket bank.⁶

The data we use come from the Reports of Condition and Income (the Call Reports) from 1988 – 2003. One advantage of using an extended time period like this is that it helps control for the facts that interest rates move cyclically and that the spread between bank interest rates and market interest rates can vary over time (Rosen, 2002). We match the Call Report data with information on market structure from the Federal Deposit Insurance Corporation's Summary of Deposits. Our sample includes 136,818 observations, with each observation representing a single market for a bank in a year. In total, there are 14,464 banks in 2,289 different markets. Table 1 gives descriptive statistics for the sample. The mean HHI is 0.172. Over 96 percent of all observations are from small banks, and these banks have 65 percent of all deposits in the markets they are in.⁷ Also, 14.9% of sample observations are multimarket banks, and the sample average market share of these banks is 29.2%.

We focus on interest-paying transaction (NOW) accounts in our main analysis. Banks are required to report quarterly average balances and interest payments for these accounts. We use these data to calculate an annual interest rate, computed as the average of the quarterly interest payments divided by the quarterly balances. As shown in Table 1, the average NOW rate in the sample is 3.21%.⁸ To illustrate the robustness of our findings, we compare the results for NOW accounts to those for money market deposit accounts in Section V.

Three other facets of market structure may affect deposit rates. Markets can vary in how densely populated with banks they are. The premise is that competition might be more intense in markets where banks are closer together. We control for this two ways. First, we include the size of the local market. Market size, measured by the log of total deposits in the market (LOG MKT SIZE), has been found to be associated with lower interest rates in previous studies (e.g., Hannan and Prager, 2004). Second, in our cross-sectional regressions, we include a dummy for whether a

⁶ For example, we could define a multimarket bank as one with at least 50 percent of its deposits outside that market, as in Hannan and Prager (2004). However, this definition makes a bank a multimarket bank in some markets but not necessarily in its home market. This makes it difficult to neatly divide the sample by whether a bank is in its home market and whether it is a multimarket bank, as we do below.

⁷ This does not indicate that small banks control 65 percent of all deposits in the banking system. Since there are a large number of small banks in our sample and these banks tend to be in markets with other small banks, the sample mean overstates the market share of small banks. During the sample period, small banks had only 31 percent of all deposits.

⁸ We drop banks with rates in the top or bottom one percent of all rates.

market is in an urban area. We follow convention by classifying local markets in MSAs as urban and those in non-MSA counties as rural. Studies have found significant differences between banks in urban and rural markets, both in the composition of their deposit portfolios (e.g., DeYoung, et. al, 2004) and in the interest rates they offer (e.g., Berger and Hannan, 1989).

An alternative way measure of competitive conditions is to use the number of banks in a market as a proxy for competition. Many models of competition such as the Cournot model suggest that prices are declining in the number of banks in a market. Much of the effect of this increased competition is picked up by the HHI, but we also include the log of the number of banks (LOG BANKS) in a market as a further measure of competitive conditions. The number of banks in a market has been found to affect bank profitability (Rhoades, 1995).

A number of bank-specific factors may also affect deposit rates. Bank size may be correlated with deposit rates, as noted earlier, since larger banks may have access to more non-deposit sources of liabilities and may have different strategic incentives than small banks (Park and Pennacchi, 2005). Size has been found to influence deposit interest rates in previous studies. We control for bank size by including dummy variables that match our size structure size classes (SIZE SMALL, SIZE MID, and SIZE MEGA).

Banks provide an array of services to depositors. As a proxy for the level of services, we use DEPOSITS PER BRANCH, the deposits per branch. Having more deposits per branch may signal a lower level of service. To compensate for this, banks may have to offer higher deposit rates.

The final bank-specific factor we include is a measure of bank strength. We use the ratio of nonperforming loans to total loans (NONPERFORMING RATIO) for this purpose. The advantage of using this ratio is that, unlike measures such as the return on assets (ROA), it is not directly related to deposit rates.⁹ The effect of bank strength on deposit rates is ambiguous. A weak bank may not be able to bid aggressively for deposit share by offering high interest rates, but depositors may want higher interest rates before they are willing to deposit money into a weak bank.

The competition a bank faces may depend on the strength of banks in a market. We control for market conditions by taking average values in each local market of the ratio of nonperforming

⁹ If a bank offers a lower deposit rate, this translates directly to a higher ROA. Thus, return measures mix bank strength with deposit rate strategy.

loans to total loans (MKT NONPERFORMING RATIO). As with the bank-specific nonperforming loan ratio, the expected effect of this variable on deposit rates is uncertain.

Finally, we use year dummies to capture changes in overall economic conditions including market interest rates.

Our baseline empirical model is:

$$\text{DEPOSIT INTEREST RATE}_{i,m,t} = f(\text{market concentration variables}_{m,t}, \text{size structure variables}_{m,t}, \text{multimarket share}_{m,t}, \text{other market structure controls}_{m,t}, \text{bank-specific controls}_{i,m,t}, \text{market condition controls}_{m,t}) \quad (1)$$

for bank i in market m during year t .

IV. Results

A. Cross-sectional versus fixed-effects regression

One question implicit, if not explicit, in many earlier studies of deposit rates is how changes in market structure, such as those resulting from a merger, affect deposit rates. We argue that fixed-effect regression often is a more appropriate methodology to answer this question than is the cross sectional analysis that is typically used. Cross-sectional analysis assumes that we can look across banks with different values of a control variable to deduce the effect of changes in the variable at a particular bank. However, if there are missing controls in the analysis, then comparing banks may not provide a good measure of what will happen at a single bank. Fixed-effect analysis, on the other hand, explicitly examines what happens to a bank over time as the control variables – such as market structure – change. Table 2 presents results from regressions of NOW rates on market concentration that illustrate how cross-sectional regressions can point in the wrong direction. The first three regressions are cross-sectional in nature. For the first regression, we pool all the data in our sample and regress the deposit rate on the HHI and year dummies, a standard cross-sectional approach. The resulting coefficient is positive and significant. This is surprising since it suggests that banks in less competitive markets offer higher deposit rates. Pooling the data this way gives greater weight to markets with a large number of banks, since there is one observation for every bank in a market each year. To see if this is causing the positive coefficient on the HHI, we regress the average NOW rate in a market on the

HHI and year dummies. This gives us one observation per market for each year. The results of this regression, reported in the second column of Table 2, also yield a positive coefficient on the HHI. Another approach is to run separate regressions for each year. In the third column, we report the average coefficient on the HHI when we do this. Again, the HHI coefficient is positive, so the three different cross-sectional approaches all indicate that deposit rates are higher in less competitive markets. However, the results are much different when we use a fixed-effects model. When MSA effects are controlled for, the coefficient on the HHI is negative and significant. With the full sample, the coefficient of -0.819, as reported in the fourth column of Table 2, indicates that a 1 percentage point increase in the HHI, all else equal, decreases NOW rates by 0.819 percent. This result is consistent with how we expect market concentration to affect deposit interest rates.

What lesson can we draw from the experiment reported in Table 2? It would be too strong to say that it shows that the cross-sectional approach is incorrect. Rather, it illustrates the importance of including sufficient controls. When we include all the controls in (1) except for the size structure and multimarket share variables, the coefficient on the HHI from a cross-sectional regression is negative and significant, as reported in the fifth column of Table 5. While the fixed-effect approach gives a more direct measure of the effect of changes within an MSA than does a cross-sectional regression, a cross-sectional regression with the proper controls can also proxy for estimating the effect of changes in a right-hand side variable. However, it is difficult to know when the set of controls is sufficient.

B. The impact of market structure on deposit rates

The regressions reported in Table 3 provide the core results in the paper. They include the results of a series of regressions of the NOW rate on the market structure variables including size structure and multimarket share, as well as the other controls in (1). The baseline model is used to generate the coefficients in the first two columns. For most variables, the coefficients for the fixed-effects regression are similar to those for the regression with MSA fixed effects. The two key differences are for the number of banks in a market and for the multimarket share.

The coefficients on LOG BANKS support the use of a model with MSA fixed effects. As shown in Table 3, the coefficient on LOG BANKS in the cross-sectional regression implies that markets with more banks have lower deposit rates while the fixed-effects model predicts that as

the number of banks in a market increases, the deposit rate increases. If the number of banks in a market measures, at least in part, the level of competition in a market, then we expect that increasing the number of banks raises the deposit rate in the market, as we find with the fixed-effects model. Again, the differences in the cross-sectional and fixed-effects models may be due to an improper set of controls, but the results are robust to adding additional controls or removing any of the controls. If we cannot be sure when we have the correct group of controls for a cross-sectional regression, however, this points toward the use of a fixed-effects model since it provides more intuitive and stable coefficient estimates.

The sign of the coefficient on the multimarket deposit share also depends on whether there are fixed effects. When MSA fixed effects are not controlled for, the coefficient is significantly negative, consistent with prior cross-sectional tests (e.g., Hannan and Prager, 2004; Park and Pennacchi, 2005).¹⁰ But, with fixed effects the coefficient is positive and significant. This implies (and simple univariate tests support) that in any given market, as the share of multimarket bank deposits in a market grows relative to that in other markets, the deposit rate in that market increases relative to deposit rates in the other markets. It suggests that there is some intrinsic difference in competition across MSAs not captured by standard control variables, possibly due to the evolution of the banking market in each MSA. This, plus the evidence described in the previous paragraph and the results in Table 2, argues for the use of MSA fixed effects.

In addition to the multimarket deposit share, the size structure of a market is another key element of market conditions. The results in Table 3 show a distinct nonlinear pattern in the results for size structure. The coefficient on SIZE STR MID is positive while that on SIZE STR MEGA is negative. These coefficients represent the marginal external effect of replacing deposits at small banks (the omitted group) with deposits at banks of the other size classes. For example, increasing SIZE STR MID by one standard deviation (0.248) with an equivalent reduction in SIZE STR SMALL increases NOW rates by 1.5 basis points at all banks in the local market (not just, for example, at a bank that changed in size). The coefficients in Table 3 trace out an inverse-V relationship between the size structure variables and deposit rates.

¹⁰ The negative sign on the coefficient when we use a cross-sectional regression is robust to the exclusion of any of the controls or the inclusion of additional controls.

Although the results on the size structure regressions imply that the presence of mid-size banks increases deposit rates for all banks in a market, that does not imply that, all else equal, a mid-size bank offers a higher interest rate than banks of other sizes. The coefficients on the mid-size and mega-bank size dummies are significantly negative, implying that small banks offer higher deposit rates than their larger competitors in a market. This is consistent with previous studies.

One potential issue with the regressions in the first two columns of Table 3 is that we have created an artificial division between a bank's multimarket status and its size. The fraction of banks that operate in multiple markets is increasing in bank size, meaning that the coefficient on multimarket share might be picking up some of the effects of size structure or that the coefficients on the mega-bank size structure may be partially proxying for the multimarket share. To test this, we add variables for the share of deposits held by multimarket banks of each size class. Let `SIZE STR SMALL MULTI` be the share of deposits at small, multimarket banks, and define analogous variables for the other size classes. Thus, the coefficients on these variables represent the marginal effect of shifting deposits to a multimarket bank of a given size from non-multimarket bank of the same size. The third column of Table 3 reports the results of a regression with these variables included. The positive coefficient on `SIZE STR SMALL MULTI` implies that replacing deposits of a small, single-market bank with deposits at a small, multimarket bank increases deposit rates at all banks in the market. This is consistent with the positive coefficient on the multimarket share in the regression in the second column of Table 3. The coefficients on `SIZE STR MID MULTI` and `SIZE STR MEGA MULTI` are likewise positive. In fact, the coefficients on the three size structure terms for multimarket banks are not statistically significantly different from each other. This suggests that the impact of a multimarket bank on deposit rates in a local market does not depend on the size of the bank. Thus, for the rest of the paper, we do not break down size structure by the multimarket status of the banks.

We discuss the other control variables briefly. The coefficients on the multimarket bank dummy are negative, suggesting that multimarket banks offer lower deposit rates than other banks. The coefficient on the urban market dummy in the cross-sectional regression is negative, consistent with urban markets being more competitive, all else equal, than rural markets. Also in the same vein, the coefficient on `LOG MKT SIZE` is positive in the fixed-effects model, indicating

that as markets grow, they become more competitive. Finally, banks offering less service (as measured by lower deposits per branch) and weaker banks offer higher deposit rates.

Our qualitative findings are robust to alternative definitions of what a multimarket bank is. To illustrate this, we run the fixed-effect regression for the variables reported in the second column of Table 3, but replacing our definition of a multimarket bank with the one used in Hannan and Prager (2004). They defined a multimarket bank as one with over 50 percent of its deposits outside the local market in question (thus, a bank can be a ‘multimarket’ bank in one market but not in another). We report the results of this regression in final column of Table 3. The results are very similar to those for the regression reported in the second column of the table.

Returning to the main focus of the paper, what do the coefficients on size structure on the multimarket deposit share mean? Size structure captures the external competitive effects of banks in different size classes. So, for example, the negative coefficient on SIZE STR MEGA is consistent with mega-banks being less aggressive competitors than banks of other sizes. Under this interpretation, when a mega-bank replaces a small or mid-size bank in a local market, the less intensive pursuit of deposits by the mega-bank relative to the smaller bank it replaces allows all banks in the market to decrease deposit rates without reducing their market share. This result is consistent with the model in Park and Pennacchi (2005), where the largest banks have access to low-cost wholesale deposit sources that smaller banks do not, and thus compete for local market deposits less aggressively. This means that when the share of market held by mega-banks increases, there might be less pressure on deposit rates because the mega-banks are content to raise liabilities for their growth strategy elsewhere (the average ratio of deposits to total liabilities are 96.3%, 83.4%, and 67.1% for small banks, mid-size banks, and mega-banks, respectively).

C. Competition inside and out of the home market

Another possible explanation for the results is that banks care more about some markets than others. Most banks raise a significant fraction of their deposits (and do a significant amount of other business) in their home market. On the other hand, banks -- especially the very largest ones -- may enter some markets mostly to have complete coverage in a region. For example, a bank that wants a statewide presence may set up a few branches in every local market for that purpose. If the markets are small enough, the bank may not find it worthwhile to aggressively pursue

deposits in those markets. Thus, the differences between mega-banks and smaller banks may reflect the fact that mega-banks raise more deposits outside their home markets.

To test whether banks compete equally aggressively in different markets, we split our market share measures by whether the deposits are at banks for which the market is their home market or are at banks from outside the local market. Let *SHARE HOME* be the share of deposits in a local market held at banks for which that market is their home market (where, as noted earlier, a bank's home market is the market where it has the most deposits). We define analogous variables for the size structure size classes, with *SIZE STR SMALL HOME* the share of deposits in a local market held at small banks for which that market is their home market, and so on.

Table 4 reports the results for fixed-effect regressions with the home market share variables. The results reported in the first column include *SHARE HOME*. The positive coefficient on *SHARE HOME* indicates that, all else equal, deposit rates rise when deposits shift to home-market banks from outside banks. This is consistent with banks competing more aggressively in their home markets. However, once we break down the home market deposit share by the size of the bank, we see that it is only the larger banks that compete more aggressively in their home markets. Looking at the regression in the second column, the coefficient on *SIZE STR SMALL HOME* is not significantly different from zero, suggesting that small banks compete similarly in their home market and outside it. The coefficients on *SIZE STR MID HOME* and *SIZE STR MEGA HOME* are positive, indicating that banks in these size classes compete more aggressively in their home markets than in other markets.

The evidence leads to three conclusions: First, banks compete at least as aggressively for deposits in their home markets as outside them (with all but small banks competing more aggressively). Second, multimarket banks are more aggressive competitors than banks that operate primarily in a single market, all else equal. Third, there is an inverse-V relationship between size structure and deposit rates, with mid-size banks being more aggressive competitors than banks of other sizes. Mega-banks appear to compete less aggressively than smaller banks. To make a specific prediction of how deposit rates will change as a market evolves, it is necessary to balance all these effects. For example, if an out-of-market mega-bank acquires a small, single market bank, then the regressions predict a decline in deposit rates for all banks in

the market.¹¹ If the market is the home market of the mega-bank acquirer, on the other hand, then the regressions predict a positive impact from the merger on deposit rates at banks in the market.

Focusing on banks outside their home markets, we see that mega-banks compete less aggressively than other banks in these markets. This is consistent with the intuition behind the spatial model in Hannan and Prager (2004). That paper treated the interest rate of a multimarket bank as being fixed in markets where the bank had less than half of its deposits. Thus, increasing the market share of multimarket banks was associated with less competition, and lower deposit rates. This is true for the multimarket mega-banks in our sample, but not of smaller multimarket banks. This may be because each individual market is more important for a smaller multimarket bank, and therefore, the bank may compete more aggressively for deposits (on average, a multimarket mega-bank has 0.8% of its deposits in each non-home market while multimarket small and mid-size banks have 17.7% and 3.7% of deposits in each non-home market, respectively). The regressions here, by allowing us to separate the effects of bank size and of being in multiple markets, allow a more nuanced view of the competitive impact of outside banks. This view provides further evidence consistent with banks caring more about competing in markets that are more important to them.

D. Urban versus rural markets

Studies have found significant differences between banks in urban and rural markets, both in the composition of their deposit portfolios (e.g., DeYoung, et. al, 2004) and in the interest rates they pay (e.g., Berger and Hannan, 1989; Hannan and Prager, 2004). In the cross-sectional regressions reported in Table 3, the coefficient on the urban market dummy is significantly negative, indicating that, all else equal, deposit rates are lower in urban markets. To examine whether there are other differences among urban and rural markets, we split our sample by whether the local market is in an MSA.¹² There are 351 urban (MSA) markets and 1,286 rural (non-MSA) markets. The urban markets, not surprisingly, have more banks per market. Overall, we have 63,988 observations from urban markets and 72,830 from rural markets. Table 5 has summary statistics for the urban and rural market subsamples.

¹¹ Using the second regression in Table 4, the net effect is the sum of the coefficients on MULTIMARKET SHARE and SIZE STR MEGA, which is $0.110 + (-0.253) = -0.153$.

¹² The results are similar if we divide markets based on size. This is not surprising, since urban markets tend to be much larger than rural markets (although not all urban markets are large and not all rural markets are small).

One conclusion that jumps out when we estimate (1) separately for urban and rural markets is that market concentration as measured by the HHI does not significantly affect deposit rates in rural markets. Table 6 gives results for fixed-effects regressions on the urban and rural subsamples. The coefficient on HHI is insignificant for rural markets, but significantly negative for urban markets. This suggests that the HHI may not be the best way to measure competitive conditions in rural MSAs.

The impact of multimarket banks on competition also differs in urban and rural markets. The deposit share of multimarket banks is positively associated with deposit rates in urban markets, but has no effect in rural markets. In addition, multimarket banks offer lower deposit rates, all else equal, in rural markets than in urban markets. Together, these indicate that multimarket banks are less aggressive competitors in rural markets than in urban markets. This is consistent with banks being more aggressive in markets where they have a larger deposit presence, since multimarket banks tend to have a larger share of their deposits in urban markets.

Size structure affects urban markets in a slightly different way than it affects rural markets. The first two columns of Table 6 show that the coefficients on SIZE STR MID and SIZE STR MEGA are both lower for the rural market subsample than for the urban market subsamples (these differences are statistically significant). However, the difference between the coefficients on SIZE STR MID and SIZE STR MEGA in each regression are about the same ($0.234 - 0.037 \approx 0.009 - (-0.201)$). This indicates that the difference between the two regressions is the impact of the deposit share of the omitted group, that is, small banks. Based on this, small banks are relatively more aggressive competitors in rural markets than in urban markets. This may be because small banks have a relatively larger presence in these markets (small banks make up 77% of deposits in the average rural market compared to 40% of deposits in the average urban market).¹³

The results here show that banks in urban and rural markets seem to respond to different factors when setting deposit rates. They suggest the need to be cautious about drawing strong conclusions about the impact of changes in market concentration and multimarket bank presence in rural markets. Still, some factors such as size structure play a role in both urban and rural

¹³ This does not mean that small banks have 40% of total deposits in urban markets. Small banks have a larger share of deposits in smaller urban markets than in larger urban markets.

markets. In addition, the “home-market” effect of being more aggressive where you have a bigger presence is common to both urban and rural markets.

E. Are multimarket banks different?

If multimarket banks set prices on a state-wide or regional basis, then they may be less responsive to conditions in a local market, even if it is their home market. However, since these banks make up such a large percentage of total deposits, we include them in our sample. As noted earlier, 13% of banks have over 25% of deposits outside their home markets -- our definition of a multimarket bank -- but these banks control 50% of all deposits. To test whether deposit rates at these banks are less responsive to market conditions, we create a series of interaction variables. Each of the market structure variables (the HHI, the multimarket bank share, and the size structure variables) is interacted with the multimarket bank dummy. These new interaction variables are added to the regressions. Thus, both HHI and HHI*MM, the product of the HHI and the multimarket bank dummy, are used as independent variables. This means that the coefficient on HHI*MM is the additional effect of market concentration on the deposit rate at a multimarket bank above that at a single-market bank (where a ‘single-market’ bank is defined as one that has less than 25% of its deposits outside its home markets).

The results of regressions including the multimarket interaction dummies are given in the first three columns of Table 7.¹⁴ The first column reports the results for all markets while the next two columns cover urban and rural markets. In general, multimarket banks seem to respond to market conditions in a similar manner to single-market banks. However, there are some differences that are loosely related to multimarket banks being less responsive to changes involving smaller banks.

In the regression in the first column of Table 7, the coefficients on MULTIMARKET SHARE*MM and SIZE STR MEGA*MM are statistically significant. The two coefficients have about the same magnitude, but different signs. This implies that, relative to single-market banks, multimarket banks increase deposit rates less as the multimarket bank deposit share increases but increase deposit rates more as the deposit share of mega-banks increases. Since most mega-banks are multimarket banks, this is consistent with multimarket banks being less responsive than

¹⁴ Note that running separate regressions for single-market and multimarket banks may produce different results because the MSA fixed effects may differ in the two subsamples.

single-market banks to changes in the deposit shares of small and mid-size multimarket banks but equally responsive to changes in the deposit shares of large multimarket banks.¹⁵

The differences between multimarket and single-market banks in urban and rural markets can also be linked, albeit tenuously, to differences in responsiveness based on bank size. Relative to single-market banks, multimarket banks are more sensitive to changes in market concentration in urban markets and less sensitive in rural markets. Since major changes in market concentration in urban markets are likely due to movements among large banks while market concentration changes in rural markets are more likely to be due to changes among smaller banks, we can interpret the coefficients on $HHI*MM$ in the urban and rural market regressions to mean that multimarket banks care more about changes in market concentration when the changes involve larger banks than when they involve smaller banks. Offsetting this, multimarket banks are more responsive to changes in deposit share at small single-market banks in the small banks' home markets.

The sample we use contains only the home markets of banks. This is motivated by the facts that most banks have few deposits outside their home markets and that we only have the average deposit rate for a bank, rather than the rate for each branch. But, as noted, multimarket banks can have significant market share outside their home market. The final column of Table 7 reports the results of a regression of deposit rates on the market structure and control variables for the non-home offices of multimarket banks (the results are similar if we include single-market banks, but by definition these banks have few deposits outside their home market). For these, we include one observation for every market outside the home market that a multimarket bank has a branch in. We use the market structure of the outside market for the market-level control variables, and the average deposit rate for the bank as the dependent variable. The only important difference between the home-market regressions and the other-market regressions is in the coefficient on $SIZE\ STR\ MEGA$. A bank is more responsive to changes in the deposit share of mega-banks in a market that is not the home market of either the bank or the mega-banks. Still, these results

¹⁵ To see this, consider a change in the deposit share of a mega-bank that is also a multimarket bank. A multimarket bank's deposit rate increase more than that of a single-market bank by $SIZE\ STR\ MEGA*MM$ times the change in deposit share, but decreases relative to a single-market bank by $MULTIMARKET\ SHARE*MM$ times the change in deposit share. These two effects offset. For changes to the deposit share of multimarket that come from changes at smaller banks, only the latter effect is significant.

should be viewed with caution since we cannot be sure that our estimate of the deposit rate is accurate for bank branches outside the home market.

V. Robustness

We do several additional robustness checks. The results are summarized in this section.

A potential issue with the baseline model is that the market structure variables are correlated with each other. As noted, mega-banks also tend to be multimarket banks. In addition, market concentration is negatively correlated with the presence of larger banks. To account for these relationships, we introduce variables to capture the possible interaction between the HHI and the other size structure variables (Hannan and Prager, 2004, and Park and Pennacchi, 2005, also have interactions between the HHI and their measures of multimarket share). Let $HERF * SIZE STR MID$ be the product of the HHI and the market share of mid-size banks. We also define similar interaction variables for mega-banks ($HERF * SIZE STR MEGA$), and the share of deposits at multimarket banks ($HERF * MULTI SHARE$). The only interaction term that is significant is on the coefficient of $HERF * SIZE STR MID$, as seen in the first column of Table 8. When the interaction terms are included, the coefficients on the multimarket deposit share and the share of deposits at mega-banks are insignificant. To see whether this is due to the inclusion of the (significant) interaction term $HERF * SIZE STR MID$, we run a regression dropping the other two (insignificant) interaction terms. The results, reported in the second column of Table 8, show that the coefficients on $MULTIMARKET SHARE$ and $SIZE STR MEGA$ are again significant. Overall, the interaction terms play little role in determining deposit rates here.

Banks offer a variety of deposit products. To see whether they use similar pricing strategies across different deposit products, we repeat our main regression for money market deposit accounts (MMDAs). MMDAs reflect a different depositor base than NOW accounts. NOWs are among the most widely held deposit products but individual accounts can be small. MMDAs, on the other hand, are less widely held, but individual accounts can be large and potentially very profitable for banks.¹⁶ Moreover, many MMDA holders also have other products at a bank, while this is true less often for checking accounts (Amel and Starr-McCluer, 2002). Thus, by

¹⁶ According to the 1998 Survey of Consumer Finances, 72.9 percent of depositors have a checking account at their primary financial institution while only 51.7 percent have a money market account there (Amel and Starr-McCluer, 2002).

contrasting MMDAs with NOWs, we can see whether interest rates are set based on similar factors for two different types of instrument.

Data on MMDA rates are available only through 2000.¹⁷ During our sample, the average MMDA rate in the sample is 4.13%, which is higher than the average rate on NOWs. Again, this reflects the different benefits and uses of the two types of accounts.

The first column of Table 9 reports selected results from a regression of MMDA rates on market structure variables and controls as given by (1). For comparison, results for a similar regression for NOW rates are reported in the second column (the coefficients differ slightly from those in column (2) of Table 3 since the results here use data from 1988-2000 to match the MMDA data). The biggest difference between MMDAs and NOWs is that mega-banks compete more aggressively for MMDAs than for NOWs. The differences between the NOW and MMDA regressions are not surprising given the different roles of NOW accounts and MMDAs. NOW accounts, along with savings accounts to a lesser degree, are the core accounts of a depositor's relationship with a bank. As noted earlier, MMDA accounts are more likely to be held in conjunction with other accounts. Thus, it may be more effective to change NOW rates than MMDA rates to attract new depositors. This would suggest that NOW rates might respond differently than MMDA rates to changes in market structure such as, potentially, the share of multimarket banks. In addition, MMDA accounts play a larger role at mega-banks than at smaller banks. Small banks have about as many NOW deposits as MMDA deposits, while mega-banks have roughly six times more MMDA deposits than NOW deposits. Thus, mega-banks may view MMDAs as a more important part of their business than small banks do, leading the mega-banks to compete relatively more aggressively for MMDA deposits.

We also explore the division of banks into size classes in a series of regressions that are summarized here but not presented. Banks we call small include some very small community banks as well as some banks that operate over a wider region. To see whether the small bank group contains banks that react in a similar fashion to market structure changes, we divide the small banks into subgroups. Overall, there seems to be a gradual change from the smallest banks to those we call mid-size banks. Increasing the deposit share of the largest small banks by taking deposit share from the smallest small banks increases deposit rates at all banks in the market, but

¹⁷ Starting in 2001, banks reported the combined balances of MMDA accounts and other savings accounts.

by no more than a shift from the smallest banks to mid-size banks. In addition, all else equal, the largest small banks offer deposit rates that are lower than those at the smallest banks but no lower than those at mid-size banks.

Examining the other cutoff between the two larger size classes shows that \$20 billion seems like the correct value. With a lower cutoff between mid-size and mega-banks, such as \$10 billion, moving deposits from mid-size to mega-banks still reduces deposit rates at all banks in a market. However, the impact is lessened (that is, the coefficient on SIZE STR MID decreases and the coefficient on SIZE STR MEGA increases). Increasing the minimum size of a mega-bank to, say, \$50 billion yields a less positive effect of shifting deposits to mid-size banks and a more negative effect of shifting deposits to mega-banks. This implies that \$20 billion is a good cutoff and that the results are robust to moderate changes in the cutoffs between size classes.

VI. Conclusions

The recent bank consolidation increased the average size of banks without having much impact on local market concentration, the focus of antitrust scrutiny. This paper explores whether the consolidation nevertheless had an impact on bank deposit interest rates. We find that deposit rates can be affected when local markets change, even if the changes do not alter market concentration.

We show that the size of the banks in a local market matters, even when that size is achieved outside the local market. Changing the size structure of the market can affect deposit rates *at all banks* in the market, even when market concentration is held constant. The effect of changes in size structure, however, depends on the type of market and how important it is to the bank.

If the consolidation in banking continues, it will mean that small and mid-size banks, including a lot of single-market ones, will be acquired by multimarket mega-banks. There is a stylized fact that large banks have lower deposit rates than small banks -- something we find evidence of. But this paper shows that there are also external effects from changing the size of banks in a local market. A movement from single-market small and mid-size banks to multimarket mega-banks can have three external effects on deposit rates in the market. Mega-banks tend to be less aggressive competitors than smaller banks. This is partially, but not completely, offset by the fact that multimarket banks tend to be more aggressive competitors. If

the consolidation involves entry through acquisition by an out-of-market bank, this will serve to reduce rates in the market even more, because mid-size and mega-banks tend to be less aggressive competitors outside their local markets. Overall, the results here suggest that a move from single-market small and mid-size banks to multimarket mega-banks will reduce deposit rates, both for depositors at the acquired banks and for others in the markets where the merger activity takes place.

Some results in this paper, specifically our finding that multimarket banks, all else equal, compete more aggressively than single-market banks, differ from the extant literature. We think this is because we rely on a fixed-effects methodology rather than a cross-sectional approach. Controlling for MSA fixed effects allows direct answers to questions about how deposit rates will change as market conditions evolve. On the other hand, we show how a cross-sectional regression can give misleading results if the set of control variables is not complete. For example, we show that a cross-sectional regression can predict that as the number of banks in a market increases, deposit rates in the market will fall. This implies, counterintuitively, that more competition leads to higher prices (i.e., lower deposit rates). However, this result flips to the more expected inverse correlation between competition and price once MSA fixed effects are controlled for. The difference suggests that there are some differences across MSAs that are difficult to control for absent MSA dummies. For these reasons, we believe that fixed effects is the preferred approach to answering questions about how markets will react to changes.

In this paper, we show that market structure has an important impact on how banks set deposit rates, but that the impact is more complex than previously thought. This has implications for regulatory policy, including antitrust. The results here suggest that it is important to account for the overall sizes of banks proposing to merge in addition to their local market shares. One implication is that the HHI alone is not sufficient to predict the effect of bank consolidation on deposit rates in a market. One must also account for changes to size structure and whether the acquiring bank is a new entrant into the market.

References

- Akhavien, Jamal D., Allen N. Berger, and David B. Humphrey, 1997, "The Effects of Megamergers on Efficiency and Prices: Evidence from a Bank Profit Function," *Review of Industrial Organization* 12, 95-139.
- Amel, Dean F. and Martha Starr-McCluer, 2002, "Market Definition in Banking: Recent Evidence," *The Antitrust Bulletin*, 47(1) (Spring 2002), 63-89.
- Berger, Allen N. and Astrid A. Dick, 2003, "Entry into Banking Markets and the First-Mover Advantage," working paper.
- Berger, Allen N. and Timothy H. Hannan, 1989, "The Price Concentration Relationship in Banking," *Review of Economics and Statistics* 71(2) (May 1989), 291-99.
- Berger, Allen N., Richard J. Rosen, and Gregory F. Udell, 2005, "Does Market Size Structure Affect Competition? The Case of Small Business Lending," working paper.
- Biehl, Andrew R., 2002, "The Extent of the Market for Retail Banking Deposits," *The Antitrust Bulletin* 47(1) (Spring 2002), 91-106.
- Cohen, Andrew M. and Michael J. Mazzeo, 2004, "Market Structure and Competition among Retail Depository Institutions," working paper.
- Corvoisier, Sandrine and Reint Gropp, 2002, "Bank Concentration and Retail Interest Rates," *Journal of Banking and Finance* 26(11), 2155-89.
- DeYoung, Robert, William C. Hunter, and Gregory F. Udell, 2004, "The Past, Present, and Probable Future for Community Banks," *Journal of Financial Services Research*.
- Gilbert, R. Alton and Adam M. Zaretsky, 2003, "Banking Antitrust: Are the Assumptions Still Valid?" *Federal Reserve Bank of St. Louis Review* (November/December 2003), 1-24.
- Hannan, Timothy H., 1991, "Bank Commercial Loan Markets and the Role of Market Structure: Evidence From Surveys of Commercial Lending," *Journal of Banking and Finance* 15, 133-149.
- Hannan, Timothy H. and Robin A. Prager, 2004, "The Competitive Implications of Multimarket Bank Branching," *Journal of Banking and Finance* 28(8), 1889-1914.
- Park, Kwangwoo and George Pennacchi, 2005, "Harming Depositors and Helping Borrowers: The Disparate Impact of Bank Consolidation," working paper.
- Prager, Robin A. and Timothy H. Hannan, 1998, "Do Substantial Horizontal Mergers Generate Significant Price Effects? Evidence from the Banking Industry," *Journal of Industrial Economics* 46(4), 433-52.
- Radecki, Lawrence J., 1998, "The Expanding Geographic Reach of Retail Banking Markets," *Federal Reserve Bank of New York Economic Policy Review* (June 1998), 15-34.
- Rhoades, Stephen A., 1995, "Market Share, Inequality, the HHI, and Other Measures of the Firm-Composition of a Market," *Review of Industrial Organization* 10(6) (December 1995), 657-674.
- Rosen, Richard J., 2002, "What Goes Up Must Come Down? Asymmetries and Persistence in Bank Deposit Interest Rates," *Journal of Financial Services Research*, 21 (3), 2002, 173-193.
- Tirole, Jean, 1988, *The Theory of Industrial Organization* (MIT Press: Cambridge, MA).

Table 1. Summary statistics

Summary statistics for the sample of 136,818 bank-year observations. The NOW interest rate is a percentage, all other variables except market size are ratios. All dollar values are in 2003 dollars.

Variable	Mean	Std. dev.
NOW rate (percentage)	3.207	1.401
Total deposits in the local market, \$ billions	0.173	1.191
Herfindahl index (HHI)	0.221	0.130
Proportion of small banks (< \$1 billion total assets; SIZE SMALL)	0.962	0.191
Proportion of mid-size banks (\$1-20 billion total assets; SIZE MID)	0.035	0.183
Proportion of mega-banks (>\$20 billion total assets; SIZE MEGA)	0.003	0.057
Deposit share of small banks (SIZE STR SMALL)	0.650	0.335
Deposit share of mid-size banks (SIZE STR MID)	0.214	0.248
Deposit share of mega-banks (SIZE STR MEGA)	0.136	0.226
Proportion of banks with at least 25 percent of deposits outside home market (MULTIMARKET DUMMY)	0.144	0.351
Market share of banks with at least 25 percent of deposits outside home market (MULTIMARKET SHARE)	0.292	0.280
Market share of small banks with at least 25 percent of deposits outside home market (MULTIMARKET SHARE SMALL)	0.070	0.122
Market share of mid-size banks with at least 25 percent of deposits outside home market (MULTIMARKET SHARE MID)	0.112	0.174
Market share of large banks with at least 25 percent of deposits outside home market (MULTIMARKET SHARE MEGA)	0.110	0.201
Deposit share of banks for which the market is their home market (SHARE HOME)	0.466	0.303
Deposit share of small banks for which the market is their home market (SHARE HOME SMALL)	0.355	0.293
Deposit share of mid-size banks for which the market is their home market (SHARE HOME MID)	0.080	0.150
Deposit share of mega-banks for which the market is their home market (SHARE HOME MEGA)	0.031	0.115
Urban market dummy (URBAN)	0.080	0.150
Log of banking market size (LOG MKT SIZE)	0.031	0.115
Log of number of banks in the market (LOG BANKS)	0.468	0.499
Deposits per branch, \$ billions (DEPOSITS PER BRANCH)	9.158	0.957
Ratio of nonperforming loans to total loans (NONPERFORMING RATIO)	1.152	0.571
Ratio of nonperforming loans to total loans in local market (MKT NONPERFORMING RATIO)	0.046	0.155

Table 2. Regressions of deposit interest rates on market concentration, 1988-2003.

Regressions of the NOW rate on the HHI and controls. The NOW interest rate is a percentage, all other variables are ratios. All dollar values are in 2003 dollars. Robust p-values corrected for cluster effects are reported in parentheses. The first column reports results for a regression that pools the data, the second column reports results for a regression where the dependent variable is the average NOW rate in a market in a given year, the third column reports results for the average coefficient on the HHI in 16 yearly regressions using one observation per bank, the fourth column replicates the regression in the first column but uses MSA fixed effects, and the fifth column replicates the regression in the first column but adds the addition control variables given in equation (1) in the text.

	(1)	(2)	(3)	(4)	(5)
	Pooled	One observation per MSA-year	Average of yearly regressions	MSA fixed effects	Pooled
HHI	0.509 (0.000)***	0.290 (0.000)***	0.557	-0.819 (0.000)***	-0.139 (0.005)***
MSA fixed effects	NO	NO	NO	YES	NO
Year dummies	YES	YES	n/a	YES	YES
Other controls	NO	NO	NO	NO	YES
Observations	136,818	38,800	n/a	136,818	136,818
R-squared	0.769	0.854	n/a	0.816	0.775

* significant at 10%; ** significant at 5%; *** significant at 1%; n/a - not applicable.

Table 3. Regressions of deposit interest rates on market structure variables and other controls, 1988-2003.

Regressions of the NOW rate using (1). The regression in the fourth column uses the definition of a multimarket bank given in Hannan and Prager (2004). All other regressions used the definition given in this paper. The NOW interest rate is a percentage, all other variables are ratios. All dollar values are in 2003 dollars. Robust p-values corrected for cluster effects are reported in parentheses. All the regressions have 136,818 observations. Year dummies are included but not shown.

	(1)	(2)	(3)	(4)
HHI	-0.098 (0.052)*	-0.194 (0.052)*	-0.201 (0.045)**	-0.194 (0.053)*
MULTIMARKET SHARE	-0.089 (0.000)***	0.118 (0.000)***		
SIZE STR SMALL MULTI			0.147 (0.000)***	0.169 (0.000)***
SIZE STR MID	0.049 (0.068)*	0.060 (0.072)*	0.086 (0.053)*	0.083 (0.062)*
SIZE STR MID MULTI			0.092 (0.025)**	0.100 (0.015)**
SIZE STR MEGA	-0.490 (0.000)***	-0.230 (0.000)***	-0.170 (0.018)**	-0.173 (0.016)**
SIZE STR MEGA MULTI			0.067 (0.308)	0.078 (0.236)
SIZE MID	-0.260 (0.000)***	-0.238 (0.000)***	-0.239 (0.000)***	-0.237 (0.000)***
SIZE MEGA	-0.106 (0.113)	-0.166 (0.007)***	-0.166 (0.006)***	-0.152 (0.014)**
MULTIMARKET DUMMY	-0.063 (0.000)***	-0.047 (0.000)***	-0.047 (0.000)***	-0.079 (0.000)***
URBAN	-0.087 (0.000)***			
LOG MKT SIZE	0.024 (0.211)	0.519 (0.000)***	0.521 (0.000)***	0.527 (0.000)***
LOG BANKS	-0.091 (0.000)***	0.353 (0.000)***	0.344 (0.000)***	0.340 (0.000)***
DEPOSITS PER BRANCH	0.089 (0.001)***	0.097 (0.000)***	0.097 (0.001)***	0.099 (0.000)***
NONPERFORMING RATIO	0.911 (0.000)***	0.804 (0.000)***	0.807 (0.000)***	0.809 (0.000)***
MKT NONPERFORMING RATIO	2.219 (0.000)***	2.180 (0.000)***	2.165 (0.000)***	2.137 (0.000)***
MSA fixed effects	NO	YES	YES	YES
R-squared	0.781	0.819	0.819	0.819

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4. Regressions of deposit interest rates on market structure and controls including home market variables, 1988-2003.

Regressions of the NOW rate using (1) with additional home market interaction terms. All dollar values are in 2003 dollars. Robust p-values corrected for cluster effects are reported in parentheses. All the regressions have 136,818 observations. Year dummies and other controls in (1) are included but not shown.

	(1)	(2)
HHI	-0.205 (0.040)**	-0.191 (0.055)*
MULTIMARKET SHARE	0.117 (0.000)***	0.110 (0.000)***
SHARE MAJOR	0.067 (0.000)***	
SIZE STR SMALL HOME		0.013 (0.404)
SIZE STR MID	0.073 (0.029)**	0.024 (0.506)
SIZE STR MID HOME		0.127 (0.000)***
SIZE STR MEGA	-0.191 (0.000)***	-0.253 (0.000)***
SIZE STR MEGA HOME		0.241 (0.000)***
SIZE MID	-0.237 (0.000)***	-0.236 (0.000)***
SIZE MEGA	-0.167 (0.006)***	-0.167 (0.006)***
MULTIMARKET DUMMY	-0.047 (0.000)***	-0.048 (0.000)***
MSA fixed effects	YES	YES
Observations	136818	136818
R-squared	0.819	0.820

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5. Summary statistics for urban and rural markets.

Summary statistics for the sample divided into urban and rural markets, where an urban market is one that comprises an MSA and a rural market is a non-MSA county. The NOW interest rate is a percentage, all other variables except market size are ratios. All dollar values are in 2003 dollars.

Variable	Urban markets		Rural markets	
	Mean	Std. dev.	Mean	Std. dev.
NOW rate (percentage)	3.125	1.469	2.908	1.335
Total deposits in the local market, \$ billions	0.306	1.725	0.039	0.139
Herfindahl index (HHI)	0.142	0.065	0.260	0.133
Proportion of small banks (< \$1 billion total assets; SIZE SMALL)	0.921	0.269	1.000	0.047
Proportion of mid-size banks (\$1-20 billion total assets; SIZE MID)	0.072	0.258	0.000	0.047
Proportion of mega-banks (>\$20 billion total assets; SIZE MEGA)	0.007	0.083	0.000	0.005
Deposit share of small banks (SIZE STR SMALL)	0.387	0.257	1.000	0.197
Deposit share of mid-size banks (SIZE STR MID)	0.364	0.245	0.000	0.160
Deposit share of mega-banks (SIZE STR MEGA)	0.250	0.268	0.000	0.106
Proportion of banks with at least 25 percent of deposits outside home market (MULTIMARKET DUMMY)	0.165	0.371	0.000	0.331
Market share of banks with at least 25 percent of deposits outside home market (MULTIMARKET SHARE)	0.366	0.298	0.150	0.246
Market share of small banks with at least 25 percent of deposits outside home market (MULTIMARKET SHARE SMALL)	0.026	0.045	0.043	0.152
Market share of mid-size banks with at least 25 percent of deposits outside home market (MULTIMARKET SHARE MID)	0.148	0.185	0.000	0.157
Market share of large banks with at least 25 percent of deposits outside home market (MULTIMARKET SHARE MEGA)	0.192	0.246	0.000	0.106
Deposit share of banks for which the market is their home market (SHARE HOME)	0.435	0.276	0.491	0.323
Deposit share of small banks for which the market is their home market (SHARE HOME SMALL)	0.230	0.193	0.454	0.320
Deposit share of mid-size banks for which the market is their home market (SHARE HOME MID)	0.144	0.178	0.000	0.088
Deposit share of mega-banks for which the market is their home market (SHARE HOME MEGA)	0.062	0.158	0.000	0.040
Log of banking market size (LOG MKT SIZE)	10.026	0.651	8.408	0.322
Log of number of banks in the market (LOG BANKS)	1.634	0.451	0.778	0.228
Deposits per branch, \$ billions (DEPOSITS PER BRANCH)	0.057	0.191	0.029	0.112
Ratio of nonperforming loans to total loans (NONPERFORMING RATIO)	0.015	0.023	0.008	0.018
Ratio of nonperforming loans to total loans in local market (MKT NONPERFORMING RATIO)	0.017	0.016	0.010	0.011
<i>Observations</i>	63,988		72,830	

Table 6. Regressions of deposit interest rates on market structure variables and other controls for urban and rural markets, 1988-2003.

Regressions of the NOW rate using (1) with additional home market variables for the sample divided into urban and rural markets, where an urban market is one that comprises an MSA and a rural market is a non-MSA county. The NOW interest rate is a percentage, all other variables are ratios. All dollar values are in 2003 dollars. Robust p-values corrected for cluster effects are reported in parentheses. All the regressions have 136,818 observations. Year dummies and other controls in (1) are included but not shown.

	(1) Urban markets	(2) Rural markets	(3) Urban markets	(4) Rural markets
HHI	-0.625 (0.000)***	-0.176 (0.156)	-0.584 (0.001)***	-0.163 (0.187)
MULTIMARKET SHARE	0.191 (0.000)***	0.048 (0.166)	0.183 (0.000)***	0.043 (0.215)
SIZE STR SMALL HOME			-0.065 (0.206)	0.006 (0.728)
SIZE STR MID	0.234 (0.000)***	0.009 (0.846)	0.148 (0.017)**	-0.050 (0.306)
SIZE STR MID HOME			0.077 (0.023)**	0.236 (0.000)***
SIZE STR MEGA	0.037 (0.598)	-0.201 (0.002)***	-0.079 (0.303)	-0.213 (0.001)***
SIZE STR MEGA HOME			0.219 (0.000)***	0.358 (0.008)***
SIZE MID	-0.254 (0.000)***	-0.128 (0.172)	-0.252 (0.000)***	-0.115 (0.226)
SIZE MEGA	-0.186 (0.002)***	-0.249 (0.659)	-0.187 (0.002)***	-0.264 (0.637)
MULTIMARKET DUMMY	-0.023 (0.170)	-0.075 (0.000)***	-0.023 (0.174)	-0.075 (0.000)***
MSA fixed effects	YES	YES	YES	YES
Observations	63,988	72,830	63,988	72,830
R-squared	0.805	0.837	0.805	0.837

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7. Regressions of deposit interest rates on market structure and controls with multimarket bank interaction terms, 1988-2003.

Regressions of the NOW rate using (1) with additional multimarket bank and home market variables. An urban market is one that comprises an MSA and a rural market is a non-MSA county. The non-home market sample includes observations for multimarket banks outside their home markets. The NOW interest rate is a percentage, all other variables are ratios. All dollar values are in 2003 dollars. Robust p-values corrected for cluster effects are reported in parentheses. Year dummies and other controls in (1) are included but not shown.

	(1) All markets	(2) Urban markets	(3) Rural markets	(4) Non-home markets
HHI	-0.207 (0.039)**	-0.479 (0.011)**	-0.197 (0.111)	-0.252 (0.016)**
HHI * MM	0.070 (0.416)	-0.484 (0.013)**	0.316 (0.003)***	
MULTIMARKET SHARE	0.154 (0.000)***	0.207 (0.000)***	0.104 (0.007)***	0.008 (0.844)
MULTIMARKET SHARE * MM	-0.190 (0.000)***	-0.131 (0.021)**	-0.231 (0.000)***	
SIZE STR SMALL HOME	0.009 (0.577)	-0.097 (0.069)*	0.006 (0.746)	0.101 (0.002)***
SIZE STR SMALL HOME * MM	0.033 (0.356)	0.327 (0.003)***	-0.004 (0.923)	
SIZE STR MID	0.003 (0.935)	0.120 (0.059)*	-0.082 (0.115)	0.192 (0.002)***
SIZE STR MID * MM	0.081 (0.118)	0.234 (0.029)**	0.098 (0.343)	
SIZE STR MID HOME	0.127 (0.000)***	0.088 (0.014)**	0.230 (0.000)***	0.074 (0.109)
SIZE STR MID HOME * MM	0.002 (0.971)	-0.055 (0.467)	0.012 (0.921)	
SIZE STR MEGA	-0.302 (0.000)***	-0.127 (0.107)	-0.272 (0.000)***	0.220 (0.005)***
SIZE STR MEGA * MM	0.196 (0.001)***	0.318 (0.002)***	0.286 (0.048)**	
SIZE STR MEGA HOME	0.261 (0.000)***	0.241 (0.000)***	0.301 (0.041)**	-0.147 (0.269)
SIZE STR MEGA HOME * MM	-0.095 (0.238)	-0.127 (0.127)	0.192 (0.487)	
SIZE MID	-0.237 (0.000)***	-0.245 (0.000)***	-0.115 (0.241)	-0.274 (0.000)***
SIZE MEGA	-0.172 (0.005)***	-0.179 (0.004)***	-0.424 (0.520)	-0.204 (0.010)**
MULTIMARKET DUMMY	-0.055 (0.096)*	-0.126 (0.128)	-0.116 (0.004)***	-0.018 (0.329)
MSA fixed effects	YES	YES	YES	YES
Observations	136,818	63,988	72,830	103,111
R-squared	0.820	0.805	0.837	0.736

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 8. Robustness checks: regressions of deposit interest rates on market structure and controls, 1988-2003.

Regressions of the NOW rate using (1). The MMDA and NOW interest rates are percentages, all other variables are ratios. All dollar values are in 2003 dollars. Robust p-values corrected for cluster effects are reported in parentheses. All the regressions have 136,818 observations. Year dummies and other controls in (1) are included but not shown.

	(1)	(2)
HHI	-0.077 (0.512)	-0.120 (0.242)
MULTIMARKET SHARE	0.073 (0.155)	0.124 (0.000)***
MULTIMARKET SHARE * HERF	0.195 (0.253)	
SIZE STR MID	0.194 (0.002)***	0.148 (0.005)***
SIZE STR MID * HERF	-0.563 (0.008)***	-0.397 (0.023)**
SIZE STR MEGA	-0.117 (0.136)	-0.217 (0.000)***
SIZE STR MEGA * HERF	-0.398 (0.123)	
SIZE MID	-0.239 (0.000)***	-0.238 (0.000)***
SIZE MEGA	-0.165 (0.007)***	-0.166 (0.007)***
MULTIMARKET DUMMY	-0.047 (0.000)***	-0.046 (0.000)***
MSA fixed effects	YES	YES
R-squared	0.819	0.819

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 9. Robustness checks: regressions of MMDA and NOW deposit rates on market structure and controls, 1988-2000.

Regressions of the MMDA and NOW rates using (1) with additional home market variables. The NOW interest rate is a percentage, all other variables are ratios. All dollar values are in 2003 dollars. Robust p-values corrected for cluster effects are reported in parentheses. All the regressions have 115,069 observations. Year dummies and other controls in (1) are included but not shown.

Dependent variable:	(1) MMDA rate	(2) NOW rate
HHI	-0.243 (0.036)**	-0.190 (0.053)*
MULTIMARKET SHARE	0.155 (0.000)***	0.117 (0.000)***
SIZE STR MID	0.204 (0.000)***	0.063 (0.039)**
SIZE STR MEGA	0.159 (0.001)***	-0.223 (0.000)***
SIZE MID	-0.076 (0.000)***	-0.264 (0.000)***
SIZE MEGA	-0.245 (0.001)***	-0.193 (0.002)***
MULTIMARKET DUMMY	0.005 (0.675)	-0.041 (0.000)***
MSA fixed effects	YES	YES
R-squared	0.831	0.872

* significant at 10%; ** significant at 5%; *** significant at 1%.