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Assessing the Common Ownership Hypothesis in the US Banking Industry

Serafin Grundl and Jacob Gramlich *

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Abstract

The common ownership hypothesis (COH) states that firms with common shareholders, primarily large asset managers, compete less aggressively with each other. The U.S. banking industry is well suited to assess the common ownership hypothesis, because thousands of private banks without common ownership (CO) compete with hundreds of public banks with high and increasing levels of CO. This paper assesses the COH in the banking industry using more comprehensive ownership data than previous studies. In simple comparisons of raw deposit rate averages we document that the deposit rates of public banks are similar in markets where they share common shareholders with their rival and in markets where they do not. Panel regressions of deposit rates on the profit weights implied by the COH are generally not consistent with the COH if bank-quarter FEs are included. These estimates are "precise zeros" with 95% CIs suggesting that the threefold rise in CO among public banks between 2005 and 2022 moved their deposit rates by less than a quarter of a basis point in either direction. To assess the COH along non-price dimensions we also estimate the effect of CO on deposit quantities, and find that the estimates are also not consistent with the COH.

*Board of Governors of the Federal Reserve System, serafin.j.grundl@frb.gov, jacob.gramlich@frb.gov. This paper extends and supersedes "The Effect of Common Ownership in the U.S. Banking Industry" (2017). The analysis and conclusions set forth are those of the authors and do not indicate concurrence by other members of the staff, by the Board of Governors, or by the Federal Reserve Banks. Rebecca Jorgensen, Nadia Wallace, Meher Islam, Logan Schultheis, Sam Blattner, Helen Willis, Adam Tucker, Nicholas Hansen and Stefan Kassem provided outstanding research assistance. We thank Jose Azar, Dan O'Brien, Jennifer Dlugosz, Nate Miller, Martin Schmalz, Gloria Sheu and Robin Prager for helpful conversations, and Traci Mach and her colleagues for help with the S&P Global/RateWatch data.

1 Introduction

The common ownership hypothesis (COH) states that firms with common shareholders, primarily large asset managers, compete less aggressively with each other. The U.S. banking industry is well suited to assess the COH, because, unlike in most other industries, there are many public and private banks (over 500 and 4,000, respectively) that compete with each other. This creates substantial variation in common ownership (CO). While there is generally no CO among private banks, public banks have experienced a large increase in CO between 2005 and 2022. The COH predicts that the rise in CO among public banks changed their objective functions such that they should care more about competitors who are held by the same shareholders. The model by O'Brien and Salop (2000) implies that the average weight public banks place in their objective functions on rival profits increased roughly threefold between 2005 and 2022, which should have had a considerable effect on their pricing decisions. In contrast, the COH predicts that private banks should maximize only their own profits and that their objective functions have remained unchanged.

Importantly, the rise in CO among public banks creates not only variation in CO between banks (especially between private and public banks), but also within individual public banks across geographic markets. For instance, in banking markets with multiple public banks CO generally increased substantially, but in banking markets where a single public bank competes with private banks it did not.

Banking is not only a good laboratory to test the COH, but is also an industry in which CO is of particular policy relevance. Shareholders have to notify the Federal Reserve if their ownership share in a bank exceeds 10 percent (Change in Bank Control Act (CIBCA)) and the Federal Reserve can object to such a CIBCA notice on competitive grounds. The banking industry was also specifically mentioned in President Biden's executive order on competition.[1]

This paper assesses the COH in banking using more comprehensive ownership data than previous studies. Usually studies on the COH use data from SEC filing 13-F, which must be filed by institutional investment managers with $100 million or more in assets under management. The holdings of large institutional investment managers tend to be diversified within industries so they often own shares of competing firms, which results in high measured CO. This paper uses not only ownership data from the 13F filings but also from other filings such as SEC forms 3, 4 and 5 ("insider forms"), SEC form DEF 14A ("definitive proxy statement"), and SEC forms 13D and 13G ("beneficial ownership reports"). These filings also

[1]This is not to say that CO is of no policy relevance in other industries. For instance, the recent draft of the new merger guidelines by the Federal Trade Commission and the Department of Justice states that "Acquisitions of partial control or common ownership may in some situations substantially lessen competition" (Guideline 12).

capture ownership by smaller institutional shareholders and by non-institutional shareholders who tend to be less diversified and thus lessen the CO incentives predicted by the O'Brien and Salop (2000) model. While this effect is typically not important for large public banks it tends to be more important for smaller public banks, especially those that are not listed on an exchange but traded over the counter.[2]

We begin with a comparison of the average deposit rates offered by public and private banks. We find that private banks offer substantially more attractive deposit rates for all deposit products at all times from 2005 to 2022. This is not a surprising finding because it is well known that smaller banks tend to offer more attractive rates than large banks. This rate gap could be due to CO or due to other differences between public and private banks, such as public banks' wider variety of products and services, larger branch and ATM networks, or better online banking. We also find that there is no widening of the interest rate gap between public and private banks over time as would be predicted by the rise in CO among public banks. This latter finding is therefore inconsistent with the COH.

We then compare the deposit rates of public banks in geographic banking markets with multiple public banks ("CO markets") to markets where a single public bank competes only with private rivals ("no CO markets"). The COH predicts that public firms should compete as aggressively as private firms in markets with no CO. We find, however, that the rates offered by public banks in "no CO markets" are far less attractive than the rates of private banks and very similar to the rates of public banks in "CO markets". There is no substantial difference in the average level of public bank rates between "no CO markets" and "CO markets." The rates also didn't diverge as common ownership among public banks increased. These patterns are not consistent with the COH and suggest that the rate gap between private and public banks is not due to CO, but due to other differences between public and private banks (e.g. greater product variety, larger branch and ATM network size, better online banking).

Next we turn to a regression analysis. In our main analysis we deviate from the approach in Azar, Schmalz, and Tecu (2018) and Azar, Raina, and Schmalz (2022), which relates prices to generalizations of the HHI that account for CO and cross ownership.[3] We argue that such an approach inherits the endogeneity problems of HHI regressions, because the HHI and its generalizations are functions of quantities. Instead, we propose to regress prices and quantities on the weights describing how much firms care about the profits of their commonly owned rivals according to the model by O'Brien and Salop (2000).

[2]These banks often have modest ownership by 13F filers, but because their market capitalization is fairly low other shareholders – often members of the family that used to own the entire bank before it went public – can hold sizable positions. In some cases such shareholders even play an important role for larger banks, such as in the case of the appropriately named Holding family that owns about 20% of First Citizens Bank.

[3]We run such regressions in a robustness check.

In the simplest specification that only includes quarter fixed effects to account for changes in the level of interest rates, but no bank fixed effects, we find that banks who care more about rival profits do, indeed, set less aggressive deposit interest rates. The largest point estimates imply that the rise in CO among public banks between 2005 and 2022 lowered their deposit rates by more than 6 basis points.[4] Like the deposit rate gap between public and private banks, these estimates could be driven by CO or by other differences between banks (e.g. product variety, branch and ATM network size, online banking).

In specifications with bank-quarter fixed effects, however, we no longer find statistically significant effects in line with the COH. The large sample size and the fact that there is substantial variation within bank-quarter pairs across markets allows us to estimate "precise zeros". The 95% confidence intervals imply that the threefold increase in CO among public banks between 2005 and 2022 moved their deposit rates by less than a quarter of a basis point in either direction. The crucial difference in this specification is that it uses only within-bank variation across banking markets. Overall our findings suggest that banks do not adjust their deposit rates market by market in accordance with the COH.

One potential concern with these findings is that banks do generally not set interest rates at each branch separately, but instead designate a "rate setter" branch for a particular region and rates for other branches in the region follow. About 10-12% of all branches are rate setters. We explore whether our findings are driven by uniform pricing by running a robustness check where only rate-setter branches are used. As in the baseline estimates we find no effect of CO on deposit rates if bank-quarter FEs are included, but the confidence intervals are wider due to the smaller sample size.[5]

A potential endogeneity concern with these panel regressions is that at least some shareholders can choose which particular banks to invest in. Therefore we consider an identification strategy specification that isolates variation in profit weights driven by variation in the number of listed banks in a market and the general trend towards increased CO, but not by particular shareholder choices. To do this we use the number of listed banks in a market interacted with a time trend as an instrument for profit weights. The basic idea is that how many banks in a market are public is not a shareholder choice. The IV estimates are simi-

[4]Total interest bearing deposits at public banks exceed $10 trillion. Therefore a 1 basis point change for all deposit interest rates of public banks would result in annual harm for depositors of more than $1 billion, or more than $3 per American.

[5]Uniform pricing is not exogenously imposed on banks, but is a choice. The prevalence of uniform pricing can therefeore be viewed as evidence against the COH, because the COH predicts that bank objective functions differ substantially across markets and uniform pricing is therefore sub-optimal. However, even if one would view uniform pricing as exogenously imposed, notice that regressions using deposit quantities (see Section 6) are also inconsistent with the COH. Even if a uniform pricing constraint were imposed upon firms, firms can geographically vary the intensity of non-price competition (e.g. service, staffing, advertising, etc), so one would expect the COH to manifest in deposit quantities.

lar to the baseline findings as all estimate are negative and statistically significant without bank-quarter FEs, but no estimates remain statistically significant if bank-quarter FEs are added.

Fully explaining the negative association between profit weights and deposit rates in specifications that only include quarter FEs is beyond the scope of this paper. However, we do note that simply controlling for the size of a bank's branch network (without bank FEs) eliminates the negative association between profit weights and deposit rates for nine out of ten deposit rates.

Next we examine the effect of CO on deposit quantities. Even if banks do not change their deposit interest rates in accordance with the COH, it is possible that banks adjust how fiercely they compete along other dimensions. For instance CO could lower service quality, reduce the variety of services a bank offers, or reduce the incentive to steal rival customers via advertising. If this were the case we would expect that it results in deposit losses in markets where banks have significant CO with their rivals. In panel regressions of deposit quantities on profit weights we find either a small positive effect of CO, which is not consistent with the COH, or obtain a precisely estimated zero effect (depending on the included fixed effects). These findings suggest that banks do not compete less aggressively in markets where they share significant common owners with their rivals, neither by lowering deposit rates nor along non-price dimensions.

Literature This paper is most closely related to Azar, Raina, and Schmalz (2022), which finds that the GHHI, a generalized version of the HHI that accounts for common ownership and cross ownership, is strongly correlated with prices. The GHHI is a function of the weights that banks place on the profits of their rivals according to the COH, and of market shares. There are several important differences between Azar, Raina, and Schmalz (2022) and this paper. Most importantly, the main analysis in this paper relates prices directly to the profit weights that are predicted by common ownership theory rather than to the GHHI. We argue that GHHI regressions inherit the well known endogeneity problems of HHI regressions, because the HHI and its generalizations are functions of market shares.[6] However, as a robustness check we run GHHI regressions and in a specification that includes only quarter FEs we find a strong negative correlation between the GHHI and all deposit rates like Azar, Raina, and Schmalz (2022). This finding disappears however once bank-quarter FEs, and bank-branch FEs are included similar to the findings of the main analysis. Another

[6] An added benefit is that profit weights vary not just at the market-time level, but at the bank-market-time level. This creates additional variation and allows us to control for market-time fixed effects in some specifications. The profit weights actually even vary at an even more granular level: that of ordered firm pairs. However, the outcomes we observe - prices and quantities - vary only at the firm level.

important difference is that this paper examines not only the effect of CO on prices but also on changes in deposit quantities. In addition to this there are several smaller differences.[7]

In addition this paper is related to the broader literature on the COH hypothesis, which was sparked by the seminal contribution of Azar, Schmalz, and Tecu (2018) who found anticompetitive effects of CO in the airline industry by relating airline prices to the MHHI.[8] Other important contributions include Backus, Conlon, and Sinkinson (2021a) who propose a structural approach to testing the COH using data from the cereal industry, and Antón, Ederer, Giné, and Schmalz (2023) showing that CO is associated with less performance sensitive managerial incentives, and thereby suggesting a mechanism for the COH. Excellent surveys of the large and growing CO literature can be found in Schmalz (2018) and Schmalz (2021). Backus, Conlon, and Sinkinson (2019), Backus, Conlon, and Sinkinson (2020) and Backus, Conlon, and Sinkinson (2021b) provide some background on theory, measurement, the historical development of CO, and a discussion of different methodologies.

Roadmap The remainder of this paper is structured as follows. Section 2 briefly explains the common ownership model by O'Brien and Salop (2000). Section 3 goes over the data sources. Section 4 first compares the deposit rates of public and private banks, and then compares the rates of public banks in markets where they compete with other public banks (CO markets) and in markets where they compete only with private banks (no CO markets). Section 5 examines the effect of CO on deposit rates in panel regressions. Section 6 examines the effect of CO on deposit quantities. Section 7 concludes.

2 Common Ownership Model by O'Brien and Salop

This section briefly discusses the model by O'Brien and Salop (2000) in which the manager of firm j maximizes the objective function Π_j, which is a weighted sum of its own profits π_j and the profits of rivals π_k who have common shareholders:

[7] First, Azar, Raina, and Schmalz (2022) use data from SEC form 13F whereas this paper uses more comprehensive ownership data that also includes data from SEC forms 3, 4 and 5, DEF 14A, 13D and 13G. Second, Azar, Raina, and Schmalz (2022) use counties as banking market definitions whereas this paper uses the geographic banking market definitions used by the Fed and the DOJ for the competitive review of bank mergers. Third, the selection of products differ. This paper considers more deposit interest rates than Azar, Raina, and Schmalz (2022), but that paper also consider fees and fee thresholds, which this paper does not . Lastly, the sample window for this paper is 2005 to 2022 whereas Azar, Raina, and Schmalz (2022) covers 2002 to 2013.

[8] See Dennis, Gerardi, and Schenone (2022) for a rebuttal.

$$\begin{aligned} \max \Pi_j &= \pi_j + \sum_{k \neq j} w_{jk} \pi_k \\ w_{jk} &= \frac{\sum_i \gamma_{ij} \beta_{ik}}{\sum_i \gamma_{ij} \beta_{ij}} \end{aligned}$$

Managers or banks are indexed by j and k, and shareholders by i. The "control share" of owner i in firm j is γ_{ij}. This is therefore the weight that manager j assigns to owner i's payoff in the objective function. For each firm j, the control shares add up to one $\sum_i \gamma_{ij} = 1$. The fraction of π_k that accrue to owner i is β_{ik}. For each firm k, the ownership shares add up to one $\sum_i \beta_{ik} = 1$ as well. It natural to assume that the control share γ_{ij} is a non-decreasing function of the ownership share β_{ij}: as i's ownership of firm j increases, manager j should place more weight on i in its objective function. In this paper we follow the most common assumption in the literature in assuming that $\gamma_{ij} = \beta_{ij}$, which is called the proportional control assumption. As owner i increases their ownership of firm j, two terms in manager j's objective function increase: β_{ij} and γ_{ij}. As the objective function depends on the interaction between between both terms, $\beta_{ij}\gamma_{ij}$, large shareholders can have a disproportionate impact on the objective functions.

The profit weights a bank places on the profits of its rivals vary across geographic banking markets m depending on which competitors are present in the market.[9] In the remainder of this paper we will focus on $w_{jm}^{total} = \sum_{k \neq j} w_{jk}$, where the sum is taken over all $k \neq j$ who are also competing in market m. The basic idea is that w_{jm}^{total} is the total weight that bank j places on the profits of its rivals in market m. For instance if $w_{jm}^{total} = 1$ then bank j cares just as much about the profits of its rivals as about its own profits. As w_{jm}^{total} increases bank j cares less about its own profits and should therefore be competing less aggressively.

3 Data

The data comes from a number of sources and covers the sample window from 2005 to 2022. Ownership data and deposit rate data comes from S&P, quantity data comes from the FDIC's Summary of Deposits (SOD), and data on the geographic market definitions comes from the Federal Reserve's CASSIDI system.[10] These data sets are briefly described below.

[9] The weights also vary over quarters q but we ignore this here to keep the notation simpler.

[10] Data from the National Information Center (NIC) is used to link subsidiaries of Bank Holding Companies to the parent institution.

Ownership Data Data on bank shareholders and the size of their holdings comes from S&P (formerly Capital IQ) ownership data set starting in 2005, which contains ownership information from several SEC filings. The literature has focused primarily on the information from SEC filing 13F, which must be filed by institutional investment managers with $100 million or more in assets under management. Filers include stand-alone asset managers, banks, insurance companies, pension funds, and university endowments. The S&P Capital IQ data however also contains data from various other SEC filings such as the 3, 4 and 5, DEF 14A, 13D and 13G. The SEC forms 3, 4 and 5 must be filed by insiders such as officers or directors of the bank to report purchases, sales and holdings of shares. The SEC form DEF 14A, the definitive proxy statement, must be filed for shareholder votes and contains a section on beneficial ownership with information on insider holdings and the holdings of other large shareholders. The SEC forms 13D is a beneficial ownership report that must be filed by shareholders owning more than 5%. Some shareholders are eligible to file the shorter SEC form 13G instead of the 13D.[11]

These additional filings capture ownership by smaller and non-institutional shareholders than 13F filers who tend to be less diversified and sometimes hold sizable concentrated positions. Accounting for their ownership therefore typically lowers the measured level of CO. The reduction in the measured CO is often important for smaller public banks, in particular the approximately 100 public banks that are not listed but traded OTC. Small public banks often have low levels of 13F ownership, but because their market capitalization is fairly low other shareholders can hold sizable positions. One common case is that members of the family that used the own the entire bank before it went public continue to hold sizable positions. In some cases such shareholders even play an important role for larger banks. The most entertaining example is the appropriately named Holding family that owns approximately 20% of First Citizens Bank, which has more than $100 billion in assets and 550 branches.[12]

Deposit Rate Data S&P (formerly RateWatch) conducts weekly surveys of branches for rates and fees for various financial products since 2003. S&P does not survey every branch in the country; they have identified what can be called rate-setter and rate-taker branches. Rate-setters are branches which set the rates for all branches in some region. S&P also provides a mapping of rate-takers to rate-setters. The distinction between rate-setter and rate-taker branches is potentially relevant for the interpretation of the findings and we show

[11]The S&P Capital IQ data also contains information from other forms such as the N-Q, N-Port and N-CSR that are filed by investment companies and therefore contain similar information as the 13F filings.

[12]First Citizen has recently acquired the commercial banking business of Silicon Valley Bank, which more than doubled its assets to more than $200 billion, making it one of the 20 largest banks in the country. However, this acquisition occurred in 2023 after the sample window used in this paper.

robustness checks that only use data from rate-setter branches.

This paper uses rates on $10,000 CDs with maturities of 3, 6, 12, 24, and 60 month, interest checking accounts starting at $0 and interest checking accounts starting at $2,500, and money market accounts with $2,500, $10,000 and $25,000. While these data are available at a weekly frequency only the last week of each quarter is used to match the frequency of the ownership data. The coverage of bank branches is not constant during the sample window. It starts with about 15,000 branches in 2005, increases to more than 50,000 branches around 2010, and remains relatively steady thereafter.

Deposit Data Data on deposit quantities comes from the FDIC's Summary of Deposits (SOD). The SOD is an annual census of insured depository institutions that is taken as of June 30 of each year, and tracks deposit information at the branch level. We also use the FDICs branch identifier in specifications with branch fixed effects.

Geographic Banking Market Definitions Data on geographic banking markets comes from the Federal Reserve's CASSIDI system. These geographic market definitions are used by the Federal Reserve and the Department of Justice to assess the competitive effects of bank mergers. There are roughly 1,500 banking markets in the US. For each Federal Reserve district the banking markets in the district are defined by the regional Fed in collaboration with the Fed Board.

4 Raw Averages

4.1 Comparing Public and Private Banks

In this section we first show how the growth of common ownership among publicly traded banks increased the predicted weight that they place on rival profits between 2005 and 2022, whereas the weight that privately held banks place on rival profits remained constant at 0. Next we look at deposit interest rates of public and private banks during the same time window to see whether this divergence of objective functions between public and private banks also led to a divergence of prices.

First consider Figure 1, which shows the weight that public and private banks place on the profits of their rivals from 2005 to 2022.[13] The profit weights are calculated using the common ownership model by O'Brien and Salop (2000) under the assumption of proportional control as described in section 2. Banks whose stock is publicly traded, either on an exchange or

[13]We treat bank holding companies with multiple bank subsidiaries as a single bank throughout the paper.

OTC, are shown in blue, and privately held banks are shown in red. The geographic market definition for this graph is a banking market as defined by the Federal Reserve to assess the competitive effects of bank mergers. For each bank j that operates in some banking market m we sum all the weights that j places on rivals k who operate in the same market: $w_{jm}^{total} = \sum_{k \neq j} w_{jk}$. Then we average w_{jm}^{total} for all public banks and for all private banks.

Privately held banks place no weight on rival profits, i.e. their objective function is to maximize their own profits. Public banks, however, place considerable weight on rival profits. In 2005 the average total rival weight w_{jm}^{total} was around 2, so the total weight placed on the profits of all rivals in the same market is on average twice as large as the weight it places on its own profits. This reflects the fact that there is already considerable common ownership among public banks in 2005. Between 2005 and 2022 the weight placed on rival profits rose steadily and more than threefold to around 6. Therefore the weight that banks place on rival profits increased threefold between 2005 and 2022.

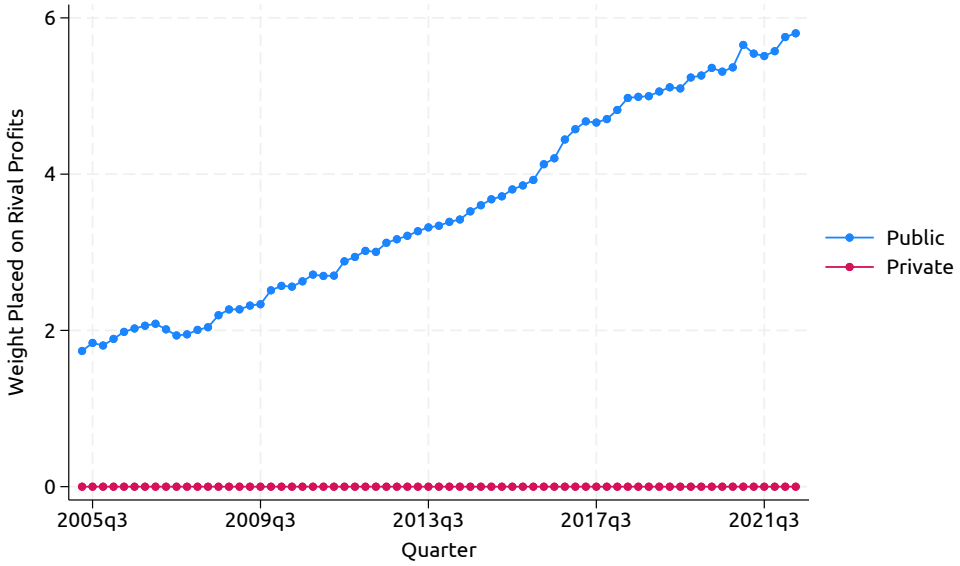


Figure 1: **Weight on Rival Profits (Public vs Private Banks):** This figure shows how much weight banks place on the profits of all their rivals in the same market from 2005 to 2022. The profit weights are calculated using the common ownership model by O'Brien and Salop (2000) under the assumption of proportional control. Banks whose stock is publicly traded, either on an exchange or OTC, are shown in blue, and privately held banks are shown in red.

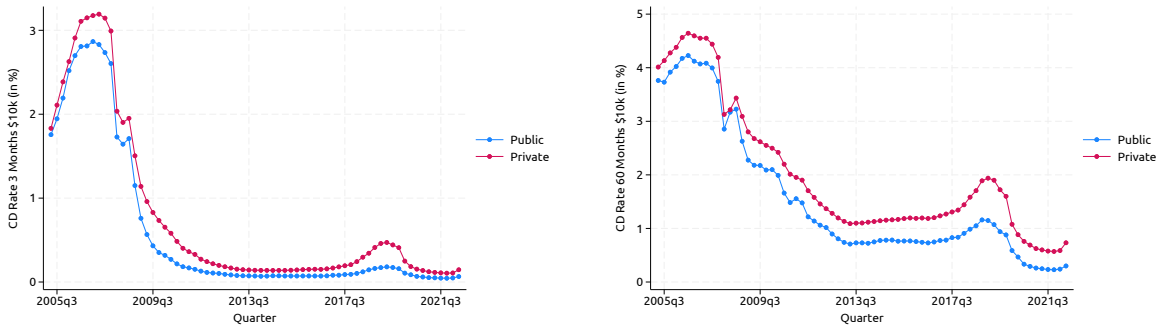
Next, consider Figure 2, which shows four different deposit interest rates from 2005 to 2022 for public banks (blue) and private banks (red). For each bank j that operates in some banking market m we collect the deposit interest rate if it is covered in the S&P data and

then average over public and private banks.[14] Panel (a) shows 3 month CD rates, panel (b) shows 60 month CD rates, panel (c) shows interest checking rates starting at a balance of $0, and panel (d) shows interest rates for a money market account with a balance of $25,000. Figure 6 in the Appendix shows CD rates for 6, 12 or 24 months, interest checking rates for higher balances and money market account rates for lower balances.

For all deposit interest rates and at almost all times during the sample window private banks pay higher rates than public banks. At times the gap exceeds 50 basis points. This is not a surprising finding because it is well known that smaller banks tend to offer more attractive rates than large banks. This rate gap could be due to CO or it could simply reflect differences in average product quality and variety between public and private banks. For example, public banks tend to have larger branch and ATM networks, better online banking options, more widely recognized brands, and offer a wider variety of products and services. due to other differences between public and private banks, such as public banks' wider variety of products and services, larger branch and ATM networks, or better online banking.

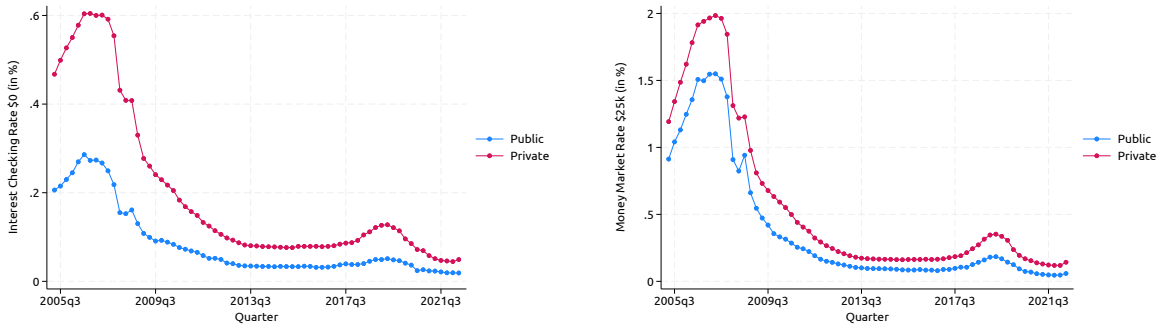
Note, importantly, that the gap in deposit interest rates between public and private banks does not widen as common ownership among public banks increases. For CD and money market rates the gap is roughly constant for most of the sample window, whereas the gap for interest checking rates narrows somewhat. The steadiness of the interest rate gap over time is inconsistent with the COH.

[14]Typically banks set the same interest rates at all branches in a market. If this is not the case we averaged rates over branches.



(a) 3 Month CD

(b) 60 Month CD



(c) Interest Checking $0

(d) Money Market $25,000

Figure 2: **Deposit Rates (Public vs Private Banks):** These graphs show deposit interest rates from 2005 to 2022. Banks whose stock is publicly traded, either on an exchange or OTC, are shown in blue, and privately held banks are shown in red. The geographic market definition for this graph is a banking market as defined by the Federal Reserve to assess the competitive effects of bank mergers. For each bank i that operates in some banking market m we collect the deposit interest rate if is covered in the Ratewatch data and then average over all bank-market pairs.

4.2 Comparing Public Banks in Markets With and Without CO

The deposit rate gap between public and private banks could be due to CO, but the gap could also be due to other differences between public and private banks that are not controlled for or even unobserved. To tell these two possibilities apart we compare the deposit rates of public banks in two different kinds of markets. The first group of markets, the "CO markets", are markets where multiple public banks compete. The second group of markets, the "no CO markets" are markets where only a single public bank competes with private rivals. Approximately 200 out of 1500 banking markets are "no CO markets" with exactly one public bank, and approximately 1150 markets have multiple public banks.

The COH predicts that the objective function of public banks in "no CO markets" is identical to the objective function of private banks. If the rate gap between public and

private banks is due to CO then we should observe a similar rate gap between the rates of public banks in "CO markets" and "no CO markets". Figure 3 shows the average weight placed on rival profits in "CO markets" (blue) and "no CO markets" (red). In "no CO markets" public banks do not place any weight on the profits of their rivals, but in "CO markets" they do. Moreover the weight placed on rival profits triple between 2005 and 2022.[15]

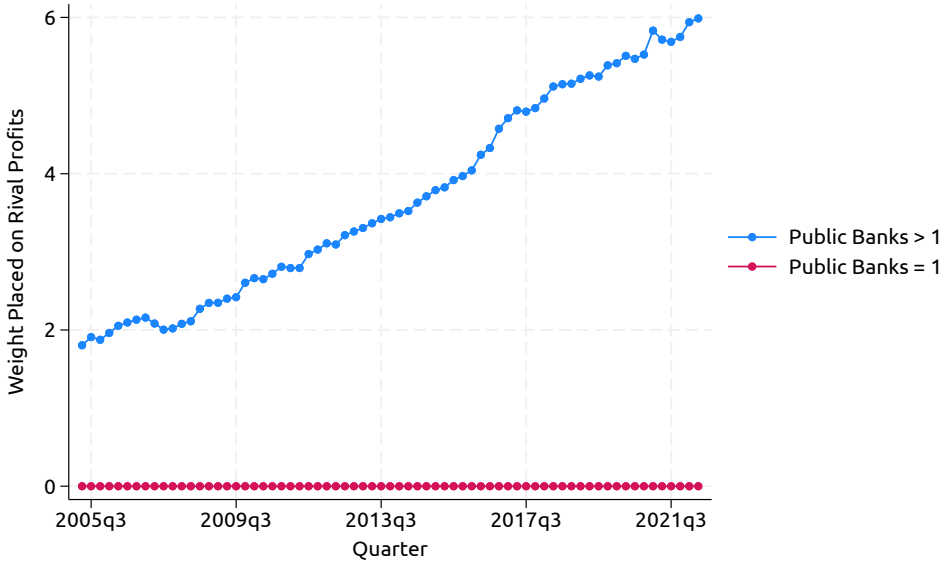


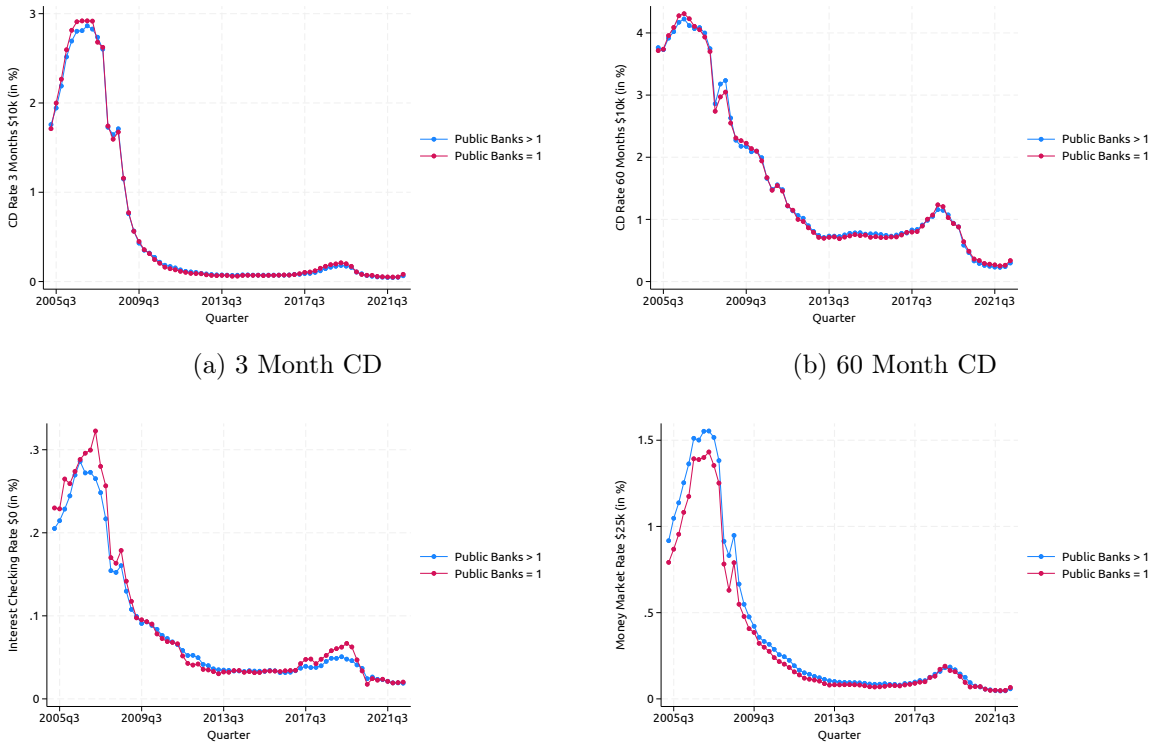
Figure 3: **Weight on Rival Profits (CO vs No CO Markets):** This figure shows how much weight banks place on the profits of their rivals from 2005 to 2022. Banking markets with at least two public banks are shown in blue (CO markets), whereas markets with a single public bank are shown in red (no CO markets).

Figure 4 compares the deposit rates of public banks in "CO markets" (blue) and "no CO markets" (red). Panel (a) shows 3 month CD rates, panel (b) shows 60 month CD rates, panel (c) shows interest checking rates starting at a balance of \$0, and panel (d) shows interest rates for a money market account with a balance of \$25,000. Figure 7 in the Appendix shows CD rates for 6, 12 or 24 months, interest checking rates for higher balances and money market account rates for lower balances.

All ten deposit rates are very similar in CO and no CO markets at almost all times. All five CD rates are very similar at all times. There are gaps for interest checking rates and for money market rates with a \$25,000 minimum balance. Interest checking rates are very similar at most times except during times of rising rates (around 2007 and around 2018) when the

[15]The average weight in CO markets shown in Figure 3 is only slightly higher than the average taken across all markets in Figure 1. The reason for the gap is that the rates of public banks in CO markets enters the average in Figure 1 but not in Figure 3. As most observations are from markets with many public banks however the observations from CO markets with a single public bank do not move the average much.

rates in no CO markets are temporarily higher than in CO markets. Notice however that even during these times the gap reaches only about 10 basis points. For money market accounts with a minimum balance of $25,000 CO markets tend to have higher rates especially during the years 2005-2009. Even during the period the gap reaches only about 10 basis points. Overall, the rates in CO markets and no CO markets are strikingly similar in comparison to the large persistent gaps between private and public bank rates.



(a) 3 Month CD

(b) 60 Month CD

(c) Interest Checking $0

(d) Money Market $25,000

Figure 4: **Deposit Rates of Public Banks (CO vs No CO Markets):** These graphs show deposit interest rates of public banks from 2005 to 2022. Banking markets with at least two public banks are shown in blue (CO markets), whereas markets with a single public bank are shown in red (no CO markets).

5 Deposit Rates

5.1 Specification

We estimate panel regressions of the following form:

$$r_{jbmq} = \theta_0 + \theta_1 w_{jmq}^{total} + \xi_{jq} + \xi_{jb} + \xi_{mq} + \varepsilon_{jbmq} \quad (1)$$

Here, r_{jbmq} is a deposit interest rate of bank j, at branch b, in market m and quarter q. Typically r_{jbmq} does not vary across branches of the same bank for a given market and quarter. The variable w_{jmq}^{total} ("Rival Weight") is the total weight that bank j places on the profits of its rivals in market m in quarter q. Thus, formally $w_{jmq}^{total} = \sum_{k \neq j} w_{jkq}$, where the sum is taken over all rival banks $k \neq j$ that operate in market m in quarter q. In the main specification we include bank-quarter fixed effects ξ_{jq} that absorb variation across banks and use variation within bank across banking markets to estimate θ_1. In robustness checks we also include bank-branch fixed effects ξ_{jb} and market-quarter fixed effects ξ_{mq}.

The null hypothesis is that managers maximize bank profits and therefore common ownership does not affect competition: $\theta_1 = 0$. Deposit interest rates are paid by banks to their customers so a finding of $\theta_1 < 0$ is consistent with anticompetitive effects of common ownership.

5.2 Baseline Findings

We estimate the regression in equation (1) for all ten deposit interest rates. The results are shown in Table 1. We start with a specification that only includes quarter fixed effects to account for the changing levels of interest rates at the top of Table 1. In the main specification in the middle of Table 1 we include bank-quarter fixed effects. Lastly, we also show a specification with bank-quarter, market-quarter and bank-branch fixed effects at the bottom of Table 1. The estimates are plotted with 95% confidence intervals in Figure 5.

The first specification with quarter FEs, but no bank FEs results in negative estimates for θ_1 for all ten deposit rates that are statistically significant at all conventional levels. The largest estimate for 60 Month CD rates implies that an increase of w_{jmq}^{total} by one lowers interest rates by approximately 1.6 basis points. The rise of CO raised the average w_{jmq}^{total} roughly from 2 to 6 between 2005 and 2022, which would result in an effect on 60 Month CD rates of about 6.4 basis points. Like the deposit rate gap between public and private banks, these estimates could be driven by CO or by other differences between banks (e.g. product variety, branch and ATM network size, online banking).

The second specification with bank-quarter FEs, however, does not result in any statistically significant negative estimates for θ_1. The only estimate that is statistically significant (for the $25,000 money market rate) is positive and more than ten times smaller in magnitude than the corresponding negative estimate in the specification without bank-quarter FEs. The estimates are precise due to the large sample size and the substantial variation of w_{jmq}^{total} across markets within bank-quarter pairs. The 95% confidence intervals across all interest rates range roughly from -0.04 basis points to +0.05 basis points. Therefore the rise of the average w_{jmq}^{total} among public banks between 2005 and 2022 would have moved deposit

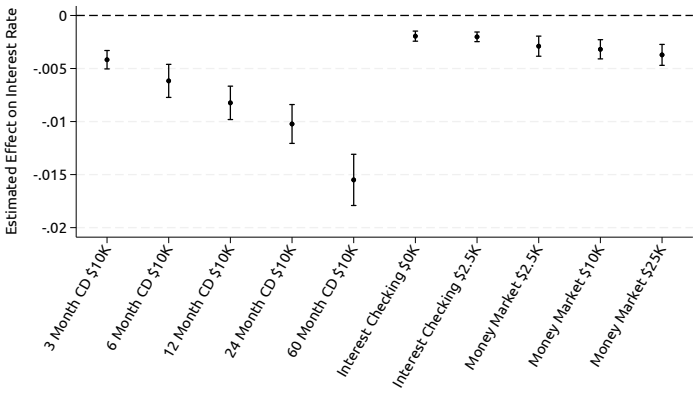
rates by less than a quarter of basis point in either direction.[16]

The third specification with bank-quarter, market-quarter and bank-branch FEs also yields estimates that are centered around zero and not statistically significant for any of the ten interest rates. The estimates are substantially less precise than if only bank-quarter FEs are included however. The 95% confidence intervals range roughly from -0.4 to +0.3 basis points.

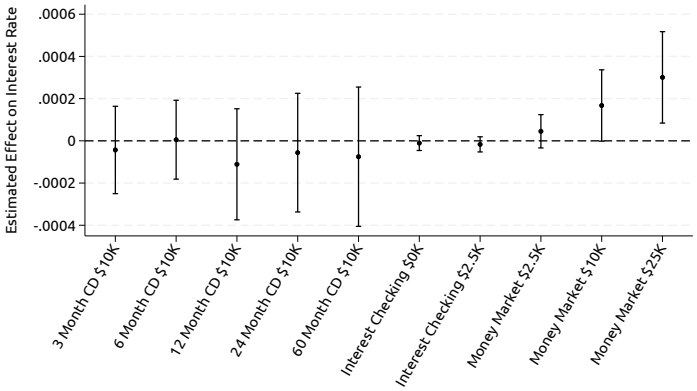
[16]Public banks hold more than $10 trillion in interest bearing deposits. If this were applied to a deposit base of $10 trillion it would translate in a total annual harm or benefit for depositors of less than $250 million or less than a dollar per American.

Table 1: **Deposit Rate Panel Regressions (Baseline):** This table shows estimates for ten different deposit interest rates from left to right. The estimates on top include only quarter FEs, the estimates in the middle bank-quarter FEs, and the estimates at the bottom include bank-quarter, market-quarter and bank-branch FEs. Standard errors are clustered at the bank level. These estimates are also illustrated graphically in Figure 5.

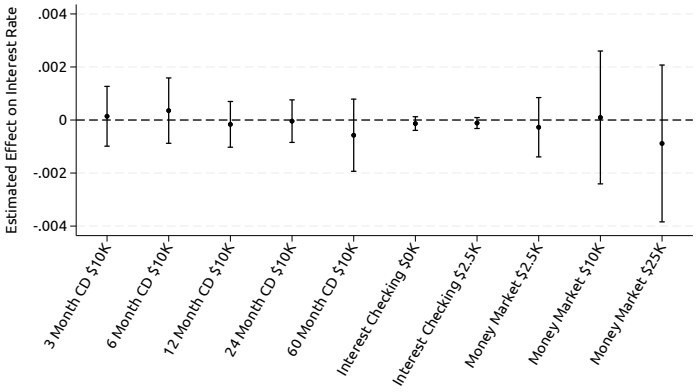
	(1) 3 Months CD	(2) 6 Months CD	(3) 12 Months CD	(4) 24 Months CD	(5) 60 Months CD	(6) Checking $0	(7) Checking $2.5K	(8) MM $2.5K	(9) MM $10K	(10) MM $25K
Weight on Rival Profits	-0.00417***	-0.00617***	-0.00824***	-0.0102***	-0.0155***	-0.00195***	-0.00201***	-0.00289***	-0.00319***	-0.00371***
	(0.000442)	(0.000795)	(0.000803)	(0.000934)	(0.00123)	(0.000243)	(0.000232)	(0.000483)	(0.000462)	(0.000503)
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-Quarter FE	No	No	No	No	No	No	No	No	No	No
Market-Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Branch FE	No	No	No	No	No	No	No	No	No	No
N	3876263	4028593	4038425	3981429	3797045	3624546	3869905	3650677	3731104	3744594
	(1) 3 Months CD	(2) 6 Months CD	(3) 12 Months CD	(4) 24 Months CD	(5) 60 Months CD	(6) Checking $0	(7) Checking $2.5K	(8) MM $2.5K	(9) MM $10K	(10) MM $25K
Weight on Rival Profits	-0.0000433	0.00000532	-0.000111	-0.0000560	-0.0000752	-0.0000106	-0.0000167	0.0000452	0.000167	0.000301**
	(0.000106)	(0.0000953)	(0.000134)	(0.000143)	(0.000168)	(0.0000179)	(0.0000183)	(0.0000403)	(0.0000863)	(0.000110)
Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Market-Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Branch FE	No	No	No	No	No	No	No	No	No	No
N	3801169	3943230	3952894	3902282	3736741	3546738	3788092	3573589	3652144	3665514
	(1) 3 Months CD	(2) 6 Months CD	(3) 12 Months CD	(4) 24 Months CD	(5) 60 Months CD	(6) Checking $0	(7) Checking $2.5K	(8) MM $2.5K	(9) MM $10K	(10) MM $25K
Weight on Rival Profits	0.000108	0.000320	-0.000206	-0.0000760	-0.000589	-0.000141	-0.000122	-0.000260	0.000123	-0.000854
	(0.000571)	(0.000626)	(0.000440)	(0.000408)	(0.000695)	(0.000129)	(0.000104)	(0.000576)	(0.00129)	(0.00152)
Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Market-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-Branch FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	3794931	3937395	3947090	3896198	3729709	3538856	3781837	3566699	3645759	3659177



(a) Quarter FEs



(b) Bank-Quarter FEs



(c) Bank-Quarter, Market-Quarter and Bank-Branch FEs

Figure 5: **Panel Regression Estimates (Baseline):** These three figures plot the point estimates and 95% confidence intervals for in findings in Table 1. Panel (a) shows estimates that only include quarter FEs, panel (b) includes bank-quarter FEs, and panel (c) includes bank-quarter, market-quarter and bank-branch FEs. Standard errors are clustered at the bank level.

5.3 Robustness Checks

Only Rate Setter Branches Banks generally do not set interest rates for each branch separately. Instead they designate "rate setter branches" for a particular region and then set interest at all other branches in the same region equal to the rate setter branch. This practice leads to geographically uniform pricing.

There are two basic interpretations of uniform pricing. One view is that uniform pricing is a choice by the banks. If a bank chooses the same interest rates at two different branches in different banking markets even though the COH predicts that the banks have different objective functions in both markets, then this is evidence against the COH. Another view is that uniform pricing is an exogenous constraint on bank pricing, which could explain why banks do not follow the predictions of the COH market by market.

To see whether the findings above are driven by uniform pricing we conduct a robustness check that uses only data from rate setter branches. The results are shown in Table 3 in Appendix B and in Figure 8 in Appendix A. Notice that the sample sizes for the specification with bank-quarter FEs are only about 10 percent of the sample sizes for the baseline estimates because on average one rate setter branch sets the interest rates for nine other branches as well. The estimates are therefore less precise than the baseline estimates.

The pattern of point estimates however follows the same pattern as the baseline findings. In the specification with quarter FEs we find sizable negative estimates, but in the specifications with bank-quarter FEs we do not.

Cross Ownership Azar, Raina, and Schmalz (2022) argue that shares held by the asset management arms of banks result in cross ownership rather than in common ownership. While common ownership refers to situations where a third party shareholder holds shares of two competing firms, cross ownership refers to situations where a firm owns shares of one of its competitors. In this paper we have so far assumed that holdings by the asset management arms of banks result in common ownership but not in cross ownership. The rationale for this choice is that the shares held by the asset management arms are ultimately not owned by the banks but by their clients and the banks have a fiduciary duty towards their clients. As a robustness check we also obtain estimates under the cross ownership assumption.

Table 4 in Appendix B and Figure 9 in Appendix A shows the findings. The estimates are very similar to the baseline estimates without cross ownership. One reason for this similarity is that the asset management arms of banks are fairly small in comparison to the large non-bank asset managers such as Blackrock, Vanguard or State Street.

GHHI Azar, Raina, and Schmalz (2022) find that deposit rates are strongly correlated

with the GHHI – a generalized version of the HHI that accounts for common ownership and cross ownership. The GHHI is a function of the profit weights w_{jk} and of market shares. In this paper we relate prices and quantities directly to the profit weights rather than the GHHI, because GHHI regressions inherit the endogeneity problems of HHI regressions as they are both functions of market shares. An added benefit is that profit weights vary not just at the market-time level, but at the bank-market-time level. This creates additional variation and allows us to control for market-time fixed effects in some specifications.[17]

However, as a robustness check we run GHHI regressions of the following form:

$$r_{jbmq} = \theta_0 + \theta_1 GHHI_{mq} + \xi_{jq} + \xi_{jb} + \varepsilon_{jbmq} \tag{2}$$

Table 5 in Appendix B and Figure 10 in Appendix A shows the findings. In the specification that only includes quarter fixed effects we find negative estimates for θ_1 for all ten deposit rates. The estimates are statistically significant at all conventional levels and economically substantial. Over the sample period the GHHI has increased by more than 2000 points. The estimates imply that a 2000 point increase in the GHHI is associated with a drop in deposit rates between 2 and 16 basis points, depending on the deposit product.[18]

The specification with bank-quarter fixed effects however does not result in estimates of θ_1 that are statistically significant. The point estimates imply that a 2000 point increase in the GHHI is associated with a change of deposit rates between 0 and -0.3 basis points. The 95% confidence interval for the most negative estimate (60 Month CDs) implies that a 2000 point increase of the GHHI leads to a change in the deposit rate between -0.8 basis and +0.2 basis points.

Including bank-branch fixed effects in addition to bank-quarter fixed effects turns the point estimates positive for seven of the ten deposit rates, and the confidence intervals become wider. None of the estimates are statistically significant.

IV Estimates A potential endogeneity concern with these panel regressions is that at least some shareholders can choose which particular banks to invest in. Therefore we consider an identification strategy specification that isolates variation in profit weights driven by variation in the number of listed banks in a market and the general trend towards increased CO, but not by particular shareholder choices. To do this we use the number of listed banks in a

[17] The profit weights actually even vary at an even more granular level: that of ordered firm pairs. However, the outcomes we observe - prices and quantities - vary only at the firm level.

[18] Notice that in the GHHI regressions, the GHHI is scaled from 0 to 1, not the 0 to 10,000 points scale typically used in discussion.

market interacted with a time trend as an instrument for profit weights. The basic idea is that how many banks in a market are public is not a shareholder choice.

To illustrate the basic idea consider two banking markets – one with a single public bank (no CO market) and one market with multiple public banks (CO market). As CO among public banks increases the first stage regression will predict widening profit weight gap between CO and no CO markets, but the first stage only depends on the number of listed banks in a market and the quarter, neither of which is affected by any particular shareholder's choices.

Notice that the number of public banks only varies at the market level. Therefore, we consider a specification of the following form:

$$r_{jbmq} = \theta_0 + \theta_1 \overline{w_{mq}^{total}} + \xi_{jq} + \xi_{jb} + \xi_{mq} + \varepsilon_{jbmq} \tag{3}$$

Here $\overline{w_{mq}^{total}}$ is the average of w_{jmq}^{total} across all banks in market m in quarter q. Figure 11 in Appendix A and Table 6 in Appendix B show the panel regression estimates for this specification. Figure 12 in Appendix A and Table 7 in Appendix B show the IV estimates for this specification if we use the number of public banks interacted with a time trend as an instrument for $\overline{w_{mq}^{total}}$. The first stage estimates are shown in Table 8 in Appendix B.

These estimates have a similar pattern to the baseline estimates. If only quarter FEs are included the estimates are consistent with the COH, but the effect disappears if bank-quarter FEs are included.

Controlling for Size of Branch Network We find consistently that specifications that include only quarter FEs match previous studies that appeared consistent with the COH, but specifications that include bank-quarter FEs are not. This raises the question which bank characteristics explain the different findings for these two specifications and the rate gap between public and private banks. While answering this question comprehensively is beyond the scope of this paper we show here a specification that controls for the size of a bank's branch network (and quarter FEs) does a significant portion of the work. The results are shown in Figure 13 in Appendix A and in Table 9 in Appendix B. For nine out of ten interest rates controlling for the size of the branch network eliminates the negative estimate for θ_1. Only for 60 month CDs the coefficient remains negative and statistically significant but the magnitude of the estimated effect is about 85% smaller than without controlling for branch network size. It should be noted that for both checking account rates, for all three money market rates, and for the 6 month CD rate the estimated effect turns positive and statistically significant, though the magnitudes are substantially smaller than the negative

estimates without controlling for branch size network.

These estimates also rule out the possibility that the COH is operating, but that firms' inability to set branch-specific prices means the CO effects only appear at the bank level, not the market level. Such an effect should be visible in specifications that only control for branch size network (not bank FEs).

6 Deposit Quantities

There are two main reasons to not only look at prices but also at quantities. First, even if banks do not change their deposit interest rates market by market in accordance with the COH, it is possible that banks adjust how fiercely they compete market by market along non-price dimensions. For instance CO could lower service quality, reduce the variety of services a bank offers, or reduce the incentive to steal rival customers via advertising. If this were the case we would expect that it results in slower deposit growth in markets where banks have lots of CO with their rivals. Second, the findings for the deposit rate regressions depend on whether bank-quarter fixed effects are included or not. This could be because CO affects bank pricing only at a bank wide level or because there are other differences between banks with high and low CO. Looking at quantity regressions with and without bank-quarter fixed effects can help us to distinguish these two possibilities.

6.1 Specification

The specification for the quantity regressions is similar to the price regressions. However, while the price regressions were at the branch level we measure deposits at the bank-market level. Moreover, the frequency of the panel is yearly rather than quarterly, because the FDIC's Summary of Deposits is conducted only once a year. The specification has the following form:

$$\log\left(\text{deposits}_{jbmq}\right) = \theta_0 + \theta_1 w_{jmt}^{total} + \xi_{jq} + \xi_{jb} + \xi_{mq} + \varepsilon_{jbmq} \tag{4}$$

As before, w_{jmt}^{total} ("Rival Weight") is the total weight that bank j places on the profits of its rivals in market m in year t. An estimate of $\theta_1 < 0$ would be consistent with the COH as it would indicate that banks with higher CO compete less aggressively and therefore lose deposits.

6.2 Findings

The findings are shown in Table 2. The estimates of θ_1 in Table 2 are all positive and therefore not consistent with the COH. The specification with bank-quarter, market-quarter and bank-branch FEs in column (3) is however not statistically significant.

Table 2: log(Deposits)

	(1)	(2)	(3)
Weight on Rival Profits	0.0272***	0.00944***	0.00187
	(0.00270)	(0.00178)	(0.00166)
Quarter FE	Yes	No	No
Bank-Quarter FE	No	Yes	Yes
Market-Quarter FE	No	No	Yes
Bank-Branch FE	No	No	Yes
N	1471423	1446535	1428458

7 Conclusion

We asses whether common ownership has given rise to anticompetitive effects in the banking industry. We find that private banks offer more attractive deposit rates than public banks, but the rate gap did not widen as CO increased. Public banks offer similar rates in markets where they compete only with private rivals and in markets where they also compete with other public banks, which is inconsistent with the COH. Regressions that only include quarter fixed effects, but no bank fixed effects suggest that CO is asscociated with lower deposit rates. Regressions with bank-quarter fixed effects, however, are not consistent with the COH. Estimates for deposit quantities are also not consistent with the COH.

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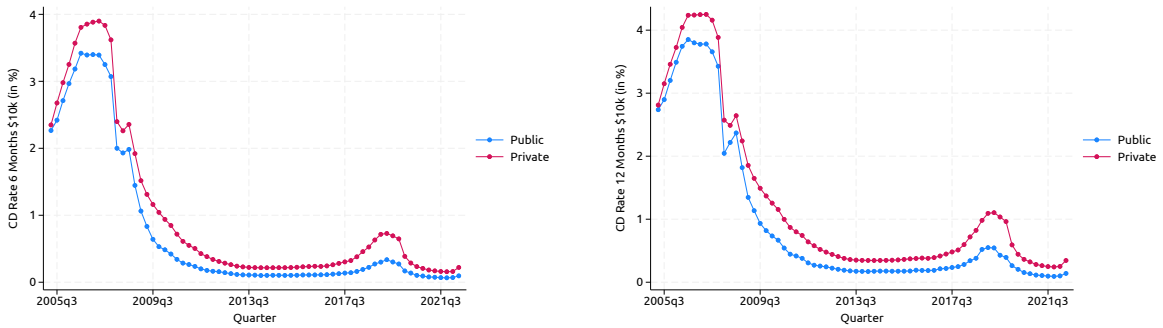
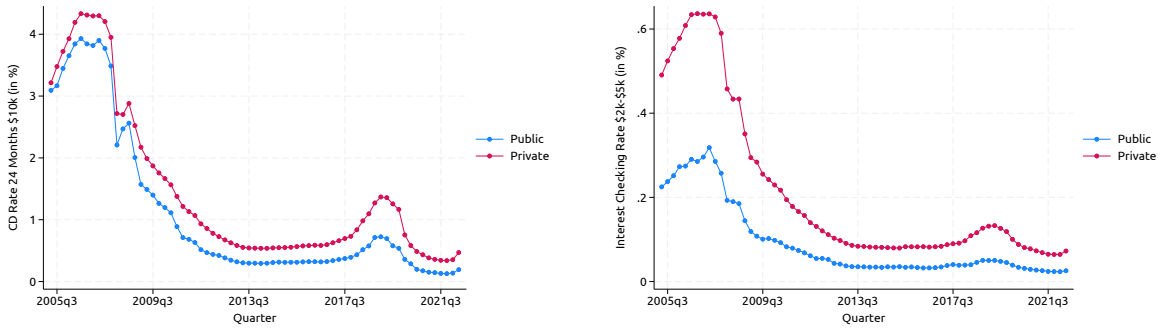
A Figures



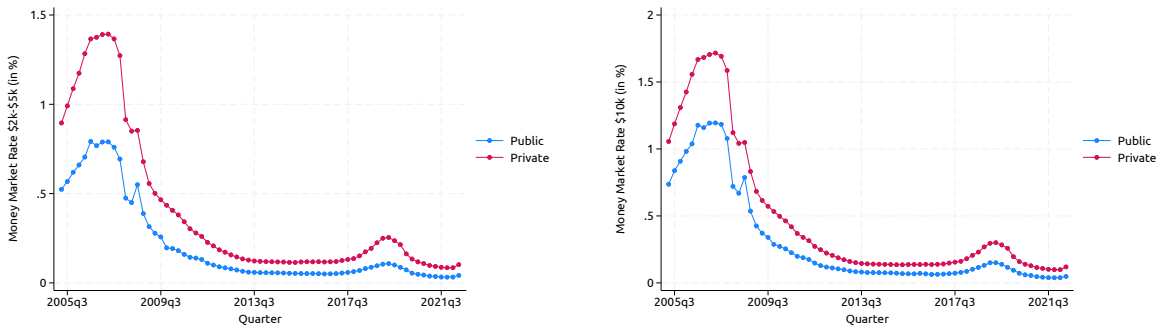
(a) 6 Month CD

(b) 12 Month CD



(c) 24 Month CD

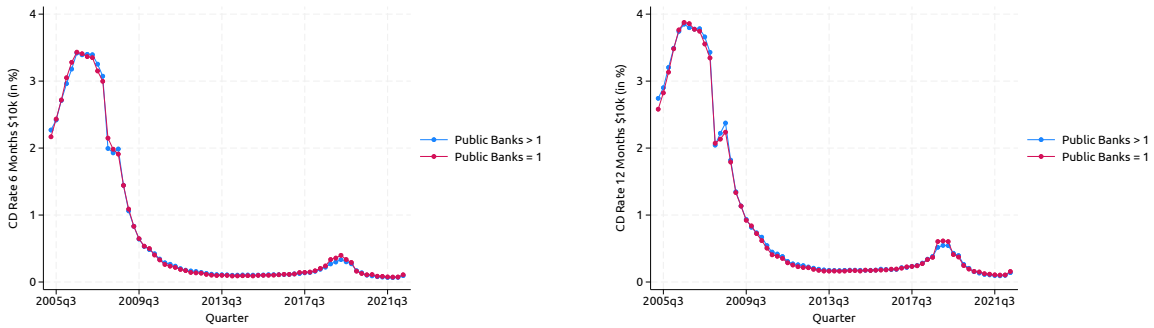
(d) Interest Checking $2500



(e) Money Market $2,500

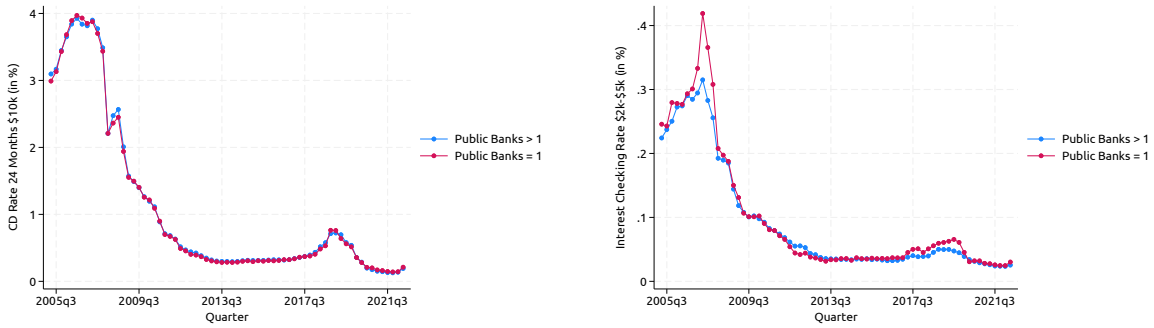
(f) Money Market $10,000

Figure 6: **Deposit Rates (Public vs Private Banks):** These graphs show deposit interest rates from 2005 to 2022. Banks whose stock is publicly traded, either on an exchange or OTC, are shown in blue, and privately held banks are shown in red.



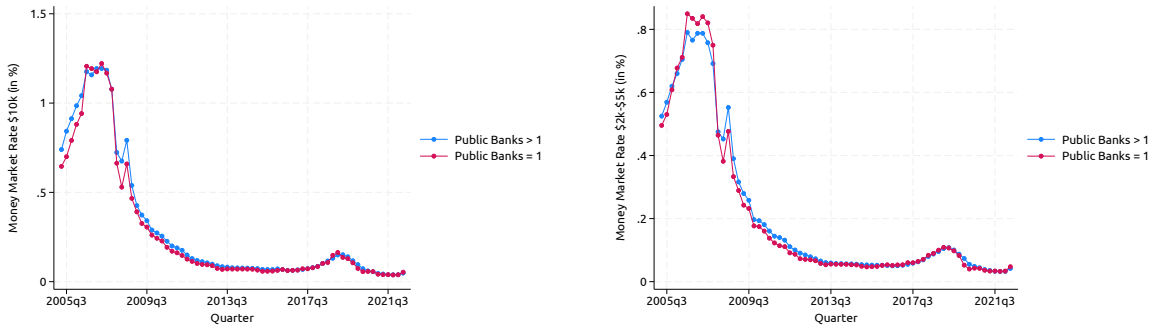
(a) 6 Month CD

(b) 12 Month CD



(c) 24 Month CD

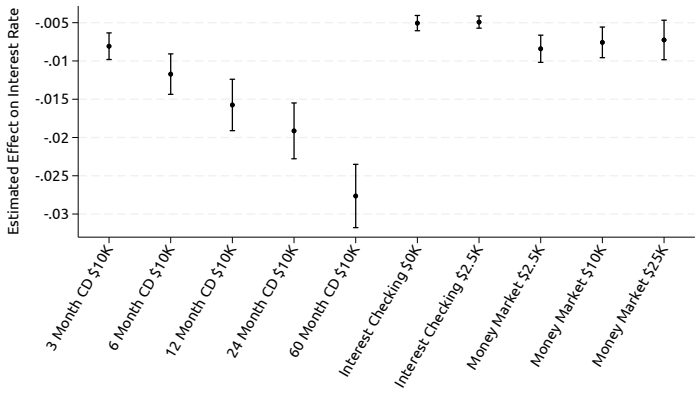
(d) Interest Checking $2,500



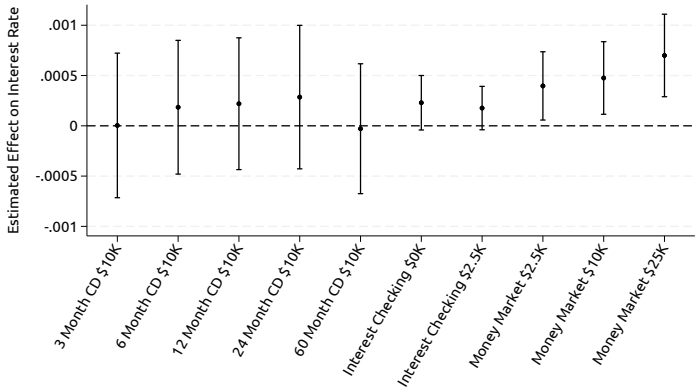
(e) Money Market $10,000

(f) Money Market $2,500

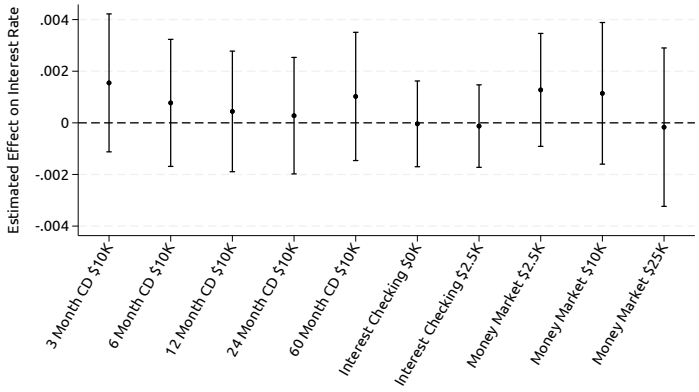
Figure 7: **Deposit Rates of Public Banks (CO vs No CO Markets):** These graphs show deposit interest rates of public banks from 2005 to 2022. Banking markets with at least two public banks are shown in blue (CO markets), whereas markets with a single public bank are shown in red (no CO markets).



(a) Quarter FEs

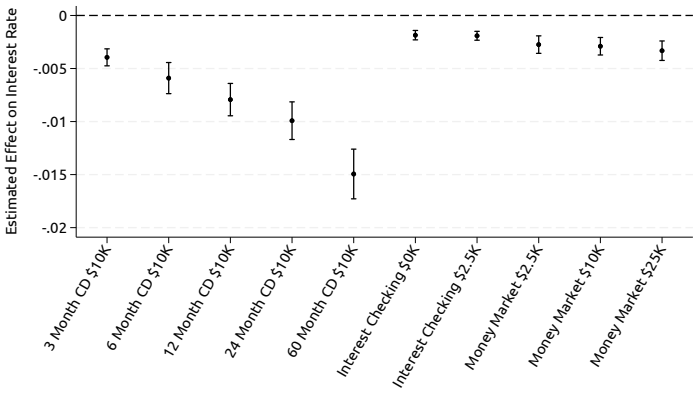


(b) Bank-Quarter FEs

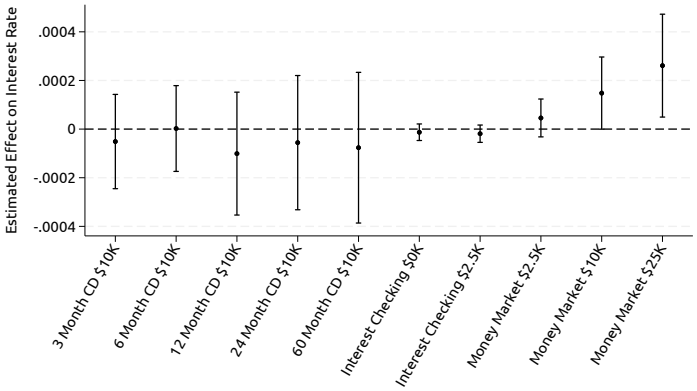


(c) Bank-Quarter, Market-Quarter and Bank-Branch FEs

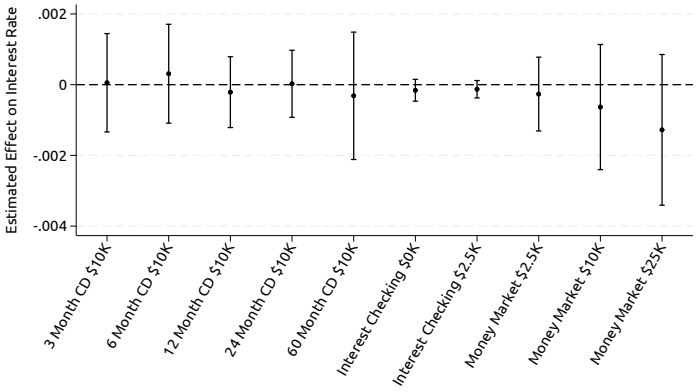
Figure 8: **Panel Regression Estimates (Rate Setter Branches Only):** These three figures plot the point estimates and 95% confidence intervals for in findings in Table 3. Unlike the baseline estimates the sample includes only rate setter branches. Panel (a) shows estimates that only include quarter FEs, panel (b) includes bank-quarter FEs, and panel (c) includes bank-quarter, market-quarter and bank-branch FEs. Standard errors are clustered at the bank level.



(a) Quarter FEs

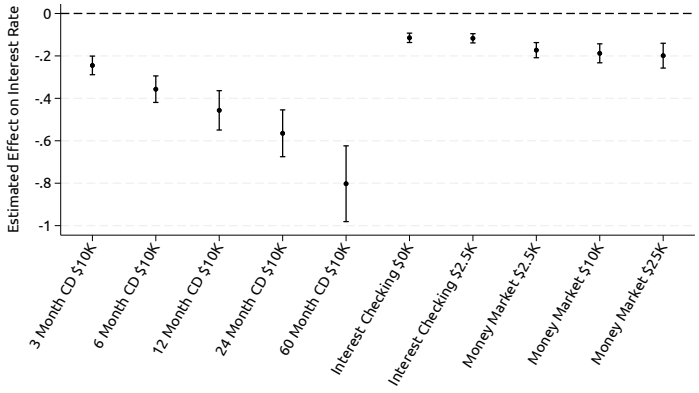


(b) Bank-Quarter FEs

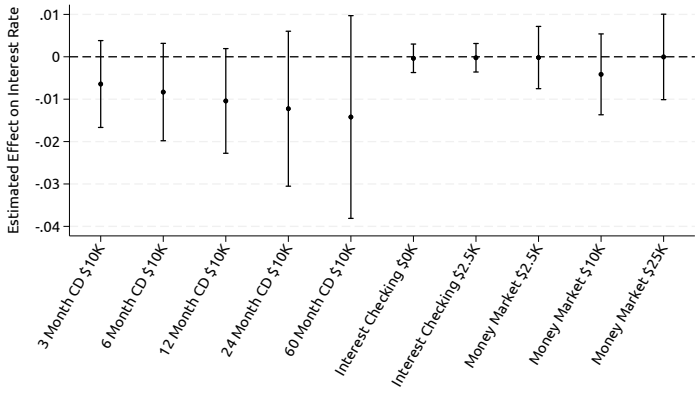


(c) Bank-Quarter, Market-Quarter and Bank-Branch FEs

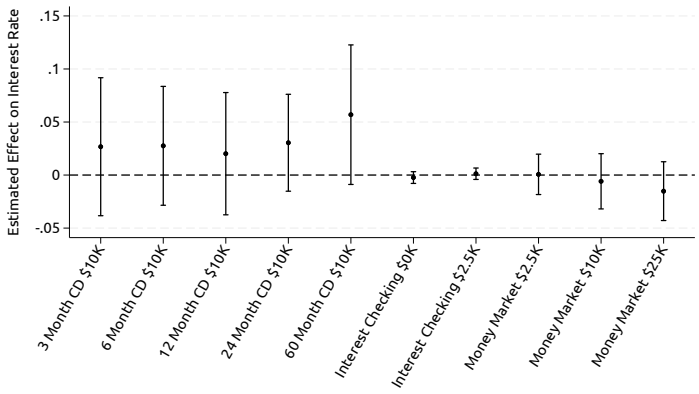
Figure 9: **Panel Regression Estimates (Cross Ownership):** These three figures plot the point estimates and 95% confidence intervals for in findings in Table 4. Unlike the baseline estimates these estimates assume that the holdings of banks' asset management arms result in cross ownership. Panel (a) shows estimates that only include quarter FEs, panel (b) includes bank-quarter FEs, and panel (c) includes bank-quarter, market-quarter and bank-branch FEs. Standard errors are clustered at the bank level.



(a) Quarter FEs

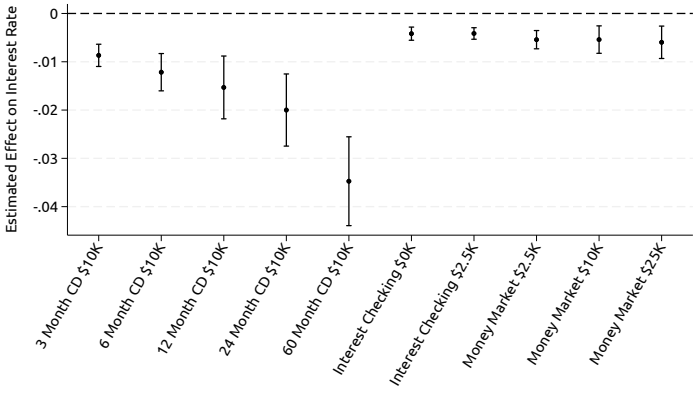


(b) Bank-Quarter FEs

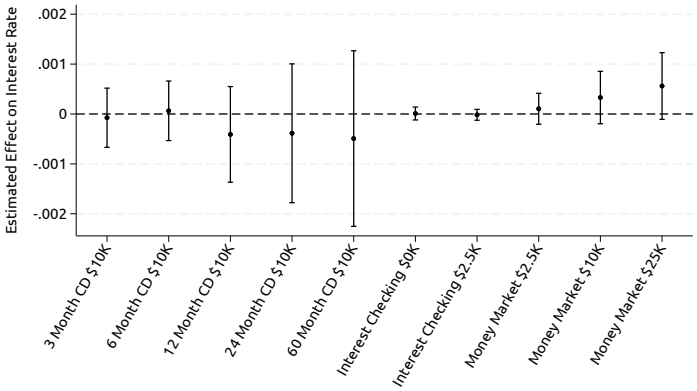


(c) Bank-Quarter and Bank-Branch FEs

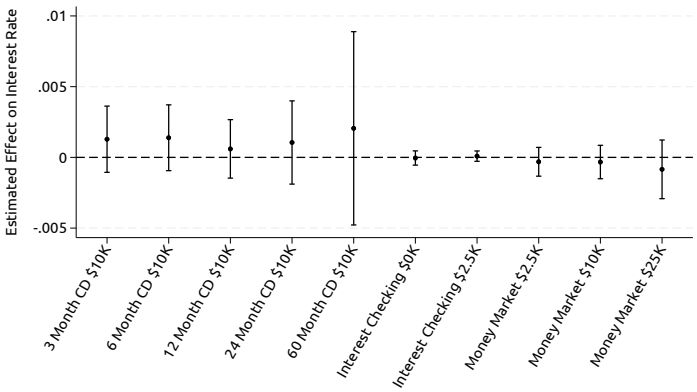
Figure 10: **Panel Regression Estimates (GHHI):** These three figures plot the point estimates and 95% confidence intervals for in findings in Table 5. Panel (a) shows estimates that only include quarter FEs, panel (b) includes bank-quarter FEs, and panel (c) includes bank-quarter and bank-branch FEs. Standard errors are clustered at the bank level.



(a) Quarter FEs

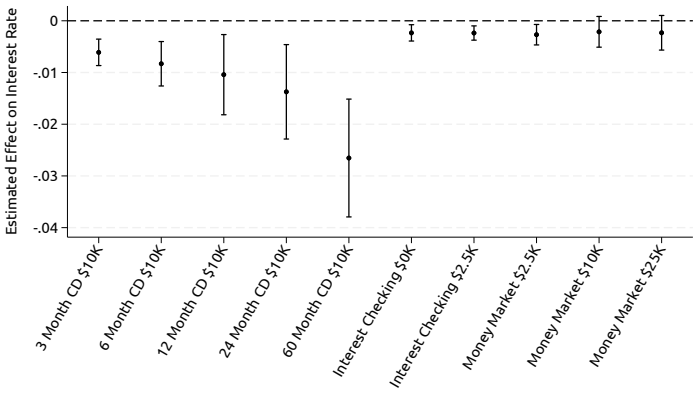


(b) Bank-Quarter FEs

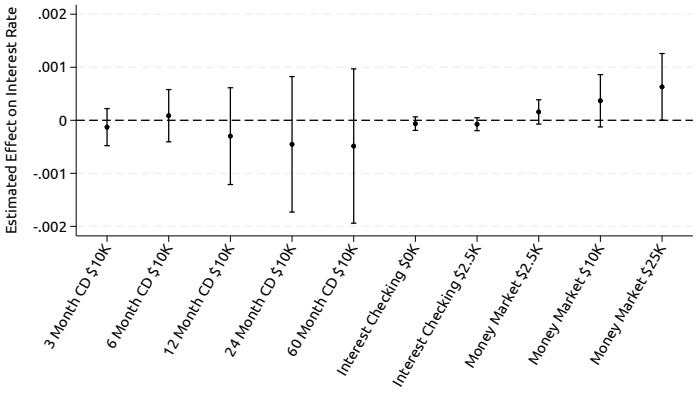


(c) Bank-Quarter and Bank-Branch FEs

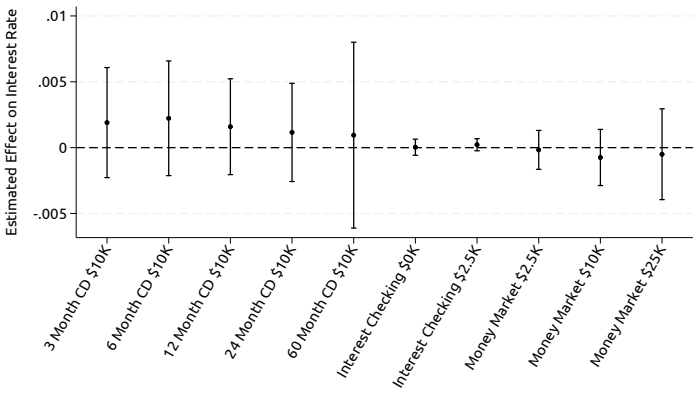
Figure 11: **Panel Regression Estimates (Average Market Weight):** These three figures plot the point estimates and 95% confidence intervals for in findings in Table 6. Panel (a) shows estimates that only include quarter FEs, panel (b) includes bank-quarter FEs, and panel (c) includes bank-quarter and bank-branch FEs. Standard errors are clustered at the bank level.



(a) Quarter FEs



(b) Bank-Quarter FEs



(c) Bank-Quarter and Bank-Branch FEs

Figure 12: **IV Estimates:** These three figures plot the point estimates and 95% confidence intervals for in findings in Table 7. Panel (a) shows estimates that only include quarter FEs, panel (b) includes bank-quarter FEs, and panel (c) includes bank-quarter and bank-branch FEs. Standard errors are clustered at the bank level.

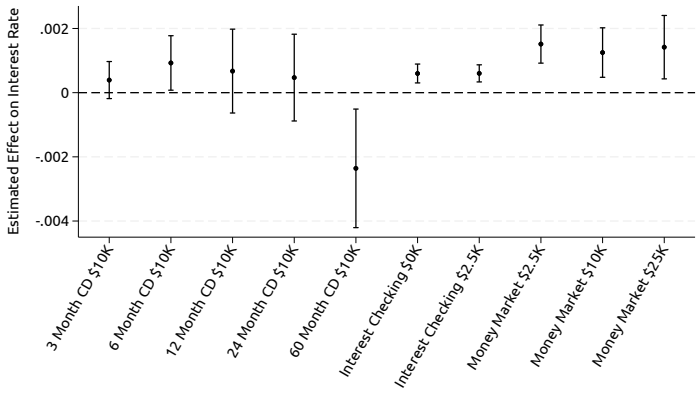


Figure 13: **Panel Regression Estimates (Controlling for Branch Counts):** These three figures plot the point estimates and 95% confidence intervals for in findings in Table 9. Unlike the baseline estimates these estimates control for the log of a bank's branch count. Only quarter fixed effects are included. Standard errors are clustered at the bank level.

B Tables

Table 3: **Deposit Rate Panel Regressions (Rate Setter Branches Only):** This table shows estimates for ten different deposit interest rates from left to right. Unlike the baseline estimates only rate setter branches are included in the sample. The estimates on top include only quarter FEs, the estimates in the middle bank-quarter FEs, and the estimates at the bottom include bank-quarter, market-quarter and bank-branch FEs. Standard errors are clustered at the bank level. These estimates are also illustrated graphically in Figure 8.

	(1) 3 Months CD	(2) 6 Months CD	(3) 12 Months CD	(4) 24 Months CD	(5) 60 Months CD	(6) Checking $0	(7) Checking $2.5K	(8) MM $2.5K	(9) MM $10K	(10) MM $25K
Weight on Rival Profits	-0.00807***	-0.0117***	-0.0157***	-0.0191***	-0.0276***	-0.00505***	-0.00492***	-0.00841***	-0.00757***	-0.00726***
	(0.000887)	(0.00135)	(0.00171)	(0.00186)	(0.00211)	(0.000508)	(0.000407)	(0.000906)	(0.00102)	(0.00132)
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-Quarter FE	No	No	No	No	No	No	No	No	No	No
Market-Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Branch FE	No	No	No	No	No	No	No	No	No	No
N	373520	409952	411665	396217	340951	367862	392707	380091	390126	391319

	(1) 3 Months CD	(2) 6 Months CD	(3) 12 Months CD	(4) 24 Months CD	(5) 60 Months CD	(6) Checking $0	(7) Checking $2.5K	(8) MM $2.5K	(9) MM $10K	(10) MM $25K
Weight on Rival Profits	0.00000382	0.000185	0.000220	0.000285	-0.0000289	0.000229	0.000176	0.000397*	0.000476**	0.000700***
	(0.000366)	(0.000339)	(0.000334)	(0.000364)	(0.000329)	(0.000138)	(0.000110)	(0.000173)	(0.000184)	(0.000209)
Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Market-Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Branch FE	No	No	No	No	No	No	No	No	No	No
N	144972	153411	153861	150076	137338	139586	146797	142357	145369	146106

	(1) 3 Months CD	(2) 6 Months CD	(3) 12 Months CD	(4) 24 Months CD	(5) 60 Months CD	(6) Checking $0	(7) Checking $2.5K	(8) MM $2.5K	(9) MM $10K	(10) MM $25K
Weight on Rival Profits	0.00132	0.000465	0.000199	0.0000755	0.00110	-0.0000759	-0.000117	0.00159	0.00156	0.000333
	(0.00129)	(0.00122)	(0.00113)	(0.00113)	(0.00130)	(0.000824)	(0.000795)	(0.00107)	(0.00135)	(0.00154)
Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Market-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-Branch FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	116742	124763	125133	121691	110118	112769	118631	113764	116748	117458

Table 4: **Deposit Rate Panel Regressions (Cross Ownership):** This table shows estimates for ten different deposit interest rates from left to right. Unlike the baseline estimates the calculation of profit weights assumes that the holdings of asset management arms of banks results in cross ownership. The estimates on top include only quarter FEs, the estimates in the middle bank-quarter FEs, and the estimates at the bottom include bank-quarter, market-quarter and bank-branch FEs. Standard errors are clustered at the bank level. These estimates are also illustrated graphically in Figure 9.

	(1) 3 Months CD	(2) 6 Months CD	(3) 12 Months CD	(4) 24 Months CD	(5) 60 Months CD	(6) Checking $0	(7) Checking $2.5K	(8) MM $2.5K	(9) MM $10K	(10) MM $25K
Weight on Rival Profits	-0.00395***	-0.00590***	-0.00793***	-0.00992***	-0.0149***	-0.00186***	-0.00191***	-0.00275***	-0.00290***	-0.00332***
	(0.000408)	(0.000748)	(0.000778)	(0.000905)	(0.00119)	(0.000227)	(0.000214)	(0.000421)	(0.000421)	(0.000468)
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-Quarter FE	No	No	No	No	No	No	No	No	No	No
Market-Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Branch FE	No	No	No	No	No	No	No	No	No	No
N	3876263	4028593	4038425	3981429	3797045	3624546	3869905	3650677	3731104	3744594

	(1) 3 Months CD	(2) 6 Months CD	(3) 12 Months CD	(4) 24 Months CD	(5) 60 Months CD	(6) Checking $0	(7) Checking $2.5K	(8) MM $2.5K	(9) MM $10K	(10) MM $25K
Weight on Rival Profits	-0.0000512	0.00000239	-0.000101	-0.0000557	-0.0000765	-0.0000129	-0.0000190	0.0000458	0.000148	0.000261*
	(0.0000989)	(0.0000900)	(0.000129)	(0.000141)	(0.000158)	(0.0000173)	(0.0000182)	(0.0000397)	(0.0000757)	(0.000108)
Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Market-Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Branch FE	No	No	No	No	No	No	No	No	No	No
N	3801169	3943230	3952894	3902282	3736741	3546738	3788092	3573589	3652144	3665514

	(1) 3 Months CD	(2) 6 Months CD	(3) 12 Months CD	(4) 24 Months CD	(5) 60 Months CD	(6) Checking $0	(7) Checking $2.5K	(8) MM $2.5K	(9) MM $10K	(10) MM $25K
Weight on Rival Profits	0.00000880	0.000264	-0.000263	-0.0000162	-0.000336	-0.000164	-0.000136	-0.000257	-0.000618	-0.00125
	(0.000708)	(0.000714)	(0.000519)	(0.000485)	(0.000920)	(0.000156)	(0.000124)	(0.000538)	(0.000912)	(0.00110)
Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Market-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-Branch FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	3794931	3937395	3947090	3896198	3729709	3538856	3781837	3566699	3645759	3659177

Table 5: **Deposit Rate Panel Regressions (GHHI):** This table shows estimates for ten different deposit interest rates from left to right. The estimates on top include only quarter FEs, the estimates in the middle bank-quarter FEs, and the estimates at the bottom include bank-quarter, market-quarter and bank-branch FEs. Standard errors are clustered at the bank level. These estimates are also illustrated graphically in Figure 10.

	(1) 3 Months CD	(2) 6 Months CD	(3) 12 Months CD	(4) 24 Months CD	(5) 60 Months CD	(6) Checking $0	(7) Checking $2.5K	(8) MM $2.5K	(9) MM $10K	(10) MM $25K
GHHI	-0.245***	-0.357***	-0.457***	-0.565***	-0.802***	-0.115***	-0.117***	-0.173***	-0.188***	-0.199***
	(0.0224)	(0.0319)	(0.0473)	(0.0563)	(0.0911)	(0.0113)	(0.0111)	(0.0182)	(0.0228)	(0.0298)
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-Quarter FE	No	No	No	No	No	No	No	No	No	No
Market-Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Branch FE	No	No	No	No	No	No	No	No	No	No
N	3892284	4045402	4055236	3997837	3811632	3641242	3886541	3666951	3747587	3761085

	(1) 3 Months CD	(2) 6 Months CD	(3) 12 Months CD	(4) 24 Months CD	(5) 60 Months CD	(6) Checking $0	(7) Checking $2.5K	(8) MM $2.5K	(9) MM $10K	(10) MM $25K
GHHI	-0.00642	-0.00832	-0.0104	-0.0122	-0.0142	-0.000358	-0.000229	-0.000180	-0.00414	-0.0000343
	(0.00523)	(0.00586)	(0.00630)	(0.00932)	(0.0122)	(0.00171)	(0.00172)	(0.00374)	(0.00486)	(0.00514)
Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Market-Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Branch FE	No	No	No	No	No	No	No	No	No	No
N	3814683	3957278	3966947	3916116	3749361	3560719	3802021	3587305	3666022	3679398

	(1) 3 Months CD	(2) 6 Months CD	(3) 12 Months CD	(4) 24 Months CD	(5) 60 Months CD	(6) Checking $0	(7) Checking $2.5K	(8) MM $2.5K	(9) MM $10K	(10) MM $25K
GHHI	0.0267	0.0276	0.0201	0.0305	0.0569	-0.00236	0.00125	0.000673	-0.00589	-0.0152
	(0.0332)	(0.0286)	(0.0294)	(0.0233)	(0.0335)	(0.00282)	(0.00274)	(0.00971)	(0.0133)	(0.0141)
Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Market-Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Branch FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	3813329	3955994	3965681	3914803	3747949	3558957	3800626	3585785	3664598	3678003

Table 6: **Deposit Rate Panel Regressions (Average Market Weight):** This table shows estimates if the profit weights are averaged over all banks in a market. Standard errors are clustered at the bank level. These estimates are also illustrated graphically in Figure 11.

	(1) 3 Months CD	(2) 6 Months CD	(3) 12 Months CD	(4) 24 Months CD	(5) 60 Months CD	(6) Checking $0	(7) Checking $2.5K	(8) MM $2.5K	(9) MM $10K	(10) MM $25K
Average Weight on Rival Profits	-0.00867***	-0.0122***	-0.0153***	-0.0200***	-0.0347***	-0.00418***	-0.00414***	-0.00543***	-0.00541***	-0.00597***
	(0.00117)	(0.00197)	(0.00332)	(0.00381)	(0.00469)	(0.000696)	(0.000608)	(0.000963)	(0.00145)	(0.00171)
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-Quarter FE	No	No	No	No	No	No	No	No	No	No
Market-Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Branch FE	No	No	No	No	No	No	No	No	No	No
N	3830515	3978123	3987743	3933857	3759074	3580317	3820910	3604165	3683145	3696544

	(1) 3 Months CD	(2) 6 Months CD	(3) 12 Months CD	(4) 24 Months CD	(5) 60 Months CD	(6) Checking $0	(7) Checking $2.5K	(8) MM $2.5K	(9) MM $10K	(10) MM $25K
Average Weight on Rival Profits	-0.0000748	0.0000638	-0.000410	-0.000386	-0.000493	0.00000966	-0.0000168	0.000104	0.000330	0.000561
	(0.000302)	(0.000304)	(0.000489)	(0.000710)	(0.000898)	(0.0000659)	(0.0000555)	(0.000158)	(0.000268)	(0.000341)
Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Market-Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Branch FE	No	No	No	No	No	No	No	No	No	No
N	3757904	3895532	3904955	3856728	3700004	3505193	3741808	3529314	3606440	3619723

	(1) 3 Months CD	(2) 6 Months CD	(3) 12 Months CD	(4) 24 Months CD	(5) 60 Months CD	(6) Checking $0	(7) Checking $2.5K	(8) MM $2.5K	(9) MM $10K	(10) MM $25K
Average Weight on Rival Profits	0.00128	0.00139	0.000599	0.00105	0.00205	-0.0000438	0.0000881	-0.000311	-0.000328	-0.000846
	(0.00119)	(0.00119)	(0.00105)	(0.00150)	(0.00349)	(0.000257)	(0.000186)	(0.000519)	(0.000603)	(0.00106)
Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Market-Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Branch FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	3756404	3894070	3903512	3855245	3698464	3503247	3740232	3527605	3604826	3618134

Table 7: **Deposit Rate IV Estimates:** This table shows estimates if the number of banks in a market and the number of banks interacted with a time trend are used as an instrument for the profit weights. Standard errors are clustered at the bank level. These estimates are also illustrated graphically in Figure 12. The first stage estimates are shown in Table 8.

	(1) 3 Months CD	(2) 6 Months CD	(3) 12 Months CD	(4) 24 Months CD	(5) 60 Months CD	(6) Checking $0	(7) Checking $2.5K	(8) MM $2.5K	(9) MM $10K	(10) MM $25K
Average Weight on Rival Profits	-0.00610***	-0.00831***	-0.0104**	-0.0137**	-0.0265***	-0.00234**	-0.00237***	-0.00269**	-0.00213	-0.00232
	(0.00130)	(0.00219)	(0.00396)	(0.00466)	(0.00581)	(0.000805)	(0.000703)	(0.00101)	(0.00152)	(0.00171)
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-Quarter FE	No	No	No	No	No	No	No	No	No	No
Market-Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Branch FE	No	No	No	No	No	No	No	No	No	No
N	3830515	3978123	3987743	3933857	3759074	3580317	3820910	3604165	3683145	3696544

	(1) 3 Months CD	(2) 6 Months CD	(3) 12 Months CD	(4) 24 Months CD	(5) 60 Months CD	(6) Checking $0	(7) Checking $2.5K	(8) MM $2.5K	(9) MM $10K	(10) MM $25K
Average Weight on Rival Profits	-0.000129	0.0000867	-0.000299	-0.000454	-0.000486	-0.0000634	-0.0000742	0.000158	0.000368	0.000630*
	(0.000178)	(0.000251)	(0.000465)	(0.000652)	(0.000742)	(0.0000650)	(0.0000621)	(0.000117)	(0.000251)	(0.000321)
Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Market-Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Branch FE	No	No	No	No	No	No	No	No	No	No
N	3757904	3895532	3904955	3856728	3700004	3505193	3741808	3529314	3606440	3619723

	(1) 3 Months CD	(2) 6 Months CD	(3) 12 Months CD	(4) 24 Months CD	(5) 60 Months CD	(6) Checking $0	(7) Checking $2.5K	(8) MM $2.5K	(9) MM $10K	(10) MM $25K
Average Weight on Rival Profits	0.00190	0.00223	0.00159	0.00116	0.000947	0.0000328	0.000221	-0.000171	-0.000747	-0.000502
	(0.00213)	(0.00222)	(0.00186)	(0.00190)	(0.00360)	(0.000311)	(0.000235)	(0.000753)	(0.00109)	(0.00176)
Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Market-Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Branch FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	3756404	3894070	3903512	3855245	3698464	3503247	3740232	3527605	3604826	3618134

Table 8: **Deposit Rate IV Estimates (First Stage):** This table shows the first stage for the estimates in Table 7. Notice that the title of each column denotes the outcome variable for the second stage. Standard errors are clustered at the bank level.

	(1) 3 Months CD	(2) 6 Months CD	(3) 12 Months CD	(4) 24 Months CD	(5) 60 Months CD	(6) Checking $0	(7) Checking $2.5K	(8) MM $2.5K	(9) MM $10K	(10) MM $25K
Number of Public Banks	-0.0215***	-0.0216***	-0.0216***	-0.0214***	-0.0226***	-0.0193***	-0.0210***	-0.0204***	-0.0206***	-0.0205***
	(0.00205)	(0.00203)	(0.00203)	(0.00204)	(0.00206)	(0.00198)	(0.00205)	(0.00211)	(0.00208)	(0.00209)
Number of Public Banks x Quarter	0.00275***	0.00276***	0.00277***	0.00276***	0.00277***	0.00269***	0.00275***	0.00274***	0.00274***	0.00274***
	(0.0000374)	(0.0000370)	(0.0000370)	(0.0000365)	(0.0000385)	(0.0000367)	(0.0000361)	(0.0000395)	(0.0000388)	(0.0000388)
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-Quarter FE	No	No	No	No	No	No	No	No	No	No
Market-Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Branch FE	No	No	No	No	No	No	No	No	No	No
N	3830515	3978123	3987743	3933857	3759074	3580317	3820910	3604165	3683145	3696544

	(1) 3 Months CD	(2) 6 Months CD	(3) 12 Months CD	(4) 24 Months CD	(5) 60 Months CD	(6) Checking $0	(7) Checking $2.5K	(8) MM $2.5K	(9) MM $10K	(10) MM $25K
Number of Public Banks	-0.0230***	-0.0231***	-0.0231***	-0.0227***	-0.0231***	-0.0224***	-0.0231***	-0.0216***	-0.0216***	-0.0215***
	(0.00303)	(0.00299)	(0.00299)	(0.00308)	(0.00301)	(0.00307)	(0.00297)	(0.00286)	(0.00282)	(0.00283)
Number of Public Banks x Quarter	0.00262***	0.00262***	0.00262***	0.00262***	0.00262***	0.00260***	0.00262***	0.00257***	0.00257***	0.00257***
	(0.0000634)	(0.0000626)	(0.0000626)	(0.0000626)	(0.0000632)	(0.0000618)	(0.0000618)	(0.0000605)	(0.0000598)	(0.0000597)
Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Market-Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Branch FE	No	No	No	No	No	No	No	No	No	No
N	3757904	3895532	3904955	3856728	3700004	3505193	3741808	3529314	3606440	3619723

	(1) 3 Months CD	(2) 6 Months CD	(3) 12 Months CD	(4) 24 Months CD	(5) 60 Months CD	(6) Checking $0	(7) Checking $2.5K	(8) MM $2.5K	(9) MM $10K	(10) MM $25K
Number of Public Banks	0.0128*	0.0132*	0.0132*	0.0146*	0.0126*	0.00730	0.0130*	0.0117	0.0127	0.0129
	(0.00603)	(0.00590)	(0.00589)	(0.00621)	(0.00584)	(0.00688)	(0.00601)	(0.00648)	(0.00691)	(0.00696)
Number of Public Banks x Quarter	0.00257***	0.00257***	0.00257***	0.00256***	0.00257***	0.00258***	0.00257***	0.00251***	0.00250***	0.00250***
	(0.0000842)	(0.0000824)	(0.0000824)	(0.0000834)	(0.0000827)	(0.0000879)	(0.0000831)	(0.0000802)	(0.0000821)	(0.0000822)
Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Market-Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Branch FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	3756404	3894070	3903512	3855245	3698464	3503247	3740232	3527605	3604826	3618134

Table 9: **Deposit Rate Panel Regressions (Controlling for Branch Count):** This table shows estimates for ten different deposit interest rates from left to right. Unlike the baseline estimates these estimates control for the log of a bank's branch count. Only quarter fixed effects are included. Standard errors are clustered at the bank level. These estimates are also illustrated graphically in Figure 13.

	(1) 3 Months CD	(2) 6 Months CD	(3) 12 Months CD	(4) 24 Months CD	(5) 60 Months CD	(6) Checking $0	(7) Checking $2.5K	(8) MM $2.5K	(9) MM $10K	(10) MM $25K
Weight on Rival Profits	0.000393	0.000926*	0.000672	0.000470	-0.00236*	0.000598***	0.000601***	0.00151***	0.00125**	0.00142**
	(0.000295)	(0.000433)	(0.000667)	(0.000690)	(0.000943)	(0.000150)	(0.000136)	(0.000303)	(0.000393)	(0.000504)
log(Branch Count)	-0.0394***	-0.0591***	-0.0741***	-0.0896***	-0.116***	-0.0215***	-0.0216***	-0.0331***	-0.0332***	-0.0384***
	(0.00187)	(0.00367)	(0.00355)	(0.00364)	(0.00748)	(0.00109)	(0.000974)	(0.00247)	(0.00242)	(0.00354)
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-Quarter FE	No	No	No	No	No	No	No	No	No	No
Market-Quarter FE	No	No	No	No	No	No	No	No	No	No
Bank-Branch FE	No	No	No	No	No	No	No	No	No	No
N	3876263	4028593	4038425	3981429	3797045	3624546	3869905	3650677	3731104	3744594