The Deposit Business at Large vs. Small Banks*

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Abstract

The deposit business differs at large versus small banks. We provide a parsimonious model and extensive empirical evidence supporting the idea that much of the variation in deposit-pricing behavior between large and small banks reflects differences in preferences and technologies. Large banks offer superior financial services but lower deposit rates, and locate where customers value their services. In addition to receiving a lower level of deposit rates on average, customers of large banks also exhibit lower rate elasticities. As a result, despite the fact that the locations of large-bank branches have demographics typically associated with *greater* financial sophistication, large-bank customers earn lower average deposit rates. Our explanation for deposit pricing behavior challenges the idea that deposit pricing is mainly driven by pricing power derived from the large observed degree of concentration in the banking industry.

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1 Introduction

The business of creating and maintaining a deposit franchise is different for large versus small banks. We show empirically that large banks tend to offer uniform deposit rates, offer lower deposit rates than small banks, have branches that cover different geographies than small banks, experience significantly lower rate elasticities, and are more likely to be located in markets with less-rate-elastic customers. Consistent with these findings, we provide an explanation for the different pricing behavior of large and small banks based on differences in preferences and technologies, rather than on market power derived from concentrated market shares. We show that large and small banks operate in markets with different characteristics and different customer bases; large banks locate their branches in areas with high populations, high incomes, high house prices, and less-elderly populations.

We present a simple model of the deposit business at large and small banks.[1] Consistent with a long literature on uniform rate setting in banking,[2] we assume that large banks set uniform rates and we provide robust empirical support for this assumption in the data.[3] Banks may choose to pay a fixed cost to operate at a large scale across multiple markets and to provide additional financial services to their customers that are superior to those of small banks. Large-bank services could include wealth management, more convenient online banking, more ATMs, or other infrastructure that allows for faster or lower-cost access to deposits.[4] The tradeoff inherent in being a large bank, aside from the fixed cost, is the constraint of uniform rates.

The free-entry conditions in our simple model establish the type and quantity of banks entering each market. In equilibrium two bank types emerge: large banks that invest in multiple markets and provide a broad menu of financial services, and small banks that do not invest in these services and enter in a single market. The model also offers strong predictions concerning the differences between markets where large banks operate with collocated small banks and markets with only small banks. Because of uniform pricing, large banks maximize profits by locating in areas with similar demand curves. If the distribution of markets' demand elasticities is skewed (as measured in the data), large banks do not open branches

[1]For quantitative industry equilibrium models of banking, see the important contributions of Corbae and D'Erasmo (2021, 2013); Wang, Whited, Wu, and Xiao (2022); Bianchi and Bigio (2022).

[2]See Calem and Nakamura (1998); Radecki (1998, 2000); Biehl (2002); Heitfield and Prager (2004); Park (2009); Begenau and Stafford (2023); Granja and Paixão (2023).

[3]Uniform pricing by large banks does not rule out deposit-market power or the possibility that low sensitivity to market rates creates a deposit channel for the transmission of monetary policy to bank lending and reduces the exposure of these banks to interest rate risk (Drechsler, Savov, and Schnabl, 2017, 2021).

[4]This is consistent with the findings in Haendler (2023) regarding small banks' sluggish adoption of mobile-banking services and those of Sarkisyan (2023) on demand deposit growth from improvements in liquidity services.

in areas with highly elastic demand curves and dominate markets with relatively inelastic demand curves. The model also provides two prediction regarding the deposit rates offered by small banks. First, they are higher than those of large banks, because they need to compete without offering financial services. Second, small banks offer lower deposit rates in markets dominated by large banks, because these are markets with relatively inelastic demand curves. Finally, in contrast to Drechsler et al. (2017), the model predicts that local-market bank rate elasticities and market-entry costs should explain more variation in deposit spreads than HHI. We find robust empirical support for these conclusions in the data.

Understanding the deposit business at large and small banks is crucial for understanding bank valuations and for measuring financial stability. The franchise values of deposit businesses has been documented as a key driver of bank value in the cross section and time series. Minton, Stulz, and Taboada (2019) show that large banks do not appear to be valued more highly than small banks, and that the size of banks' deposits relative to total liabilities is positively correlated with bank value.[5] Egan, Lewellen, and Sunderam (2022) show that deposit productivity is more important than loan productivity for understanding the cross section of bank values. Atkeson, d'Avernas, Eisfeldt, and Weill (2018) develop a calibrated framework which quantifies the impact of time-series variation in the value of the deposit franchise on the financial soundness of the banking sector. Ma and Scheinkman (2021) show that the leverage of banks is supported by their going-concern value, which includes the deposit-franchise value. It is important to note that despite the importance of deposit franchises for bank values, and despite the higher spreads that large banks have and the lower rate elasticities of their customers, large banks have *lower* valuation ratios (Minton et al., 2019; Atkeson et al., 2018). This fact cuts against explanations of large banks' pricing behavior that rely on high profitability.

Our deposit-rate-setting framework contributes to understanding recent bank failures and to discussions regarding bank-interest-rate risks.[6] Small banks may be more vulnerable in a tightening environment because their customers are more sensitive to deposit-rate changes, and because they need to incur higher funding costs by offering higher rates to retain deposits.[7] This is despite the fact that, on average, small banks have a lower fraction of uninsured deposits. Consequently, small-bank deposit franchises may have weaker hedg-

[5]See also Calomiris and Nissim (2014) for a related empirical study of bank valuation ratios.

[6]See Jiang, Matvos, Piskorski, and Seru (2023b); Haddad, Hartman-Glaser, and Muir (2023); Chang, Cheng, and Hong (2023) for studies of the 2023 bank failures. Drechsler et al. (2021) is the classic study of the effect of the deposit franchise on bank interest rate exposures. Begenau, Piazzesi, and Schneider (2015) study bank-interest-rate exposures, but focus on the asset side of banks' balance sheet.

[7]See Egan, Hortaçsu, and Matvos (2017) for a model of a related effect for banks with a greater share of uninsured deposits. Chang et al. (2023) shows that smaller banks with more uninsured deposits had greater profitability and market valuations prior to the bank failures in the spring of 2023.

ing benefits (Drechsler et al., 2021) and a shorter duration. Our contribution emphasizes that banks do not compete solely on rates and that large and small banks operate different deposit business models. We offer a framework that highlights the differences in these business models and structurally links them to the banks' pricing behavior, location choices, and customer rate elasticities.

Key empirical differences between large and small banks are the higher average deposit rate of small banks and the prevalence of uniform rate setting by large banks. These two features are explored in Section 4 using data from RateWatch (advertised rates) and Call Report (realized rates). We first present evidence that variation in local market conditions is not associated with the variation in rate-setting behavior. We then provide evidence that large banks set lower deposit rates relative to small banks for all deposit products. Additionally, we show that rate disparities exist among small banks that do vs. do not co-locate with large banks. Small banks in areas with a higher market share of large banks set relatively lower rates than those in regions with a smaller share of large banks.

In Section 5, we provide empirical evidence for how large banks retain deposits with low deposit rates and uniform-rate policies. We contend that differences in preferences and technologies is the answer, rather than market power arising from concentration. We define product market competition as occurring within counties but between differentiated products. We then present reduced form evidence that large banks typically select markets with similar characteristics, primarily in densely populated urban areas with higher household income, housing prices, and fewer elderly individuals. These market selection patterns support the idea that large banks serve locations with customers who have a higher willingness to pay for superior financial service technologies and are less concerned about low deposit rates, while small banks locate where customers are more sensitive to deposit rates.

We show that large and small banks also differ in their respective asset and liability structures. Large banks hold more complex financial assets, including real estate loans, commercial loans, and mortgage-backed securities (MBS), while small banks possess more agriculture loans, catering to farmers and rural customers, as well as highly liquid assets, consistent with more rate-sensitive deposit withdrawals. Large banks also maintain a larger savings-deposit base, while small banks hold more transaction deposits.

To better document the causal mechanisms that lead large-bank customers to empirically exhibit lower rate elasticities, we conduct a structural estimation of banks' rate elasticities by extending the methodology of Egan et al. (2017); Xiao (2020); Wang et al. (2022) to focus on bank size and location choice. Our premise is that size proxies for the technologies of banks' deposit businesses and that location proxies for the preferences of customers. Large banks are differentiated by their offered deposit rates and the quality of their other offered financial services, while collocated small banks provide higher deposit rates and lesser quality alternative services. Assuming households choose from available local-market banks, we conduct our analysis at the bank-county level, clustering very small neighboring counties. We estimate the deposit-demand system on a cluster-by-cluster basis. After estimating the model's demand parameters, we calculate each bank's rate elasticity in each local market, finding that large banks experience significantly lower rate elasticities and are more likely to be located in markets with less-elastic customers.[8]

Prior research documents a number of other differences between large and small banks. Bassett and Brady (2002) find that large and small banks have quite different liabilities, with small banks' liabilities comprised mainly by (FDIC-insured) retail deposits, while larger banks have larger quantities of uninsured deposits. Park and Pennacchi (2009), supported empirically by Berger, Miller, Petersen, Rajan, and Stein (2005); Cole, Goldberg, and White (2004); Haynes, Ou, and Berney (1999), note that larger banks face lower funding costs than smaller banks due to their access to wholesale financing, and that the greater organizational complexity of large banks may mean that they face higher costs of servicing small businesses and consumers, and may be more likely to rely on simple decision rules regarding lending and pricing that are based only on "hard" information. In a comparison of the capital structure of traditional banks and shadow banks, Jiang, Matvos, Piskorski, and Seru (2023a) show that bank leverage is insensitive to bank size and that uninsured deposits increase with bank size.[9] Our complementary focus is on the different business models for deposits at large vs. small banks.

The remainder of this paper is organized as follows: Section 2 presents and analyzes our model. Section 3 details the data. Section 4 provides comprehensive evidence describing banks' deposit-rate-setting behavior and investigates the different rate-setting behavior of large vs. small banks. Section 5 presents empirical evidence on the different market selections of large and small banks. Section 6 presents estimates of rate elasticities, and Section 7 concludes.

2 Model

In this section, we present a parsimonious model of banking for large and small banks in which customers' have heterogeneous preferences for deposits. We use the model to provide

[8]A connection can be drawn to the sorting emphasized in Chang et al. (2023), who show that uninsured depositors at smaller banks have small-business loan demands, and the value of their banking relationship is a joint consideration.

[9]See also Buchak, Matvos, Piskorski, and Seru (2024), which shows that bank lending is not constrained by balance sheet size due to bank access to securitization markets.

intuition about our empirical findings and derive equilibrium predictions for deposit-rate differences, bank-location choices, and rate elasticities.

Depositors The economy is divided into local markets, each indexed by $k \in \{1, \ldots, K\}$ and with a mass M_k of depositors. As in Xiao (2020), each depositor is endowed with one dollar and makes a discrete choice among bank deposits. Each option j is characterized by the deposit rate r_j and by the financial services $x_j \in \{0,1\}$ offered by the bank to its depositors. Depositor i in market k maximizes the utility function[10]

$$\max_{j \in \mathcal{B}_k} u_{ijk} = \alpha_k \left(r_j - r^f \right) + \beta_k x_j + \epsilon_{ijk}, \tag{1}$$

$$= -\alpha_k s_j + \beta_k x_j + \epsilon_{ijk}, \tag{2}$$

where r^f is the competitive risk-free rate; s_j is the deposit spread, $s_j \equiv r^f - r_j$; and ϵ_{ijk} is an idiosyncratic utility shock for depositor i if choosing bank j, which follows the extreme value distribution with cumulative distribution function $F(\epsilon) = \exp(-\exp(-\epsilon))$. The choice set $\mathcal{B}_k$ contains the index of each bank with a branch in market k. The parameters α_k and β_k are the sensitivity to deposit rates and financial services in market k.[11]

In Section 6, we estimate α_k's and β_k's for different markets as a function of income. The idea is that the underlying utility function for deposits might not be homethetic with respect to income. For instance, wealthy households are likely have a lower rate sensitivity because they hold a smaller proportion of their wealth in deposits. Beyond a certain income threshold, it becomes profitable to pay the participation cost to access the stock market, leading these households to keep only the minimum necessary in deposit accounts. These households then primarily value a broader menu of financial products, such as liquidity services, and are less sensitive to deposit rates, unlike poorer households that rely more on deposits as a saving vehicle and do not invest in other financial products.

In Equation (1), we also implicitly assumed that a bank sets the same interest rate across all of its branches, $r_{jk} = r_j$. We discuss and provide empirical support for this assumption in Section 4. Given the extreme value distribution, the market share for the deposits of bank j in market k is given by

$$d_{jk} = \frac{\exp(-\alpha_k s_j + \beta_k x_j)}{\sum_{i \in \mathcal{B}_k} \exp(-\alpha_k s_i + \beta_k x_i)}, \tag{3}$$

[10]This is a simplified version of the utility function we shall estimate later in Section 6, allowing us to obtain closed-form solutions.

[11]Without loss of generality, we assume that no two markets have the same values for both α_k and β_k.

and the total demand is $D_{jk} = M_k d_{jk}$.

Banks Banks earn profits by raising deposits and investing in bonds, earning the competitive risk-free rate r^f. Each bank chooses in which markets to open branches and whether to increase the financial services provided to their customers, both of which require large investment expenditures.

We can write the profit maximization problem of bank j as

$$\max_{x_j, b_{jk}, s_j} \sum_{k \in \mathcal{M}_j}^{K} \left((s_j - c) D_{jk} - \kappa_k \right) b_{jk} - \chi x_j, \tag{4}$$

where c is the variable cost of servicing deposits, $b_{jk} = 1$ if the bank decides to pay the fixed cost κ to open a branch in a given market and 0 otherwise, $\mathcal{M}_j$ is the set of markets where bank j opens a branch, $\mathcal{M}_j \equiv \{k : b_{jk} = 1\}$, and $x_j \in \{0,1\}$ indicates whether the bank provides additional financial services to its customers (at cost χ). To discipline our analysis, we assume that

$$\beta_k < \log\left(1 + \frac{\chi}{\kappa_k}\right)\left(1 + \frac{\kappa_k \alpha_k}{M_k}\right), \quad \frac{M_k}{\kappa_k \alpha_\ell} > 1, \quad \text{and} \quad \frac{1}{\alpha_k} + \frac{\kappa_k}{M_k} \neq \frac{1}{\alpha_\ell} + \frac{\kappa_\ell}{M_\ell} \quad \forall k,\ell. \tag{5}$$

The first assumption implies that single-market banks find it too costly to invest in providing these additional financial services. The second assumption guarantees that every market is sufficiently large for at least two single-market banks to open a branch. Finally, the third assumption ensures that each market has a different optimal deposit spread for single-market banks.

The deposit rate is set to maximize the bank's profits, which gives

$$\sum_{k \in \mathcal{M}_j} D_{jk} + (s_j - c) \sum_{k \in \mathcal{M}_j} \frac{\partial D_{jk}}{\partial s_j} = 0. \tag{6}$$

Given households' preferences, solving for the first-order condition (6) yields

$$s_j = c - (\eta_j^s)^{-1}, \qquad \text{so} \tag{7}$$

$$r_j = r^f - c + (\eta_j^s)^{-1}, \tag{8}$$

where η_j^s is the deposit-weighted average spread semi-elasticity faced by bank j,

$$\eta_j^s \equiv \frac{\sum_{k \in \mathcal{M}_j} \partial D_{jk} / \partial s_j}{\sum_{k \in \mathcal{M}_j} D_{jk}} = -\frac{\sum_{k \in \mathcal{M}_j} D_{jk} \alpha_k (1 - d_{jk})}{\sum_{k \in \mathcal{M}_j} D_{jk}}. \tag{9}$$

We assume a simple rule for the decision to open a branch in a market:[12]

$$b_{jk} = 1 \quad \text{if and only if} \quad (s_j - c)D_{jk} \geq \kappa. \tag{11}$$

Thus, bank j operates in market k if the additional branch's revenues would cover the fixed cost κ.

When the bank decides whether to open a branch in a market, we allow the bank to acquire an existing single-market bank at market value. This becomes relevant when verifying potential deviations from equilibrium. Without this provision, multiple equilibria could arise. For instance, one equilibrium might have $b_{jk} = 1$ and another $b_{jk} = 0$. In the former, staying in market k and competing with $N_k - 1$ other banks could be profitable, whereas in the latter, opening a new branch and competing with N_k other banks might not be. Allowing the acquisition of existing single-market banks ensures the condition in both potential equilibria is the same.

Finally, a free-entry condition for banks pins down the quantity of banks entering each market.

Equilibrium Given the set of parameters $\theta = \{\chi, \kappa, c, M_k, \alpha_k, \beta_k\}_{k=1}^{K}$, an equilibrium[13] is a set of decision rules for depositors $j^{\star}_{ik}$ and banks b_{jk}, x_j, s_j that solves depositors and banks' maximization problems and such that the market for deposits clears and the free-entry condition is satisfied.

Analysis We first we derive the number of single-market banks entering every market in Proposition 1. The term $\theta_k \in [0, 1)$ arises from the fact that N^S_k needs to be a natural number. The mass of depositors in a market M_k might increase, but not sufficiently to warrant the entry of an additional bank. This residual θ_k could have an impact on bank's j market share d_{jk} in very small markets, but becomes vanishingly small as M_k increases. To ease the exposition of our results, we now assume $\theta_k = 0$ and $N^S_k > 0$.

Proposition 1. *(Free-entry condition) Denote the deposit spread and financial services of*

[12] A comprehensive optimization rule should include the impact of a branch on total profits. That is, $b_{jk} = 1$ if and only if

$$0 \leq \sum_{\ell \in \mathcal{M}_{-k}} \left((\widetilde{s}_j - c)\widetilde{D}_{j\ell} - \kappa \right) - \sum_{\ell \in \mathcal{M}_{-k}} ((s_j - c)D_{j\ell} - \kappa) \leq (s_k - c)D_{jk} - \kappa, \tag{10}$$

where $\widetilde{s}_j$ denotes optimal deposit spread without market k, $\widetilde{D}_{jk}$ is the deposit demand in market k given spread $\widetilde{s}_j$, and $\mathcal{M}_{-k} = \{\ell : b_{j\ell} = 1\} \backslash \{k\}$. Note that as a bank enters more markets, this difference gets closer to 0.

[13] We solve for a pure-strategy Nash equilibrium.

single-market banks entering market k as s_k^S and x_k^S. The free-entry condition in market k is such that the number of single-market banks entering market k is given by

$$N_k^S = \left\lfloor \frac{M_k}{\kappa_k \alpha_k} - \Omega_k e^{\alpha_k s_k^S - \beta_k x_k^S} + 1 \right\rfloor = \frac{M_k}{\kappa_k \alpha_k} - \Omega_k e^{\alpha_k s_k^S - \beta_k x_k^S} + 1 - \theta_k \quad \text{if} \quad N_k^S > 0, \tag{12}$$

where $\theta_k \in [0,1)$, $\Omega_k = \sum_{i \in \mathcal{L}_k} \exp(-\alpha_k s_i + \beta_k x_i)$, and $\mathcal{L}_k \equiv \{j : b_{jk} = 1 \text{ and } |\mathcal{M}_j| > 1\}$ is the set of multi-market banks entering market k.

Proposition 2 derives an equilbrium result with two types of banks. We have large banks (L) that invest in financial services and operate across various markets by opening multiple branches, and small banks (S) that do not invest in financial services and only open a branch in a single market. We use the superscript S or L to denote choice variables pertaining to small or large banks, respectively.

Proposition 2 (Small banks operate in one market)**.** *If $x_j = 0$, then $|\mathcal{M}_j| = 1$.*

These results highlight the trade-off between bearing the cost of financial-service technologies, which is profitable only when operating at a large scale across multiple markets, and the capacity of small banks to set rates fine-tuned to individual markets. In other words, a bank constrained to set a deposit spread different from the optimal spread in a given market cannot compete with other unrestricted single-branch banks, unless it also offers additional financial services.[14]

As we demonstrate below, the model offers strong predictions regarding the disparity between markets where large banks operate and markets with only small banks. For these propositions, we define *collocation* markets to be the set of markets $\mathcal{C}$ where both small and large banks operate, $\mathcal{C} = \{k : \exists j, b_{jk} = 1 \text{ and } |\mathcal{M}_j > 1|\}$. Proposition 3 provides a condition for such markets.

Proposition 3 (Collocation markets' demand)**.** *If $i \in \mathcal{C}$, the ratio of deposits supplied by small and large banks is given by*

$$\log\left(\frac{D_k^S}{D_{jk}^L}\right) = \alpha\left(s_j^L - s_k^S\right) - \beta_k. \tag{13}$$

Proposition 3 illustrates that in collocation markets, small banks engage in competition for deposits by offering lower deposit spreads, while large banks benefit from the preference for financial services β_k.

[14] As discussed above, Haendler (2023) and Sarkisyan (2023) provide strong empirical support for this result. Additionally, Choi and Rocheteau (2023) develop a model in which banks can increase market power by learning about consumers' liquidity needs, for example using "big data."

The next Proposition demonstrates that if the deposit spread of small banks is smaller than that of large banks, as observed in the data, it must be because these large banks operate in markets that are less elastic on average.

Proposition 4 (Deposit spreads and average spread semi-elasticity)**.** *Given* (7)*,* $s_i < s_j$ *if and only if* $|\eta_i^s| > |\eta_j^s|$*.*

However, although small banks establish branches in every market, large banks may choose not to do so in markets with significantly different spread semi-elasticities compared to other markets where they operate branches. In these markets, opening a branch might not be profitable due to the constraint that the deposit rate must be uniform across all branches. Proposition 5 demonstrates that large banks never establish branches in markets with a rate sensitivity α_k sufficiently different from the spread semi-elasticity η_j^s. (Inequality (14) is never satisfied for small banks.)

Proposition 5 (Large banks' location)**.** *If*

$$\frac{\alpha_k}{|\eta_j^s|} - \log\left(\frac{\alpha_k}{|\eta_j^s|}\right) > 1 + \beta_k x_j + \frac{\kappa_k \alpha_k}{M_k}, \tag{14}$$

then bank j *does not locate in market* k*.*

Given a distribution of α_k's, large banks maximize their profits by choosing a deposit spread that allows them to open branches in the largest possible number of markets. If the distribution is heavily skewed, we would therefore expect large banks to locate in markets close to the median, and neglect markets with large sensitivities to deposit rates.

Proposition 6 demonstrates that if we observe two markets—one where a large bank locates and another where it does not locate—then the latter market must have a rate sensitivity that is further away from its semi-elasticity η^s.

Proposition 6 (Collocation markets)**.** *Assume that* $M_k/\kappa_k \geq M_\ell/\kappa_\ell$ *and* $\beta_k \leq \beta_\ell$*. If* $k \in \mathcal{M}_j$ *and* $\ell \notin \mathcal{M}_j$*, then*

$$\frac{\alpha_k}{|\eta_j^s|} - \log\left(\frac{\alpha_k}{|\eta_j^s|}\right) < \frac{\alpha_\ell}{|\eta_j^s|} - \log\left(\frac{\alpha_\ell}{|\eta_j^s|}\right). \tag{15}$$

Proposition 7 demonstrates how heterogeneity in market competition differs whether the heterogeneity is driven by difference in entry costs or the rate sensitivities. For simplicity, consider a market with only small banks. If the cost of opening a branch κ_k increases, then net profits decrease, fewer banks enter, and competition, measured by deposit spreads or the Herfindahl–Hirschman index (HHI), worsen. If rate sensitivity α_k increases instead, we also have that net profits decrease and fewer banks enter. However competition, as measured by deposit spreads, improves! From the perspective of a bank, a market with higher rate semi-elasticity is a more competitive environment, while a market with a higher entry cost is less competitive. However, HHI only depends on the number of banks, which decreases in both cases. In the next section, we find that α_k explains more variation in deposit spreads than HHI.

Proposition 7 (Herfindahl–Hirschman index)**.** *If $k \notin \mathcal{C}$, then*

$$d_k^S = \frac{1}{1+\frac{M_k}{\kappa_k \alpha_k}}, \quad s_k^S = c + \frac{1}{\alpha_k} + \frac{\kappa_k}{M_k}, \quad and \quad HHI_k = \frac{10000}{1+\frac{M_k}{\kappa_k \alpha_k}}. \tag{16}$$

Thus,

$$\frac{\partial s_k^S}{\partial \alpha_k}\frac{\partial \alpha_k}{\partial HHI_k} < 0 \quad and \quad \frac{\partial s_k^S}{\partial \kappa_k}\frac{\partial \kappa_k}{\partial HHI_k} > 0. \tag{17}$$

In the next sections, we first verify the assumptions that banks tend to set uniform rates. Then, we test the predictions that large banks tend to offer lower deposit rates and locate in areas in which rate semi-elasticity is closer to the median.

3 Data

We define large banks as the fourteen depositories that were identified as large complex bank-holding companies subject to the Supervisory Capital Assessment Program (SCAP) of 2009 with year-end 2008 assets exceeding \$100 Billion.[15] These fourteen banks also participated in the 2011 Comprehensive Capital Analysis and Review (CCAR) for complex bank-holding companies, and accounted for 29% of all U.S. deposits in 2000 and 54.7% in 2019.[16] The fourteen banks are all designated as either Systemically Important Financial Institutions (SIFIs) or U.S.-domiciled Global Systemically Important Financial Institutions (G-SIBs).[17]

[15] See `https://www.federalreserve.gov/newsevents/pressreleases/files/bcreg20090424a1.pdf`.

[16] The fourteen banks are Bank Of America Corporation, BB&T Corporation, Capital One Financial Corporation, Citigroup Inc., Fifth Third Bancorp, Goldman Sachs Group, Inc., The JP Morgan Chase & Co., Keycorp, Morgan Stanley, PNC Financial Services Group, Inc., The Regions Financial Corporation, Suntrust Banks, Inc., U.S. Bancorp, and Wells Fargo & Company. The SCAP and CCAR reviews also included three other non-depositories (Ally Financial, American Express Company, Metlife Inc.) and two processing banks (State Street Corporation and Bank of New York Mellon Corporation) (see `https://www.federalreserve.gov/newsevents/pressreleases/files/bcreg20110318a1.pdf`).

[17] Under Section 117 of the Dodd-Frank Act, the SIFI designation applies to any bank holding company with total consolidated assets of at least \$50 Billion (`https://home.treasury.gov/policy-issues/financial-markets-financial-institutions-and-fiscal-service/fsoc/designations`). The G-SIB designation is determined by the Financial Stability Board (FSB) in consultation with the Basel Com-

We designate all branches that are acquired by these institutions over our analysis period of 2001 to 2020 as 'large-bank branches' post-acquisition.[18] In the spirit of the definition for large banks, our analysis defines a bank at the bank holding company level, combining banks owned by the same bank holding company into a single entity.

Our empirical analyses rely on three major datasets for information on bank deposit product-types and the rates that banks pay customers for those deposits. First, we investigate branch-level deposit rates using the RateWatch Data from S&P Global. The advantage of the RateWatch data is that the data are reported for nearly 100,000 banks from 2001 to 2020, they include extensive branch-level geographic coverage of the U.S., and they are easily merged to both the FDIC Summary of Deposit data and the FDIC Consolidated Report of Condition and Income (call report) data. The RateWatch data are collected weekly at the branch-level for precisely defined deposit products and include the advertised deposit rates for these products.[19] We focus on the four deposit products with the greatest coverage in RateWatch, namely interest checking account with a balance of \$2,500 (CHECK \$2.5K), savings account with a balance of \$2,500 (SAV \$2.5K), 12-month CD with a balance of \$10,000 (12M CD \$10K), and money-market account with a balance of \$25,000 (MM \$25K). RateWatch's SAV \$2.5K accounts are very similar to checking accounts, except for limitations on the number of withdrawals. A limitation of the data is that about 32% of small banks' branches are not tracked by RateWatch.

Our second two major data sets are the Consolidated Report of Condition and Income (Bank Call Reports) and the Summary of Deposits, both from the Federal Deposit Insurance Corporation. The Call Report data include bank-level asset and liability structure, the income statement, and supporting schedules for all of the FDIC regulated banks in the U.S. A key variable for our analysis is the annual bank-level deposit rate which we compute using the Call Report data by dividing the reported end-of-year bank deposit interest expenses by the reported end-of-year bank deposit balance for each year 2001 through 2020.

The Call Report data also reports aggregates of deposit products such savings deposits and time deposits, in contrast to the more narrowly defined specific deposit product types that are reported in RateWatch.[20] The savings deposits data include interest bearing bank

mittee on Banking Supervision (BCBS) and national authorities of the Group of Twenty (see `https://www.bis.org/bcbs/publ/d445.pdf`).

[18]In Appendix B we replicate our structural analysis with the top 1% of large bank holding companies by deposits. In 2000, the top 1% of banks consisted of 89 banks which accounted for 57% of total U.S. deposits. In 2019 the top 1% of banks consisted of 53 banks accounting for 72% of deposits.

[19]Although the RateWatch data includes a flag for a subset of branches that are labelled "rate setter" branches, RateWatch advised us that the designation was an in-house data storage identification number and did not indicate that a flagged branch actually set rates for other branches. Thus, they recommended that we ignore these flags.

[20]Definitions for time deposits savings deposits, and transaction deposits are reported in Part 204 of

accounts with transfers and withdrawal restrictions. These accounts include passbook savings accounts, statement savings accounts, and money market deposit accounts. Time deposits data include all interest-bearing bank accounts that have a required pre-set date of maturity to earn the stated rate of interest. Certificate of deposits (CD) are the dominant form of time deposit accounts. Transaction deposits include interest bearing bank accounts that allow the depositor to make transfers from the account without regard to the number of transfers made. Interest checking accounts are the common type of transaction deposits.

We also supplement the Call Report data with the FDIC's Summary of Deposits, which reports branch-level total deposit balances and branch locations. This additional data source allows us to explore banks' branch-site choices and to obtain local market shares for our rate-elasticity analysis. Additionally, we used the Summary of Deposits data to compute the Herfindahl-Hirschman Indices (HHI) for market shares at the zipcode level using data from the Summary of Deposits.[21]

To explore the demographics of customers and their potential impact on deposit rates, we rely on Data Axle's U.S. Consumer Database, formerly known as Infogroup. This dataset provides annual information on household income for about 67 million U.S. households from 2006 to 2020 and is available at the household level using latitudinal and longitudinal geo-identifiers.[22] The Zipcode level population data is from American Community Survey.[23]

4 Rate-setting behavior of large and small banks

In this section, we document that rate setting is uniform across branches within banks which is an assumption that we use both in our model and in our empirical work. We also reveal a consistent pattern where large banks offer lower deposit rates across a range of deposit products compared to small banks. Furthermore, small banks located in areas with a higher market share of large banks tend to set lower deposit rates than those in regions where large banks are less prevalent. These findings are consistent with the predictions made by our model on bank rate-setting behavior.

the Reserve Requirements of the Depository Institutions (see https://www.ecfr.gov/current/title-12/chapter-II/subchapter-A/part-204).

[21]The zipcode-level HHIs were computed as the sum of squares of bank deposit shares, i.e. HHI in Zipcode $z = \sum_{\text{banks } b \text{ in } z} \frac{Deposit_b}{Deposit_z}^2$.

[22]Data Axle models the annual income of the household heads using the MRI/Simmons annual Survey of the American Consumer. The estimated income model is updated based on changes in Census Bureau data, changes from the latest MRI survey, actual changes in the surveyed household income, and changes in the Data Axle consumer data. The data used in the Data Axle income model include about 35 individual, household, and consumer lifestyle characteristics and about 26 geoprocessed Census data fields.

[23]American Community Survey provides Zipcode level population data from 2011 to 2020. The population data before 2011 are extrapolated.

4.1 Uniform pricing

We first investigate the sources of branch-level deposit rate variation by regressing product-type deposit rates on fixed effects using the RateWatch data,

$$\text{Rate}_{branch,t} = \text{FE} + \epsilon_{branch,t}. \tag{18}$$

$\text{Rate}_{branch,t}$ is the weekly product-type deposit rate at the branch level from RateWatch between 2001 and 2020 and the fixed effects, FE, are measured as either Time or Bank×Time.

The results from the regression analysis of Equation 18 are reported in Table 1. Columns 5 and 6 concentrate on the 12M CD $10K rates. The R^2 indicates that 86.6% of rate variation can be explained by time fixed effects, suggesting that rate setting is similar across both branches and banks at any given point in time. Meanwhile, 98.8% of variance can be accounted for by bank-time fixed effects, confirming quite minimal rate variation within banks. The remaining columns examine the MM $25K rates, SAV $2.5K rates, and CHECK $2.5K rates. These three deposit products exhibit more rate variation across branches and banks, with only less than 60% of variation explained by time fixed effects. However, bank-time fixed effects still account for almost all of the rate variation, at around 94%. Overall, Table 1 shows that banks tend to set uniform rates across branches, with the majority of deposit-rate variation arising across rather than within banks.

There are various potential reasons why large banks might implement uniform rates. First, a lack of local experts and high costs make it difficult for banks to analyze local markets and set deposit rates at the branch level.[24] Second, setting different rates exposes banks to potential complaints about regional price dispersion.[25] Uniform rate setting has crucial implications for how banks compete for deposits. Large banks operating in multiple regions and setting uniform rates face limitations when responding to changes and competition in local markets, instead determining rates based on national market conditions. Conversely, small and local banks can set rates locally, offering greater flexibility. Our empirical findings are consistent with the prior empirical literature that argues that large banks leverage their extensive ATM networks and superior financial services technologies to operate nationally, while small banks rely on local knowledge, personalized services, and community ties to compete within their specific regions. This results in a disparity in rate-setting behavior and

[24]See the earlier literature on uniform deposit rates (for example, Radecki, 2000; Biehl, 2002; Heitfield, 1999; Heitfield and Prager, 2004; Park and Pennacchi, 2009).

[25]See the large literature on uniform pricing by chain stores and other retail outlets (for example, Anderson and Simester, 2001; Leslie, 2004; Orbach and Einav, 2007; Anderson, Jaimovich, and Simester, 2015; DellaVigna and Gentzkow, 2019) and online retailers (`https://thebillionpricesproject.com/datasets/` and Cavallo, 2018).

	CHECK \$2.5K		SAV \$2.5K	
	(1)	(2)	(3)	(4)
FE	Time	Bank×Time	Time	Bank×Time
Observations	52,618,184	51,125,529	54,525,429	52,999,174
R-squared	0.351	0.915	0.474	0.942
	12M CD \$10K		MM \$25K	
	(5)	(6)	(7)	(8)
FE	Time	Bank×Time	Time	Bank×Time
Observations	55,162,370	53,630,152	51,808,776	50,371,019
R-squared	0.866	0.988	0.583	0.947

Table 1: **Rate variation within banks (RateWatch Data).** The data consist of weekly deposit rates from RateWatch, covering the period from 2001 to 2020 at the branch level. The selected deposit products include interest checking accounts with a balance \$2,500 (columns 1 and 2), savings accounts with a balance \$2,500 (columns 3 and 4), 12-month CDs with a balance of \$10,000 (columns 5 and 6), and money market accounts with a balance of \$25,000 (columns 7 and 8). Odd-numbered columns incorporate week fixed effects, while even-numbered columns include bank-week fixed effects.

in the business of deposits at large vs. small banks.

Table 2 tests the contribution of local-market characteristics to rate variation after removing time variation, implementing a two-step analysis. We first regress branch-level deposit rates on time fixed effects to extract the time effects, and then regress the residuals on the fixed effects of interest in the second step to evaluate their explanatory power for the remaining variation:

$$Rate_{branch,t} = \alpha_t + \epsilon_{branch,t}, \tag{19}$$

$$\hat{\epsilon}_{branch,t} = FE + \varepsilon_{branch,t}. \tag{20}$$

As a baseline, we test bank×time fixed effects in the second step, finding that around 90% of the remaining rate variation can be accounted for by bank-time in all four products. By contrast, time-varying local HHI and local population at the county level have little explanatory power for rate variance, with only around 1% or less across all rates. Instead, bank size has more explanatory power for rate variation. Using the SCAP/CCAR set of 14 large banks, we find that large × time fixed effects explain 14% of the remaining variance of checking account rates, 15.1% of savings rates, 21.9% of CD rates, and 11% of money market rates, which is around 10 times the impact from local characteristics. These results support the argument that variation in local market conditions doesn't explain much of the variation in deposit-rate setting behavior, while differences in bank size explain substantially more of the variation in rates.

4.2 Deposit rates for large vs. small banks

We quantify the deposit rate differences between small and large-banks in two ways. First, based on RateWatch data we show the time series of weighted average deposit rates of the median large bank compared to the median small bank in Figure 1. As shown in Figure 1, the small banks persistently set higher rates for money market accounts of $25k (MM $25K), for 12-month CDs of $10k (12M CD $10K), for savings deposits of $2.5k (SAV $2.5K), and for checking deposits of $2.5k (CHECK $2.5K) from 2001 through 2020.[26]

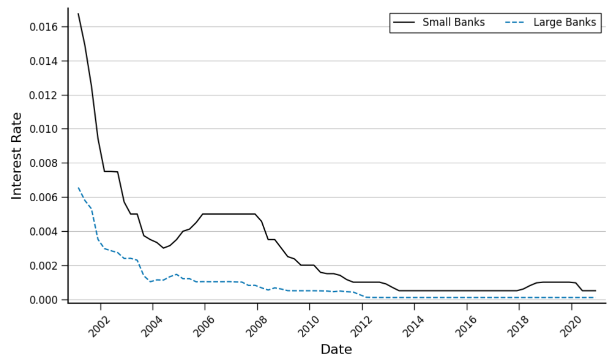
Second, we regress the weighted average deposit rates by bank of the four products on the large indicator variable and time fixed effects. As shown in column 3 of Table 3, large banks set 12M CD $10K rates 0.5 percentage points lower than small banks after controlling for time fixed effects. The remaining columns implement the same tests, revealing that large banks set rates 0.3 percentage points lower for MM $25K accounts, 0.3 percentage points lower for SAV $2.5K accounts, and 0.2 percentage points lower for CHECK $2.5K accounts. Overall, large banks offer lower rates across all four products.

Finally, we document the differences in the deposit rates of small banks that either do or do not co-locate with large banks. Again using RateWatch data from 2001 to 2020, Figure 2 illustrates that small banks located in areas where large banks have a higher market share set relatively lower rates than small banks in areas with a smaller share of large banks. As shown in Figure 2, the deposit rates of checking accounts of $2,500, saving accounts of $2,500, 12 month CD of $10,000, and money market accounts of $25,000 all have a negative relationship with the deposit share of large banks in the areas where the small banks operate. This pattern is not consistent with small banks needing to set higher rates to compete effectively against large banks when small banks co-locate with large banks. Instead, the patterns indicated that small banks co-located with larger banks charge lower rates on average relative to other small banks.

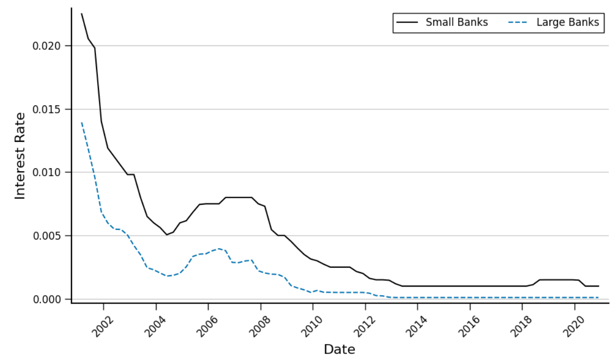
[26]We corroborate the RateWatch deposit pricing differentials reported in Figure 1 using similar data for large and small banks from the Call Reports Data using broader categories of more heterogeneous deposit product-types, including time deposits, savings deposits and transactions deposits. The Call Report results are reported in Appendix A and are consistent with the RateWatch results.

	CHECK $2.5K			
	(1)	(2)	(3)	(4)
FE	Bank×Time	Large×Time	HHI×Time	Population×Time
Observations	51,125,529	49,897,464	51,125,529	50,160,286
R-squared	0.874	0.140	0.010	0.011
	SAV $2.5K			
	(5)	(6)	(7)	(8)
FE	Bank×Time	Large×Time	HHI×Time	Population×Time
Observations	52,999,174	51,692,433	52,999,174	52,002,321
R-squared	0.894	0.151	0.010	0.009
	12M CD $10K			
	(9)	(10)	(11)	(12)
FE	Bank×Time	Large×Time	HHI×Time	Population×Time
Observations	53,630,152	52,315,397	53,630,152	52,606,682
R-squared	0.913	0.219	0.009	0.013
	MM $25K			
	(13)	(14)	(15)	(16)
FE	Bank×Time	Large×Time	HHI×Time	Population×Time
Observations	50,371,019	49,076,644	50,371,019	49,543,246
R-squared	0.877	0.110	$8.618e-04$	0.004

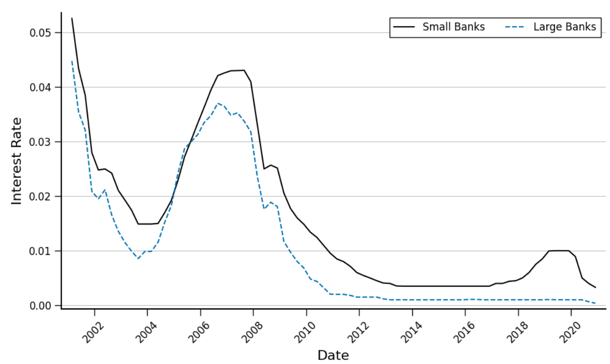
Table 2: **Residual analysis (RateWatch Data).** This table tests the contribution of local market characteristics to rate variations after removing time variation. The data consist of weekly deposit rates from RateWatch, covering the period from 2001 to 2020 at the branch level. The selected deposit products include interest checking accounts with a balance of $2,500 (CHECK $2.5K) shown in columns 1–4, savings accounts with a balance of $2,500 (SAV $2.5K) shown in columns 5–8, 12-month CDs with a balance of $10,000 (12M CD $10K) shown in columns 9–12, and money market accounts with a balance of $25,000 (MM $25K) shown in columns 13–16. Fixed effects incorporated are bank-time, large-time (with "Large" as a dummy for the 14 large banks defined above), HHI-time (HHI calculated at the county level interacted with time fixed effects), and population-time fixed effects (population size interacted with time fixed effects).



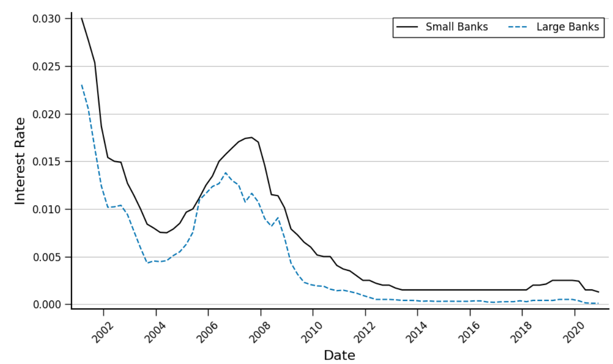
(a) CHECK $2.5K



(b) SAV $2.5K

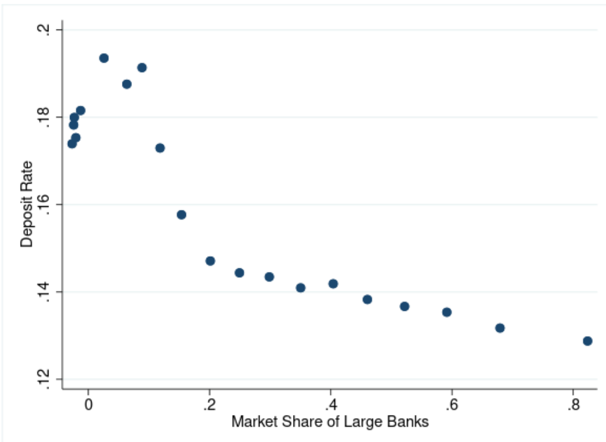


(c) 12M CD $10K

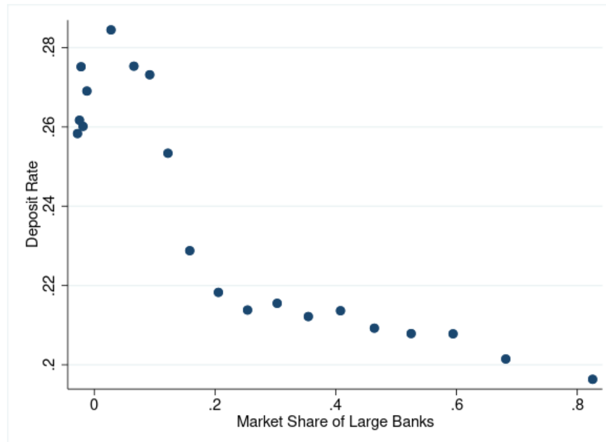


(d) MM $25K

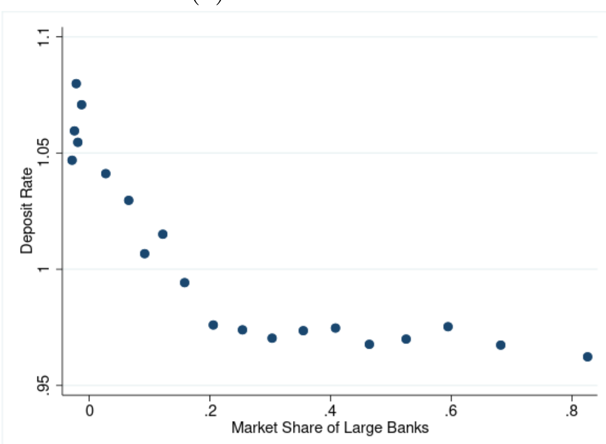
Figure 1: **Deposit rates of large vs. small banks (RateWatch data).** The figures show the time series of weighted average deposit rates of the median large bank compared to the median small bank using the RateWatch data from 2001 to 2020. The charts display rates for checking accounts with a balance of $2,500 (CHECK $2.5K), savings accounts with a balance of $2,500 (SAV $2.5K), 12-month CDs with a balance of $10,000 (12M CD $10K), and money market accounts with a balance of $25,000 (MM $25K). The blue lines denote small banks and the orange lines denote large banks.



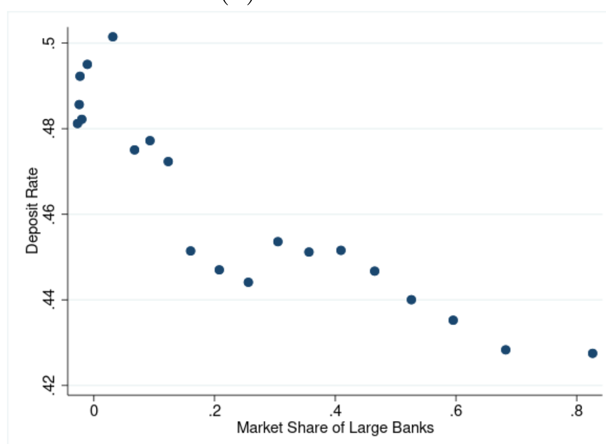
(a) CHECK $2.5K



(b) SAV $2.5K



(c) 12M CD $10K



(d) MM $25K

Figure 2: **Small-bank deposit rates vs. large-bank market share (RateWatch and Summary of Deposits Data).** These figures illustrate the relationship between deposit rates of small banks and the market share of large banks in the local market where small banks operate, using RateWatch data from 2001 to 2019 at branch-level, and controlling for week fixed effects. The charts display deposit rates of checking accounts of $2,500, saving accounts of $2,500, 12 month CD of $10,000, and money market accounts of $25,000. The market share of large banks is calculated at the zip-code level by dividing the total deposits held by large banks by the total deposits within the zip-code from Summary of Deposits.

	CHECK \$2.5K (1)	SAV \$2.5K (2)	12M CD \$10K (3)	MM \$25K (4)
large	-0.002^{***}	-0.003^{***}	-0.005^{***}	-0.003^{***}
	$(2.501e-05)$	$(2.952e-05)$	$(3.601e-05)$	$(4.367e-05)$
T-FE	Yes	Yes	Yes	Yes
Observations	4,197,967	4,332,303	4,352,620	4,167,318
R-squared	0.477	0.577	0.912	0.651

Table 3: **Deposit rate differences between large and small banks (RateWatch Data).** This table estimates the average deposit rate difference between large and small banks using RateWatch data from 2001 to 2020. Branch-level deposit rates are collapsed into bank-level rates by taking the average rates weighted by branch deposit balance. The 14 large depository institutions are defined above and the dependent variables are deposit rates of checking account of \$2,500, saving account of \$2,500, 12 month CD of \$10,000, and money market accounts of \$25,000. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.3 Rate-setting conclusions

Overall, the RateWatch data indicate that banks tend to set uniform rates across branches, and that bank size, not local market conditions, explains the rate variation, thus supporting a key assumption of our model. In addition, the RateWatch Data, corroborated by the Call Report data as reported in Appendix A, indicate that that small banks persistently set higher rates than large banks in all deposit product-types. Finally, the reduced form results indicate that deposit rates of all deposit product-types have a negative relationship with the local-market deposit share of large banks, consistent with the large and small bank collocation results of the model.

5 Market selection by large vs. small banks

In this section, we provide evidence that large and small banks tend to operate in markets with different characteristics, and have different balance-sheet compositions. These differences are consistent with large and small banks having different financial-services technologies, and serving customers with different preferences over the tradeoff between higher deposit rates and such services.

First we show that large banks typically operate in markets with similar characteristics, primarily in densely populated urban areas with higher household income, housing prices, and fewer elderly individuals.[27] This is interesting, because large banks also offer lower deposit rates. Why would *more* financially sophisticated consumers receive *lower* deposit rates on average? Campbell (2006) and Smith, Zidar, and Zwick (2023) document the many environments in which *less* financially sophisticated consumers earn higher financial returns. We argue that the reason more financially sophisticated consumers receive lower deposit rates, and are less likely to withdraw deposits as deposit spreads widen, is because they are willing to accept lower deposit rates in exchange for superior menu of financial services.

Next, we document the differences between large and small banks' balance sheets. Large banks hold more complex financial assets, including real estate loans, commercial loans, and mortgage-backed securities (MBS), while small banks possess more agriculture loans, catering to farmers and rural customers. Small banks also hold larger balances of liquid assets, consistent with higher potential for deposit withdrawals. Large banks maintain a larger savings deposit base, whereas small banks hold more transaction deposits.

These balance-sheet differences between large and small banks are consistent with a technological difference between large and small banks, and with large and small banks serving customers with different preferences. We provide demographic evidence that, indeed, large and small banks serve different types of customers. We argue that large banks therefore operate different business models for their deposit franchises. Our empirical findings suggest that differences in preferences and technologies are the main driver of differences between the deposit franchises of large vs. small banks. Our model and empirical findings stand in contrast to the prior literature, which has emphasized market power from market-share concentration as the key force behind bank rate-setting behavior.

5.1 Customer demographics

We document that large banks are located in areas with high populations, high incomes, high housing prices, and less elderly populations.

Consistent with large banks finding it costly to offer county-specific deposit rates, large banks generally operate in markets with similar characteristics. In particular, large banks are primarily found in more densely populated and more urban areas. Such urban areas may be populated with consumers with strong preferences for low-cost deposit access due to commuting and other opportunity costs. In contrast, rural areas are more likely to be served by small banks, consistent with small banks utilizing local knowledge and community connections to address county-specific needs.

[27] See Sakong and Zentefis (2024) for a study of customer activity at bank branches. Consistent with our model and empirical findings, they show that branch activity is correlated with demographics. Importantly, they also provide evidence that customers use banks with local branches.

Figure 3 displays the branch locations of large banks in 2019 in red, and population in shades of green, with darker green indicating a higher population. The figure clearly illustrates the concentration of large banks in more densely populated areas on the coasts and in large cities. We categorize banks into large and small based on whether the bank is one of the 14 large, complex financial institutions that are depositories.

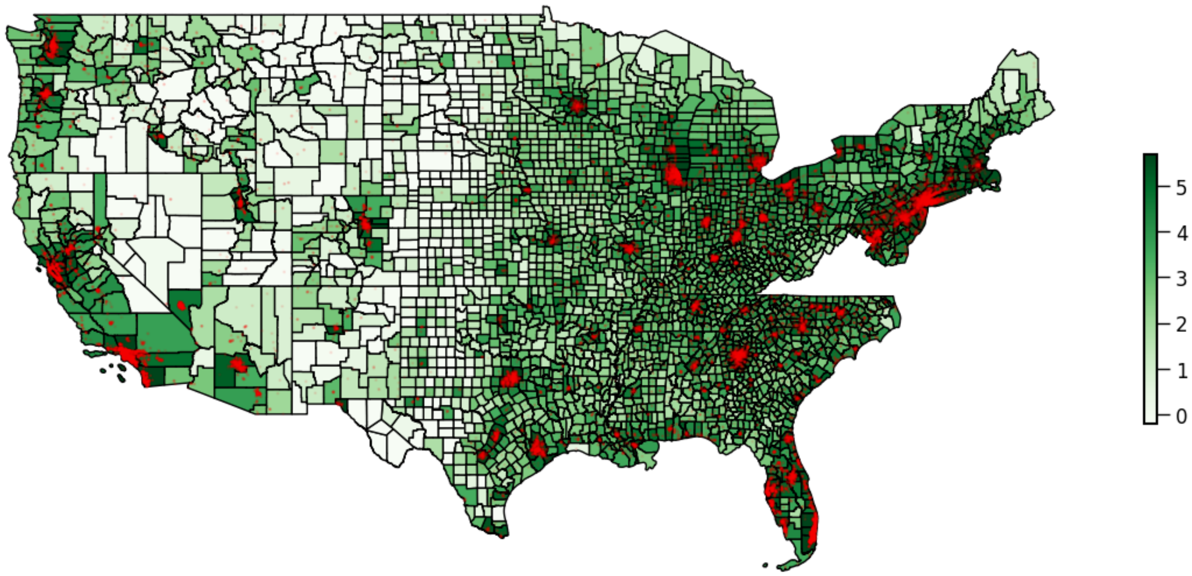


Figure 3: **Branch location of large banks and county population.** This map displays the branch locations of large banks in 2019 in red, and the log of population density in shades of green with dark green indicating a higher population density. The location data are from FDIC's Summary of Deposits.

Figure 4 provides further detail on the distribution of large and small bank branches across the US by mapping the share of branches belonging to large and small banks. Counties are colored according to the proportion of branches held by smaller banks in 2019, with darker shades of green indicating a larger share of branches being owned by small banks. Large banks hold more shares in coastal and major cities, whereas more rural and less populated areas, such as the Midwest and Central South regions, have a higher share of branches owned by small banks.

Figure 5 presents binned box-plots illustrating the correlations between large and small banks' location choices and geographical demographics. Each panel displays the share of branches at the zip-code level on the y-axis and the demographic variable split in to 10 equally sized bins, on the x-axis. The blue boxes represent the interquartile range of the data, the band inside the box is the median, the whiskers represent the upper and lower-boundaries respectively. These figures show that small banks hold a higher market share

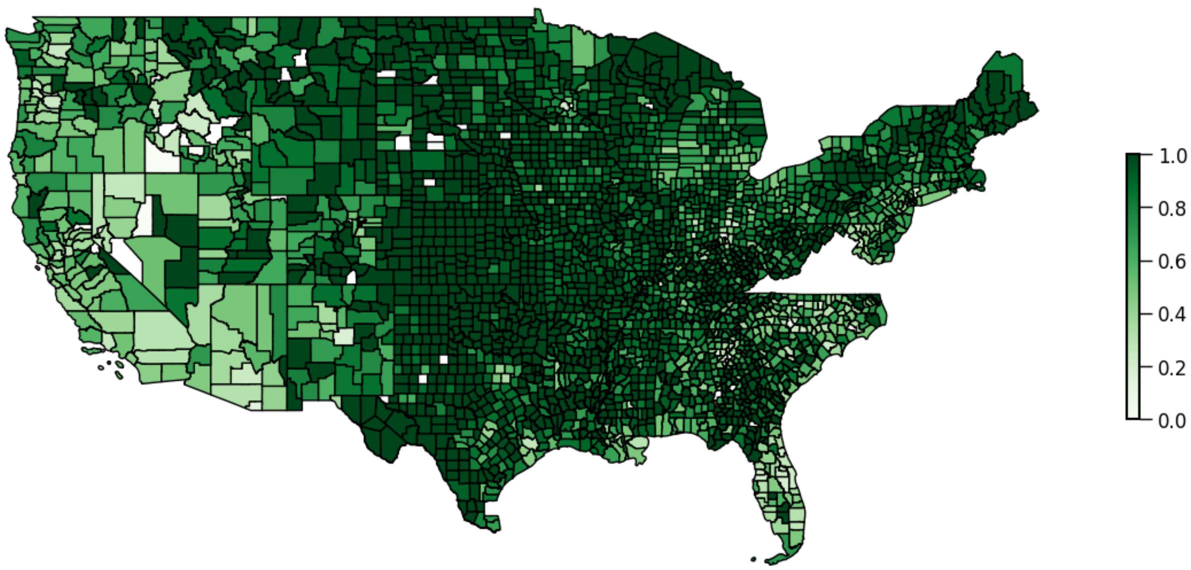
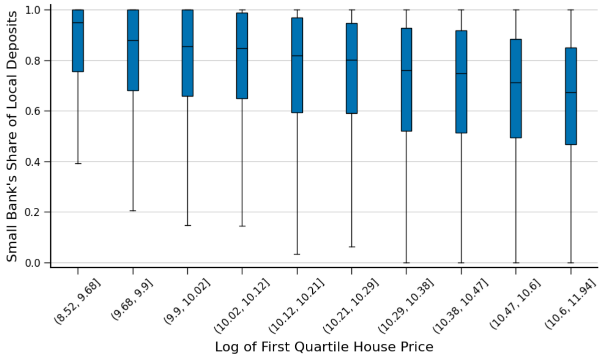
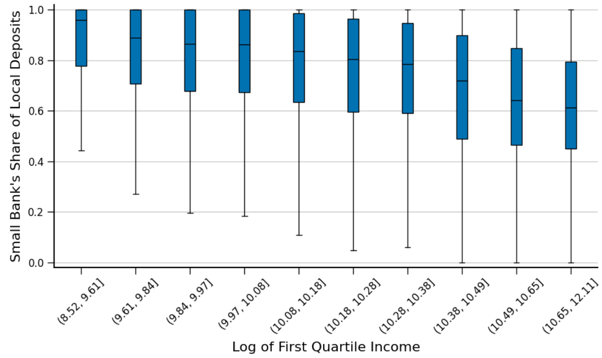


Figure 4: **Share of branches held by small banks.** This map displays the share of branches held by small banks at the county level in 2019. The share of small banks' branches is calculated by dividing the number of branches held by small banks by the total number of branches in the county. The intensity of the color represents the level of branch shares, with deeper shades indicating a higher share of small bank branches. The branch location data are from FDIC's Summary of Deposits.

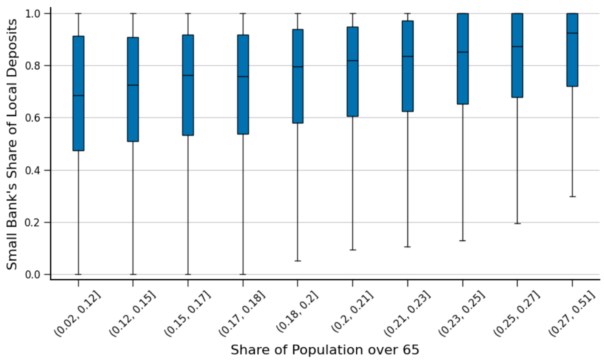
in areas characterized by lower population density, lower household income, lower housing prices, and a higher proportion of individuals over 65 years of age.



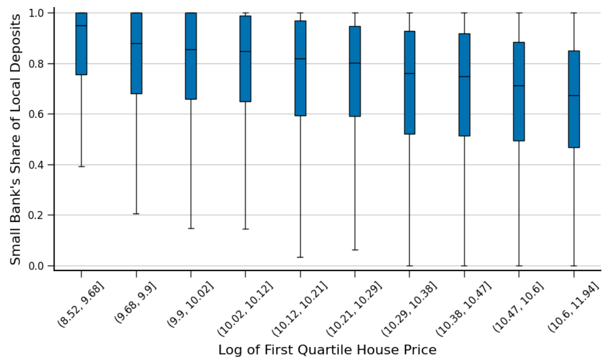
(a) Population



(b) Income



(c) Old population



(d) Housing price

Figure 5: **Small bank share and demographics.** These figures examine the relationship between the share of small bank branches and local population, income, elderly population, and housing prices from 2006 to 2019. Demographic data are sourced from Data Axle at the zip-code level. Income and housing prices represent the 25% quantile of the respective measures. The Small bank share data are derived from FDIC's Summary of Deposits. Two datasets are merged using County FIPS codes. The grey area in the figures illustrates one standard deviation below and above the average.

These graphs suggest differences in the customer bases of large and small banks. Large banks target more highly populated areas with higher average incomes, higher house prices, and lower average ages. We argue that customers with these demographics, who were shown by Campbell (2006) to have higher financial sophistication, place a higher value on the greater menu of financial services of large banks. Small banks operate in less populated areas with lower average incomes, lower house prices, and an older demographic.[28] Although

[28] Jiang, Yu, and Zhang (2023c) show that older individuals tend to exhibit lower elasticity in their demand than younger individuals, so the presence of old customers is unlikely to be driving the higher elasticities at small banks.

these characteristics have been shown to be associated with a lower degree of financial sophistication, and lower financial returns on average (Smith et al., 2023), it appears that within the deposit asset class these consumers actually earn higher deposit rates on average. This may be because deposits represent a larger fraction of their overall wealth, and thus more attention is directed at deposit rates than for wealthier consumers for whom deposits offer access to better financial services but are a smaller fraction of overall wealth.[29] That is, deposits may serve different purposes for customers with different demographics.

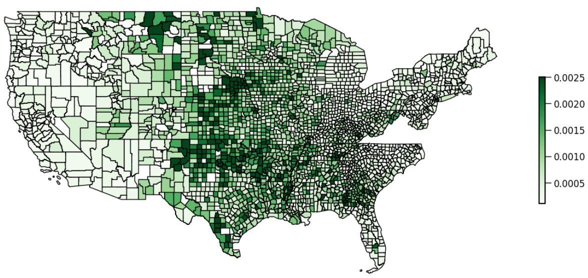
We note the connection between the different customer bases of large vs. small banks, and banks' uniform rate-setting policies. If large banks were to expand into rural areas dominated by small banks, they would find it costly to offer county-specific rates. Since customers in small-bank markets are sensitive to deposit rates, large banks may struggle to compete effectively with small banks offering better rates. Alternatively, large banks could raise rates to compete, but they would lose profits in urban areas since customers there are inelastic to deposit rates. Consequently, neither approach to expanding into rural areas may be profitable for large banks. Similarly, in urban areas, superior financial-service technologies appear to be valued more highly than superior rate offerings, making it challenging for small banks to compete in urban areas served by large banks with superior financial-service technologies.

The geographic distribution of large vs. small banks, along with the rate differences between them, results in observable deposit rate differences across distinct geographic areas. Figure 6 displays the average deposit rates weighted by branches' deposit shares by county using RateWatch data from 2019. This figure can be compared with Figure 4, depicting the geographic distribution of small banks, indicating that areas with a higher share of small banks exhibit higher average deposit rates for CDs, Savings, Checking, and Money Market Accounts. Rural and less-populated area populations benefit from higher deposit rates, while urban populations appear to value the compensating differential of the superior financial services of large banks. We note that low-income populations in urban areas may be worse off due to market segmentation, as they may prefer higher deposit rates over financial services but are served by large banks that cater to other urban consumers.

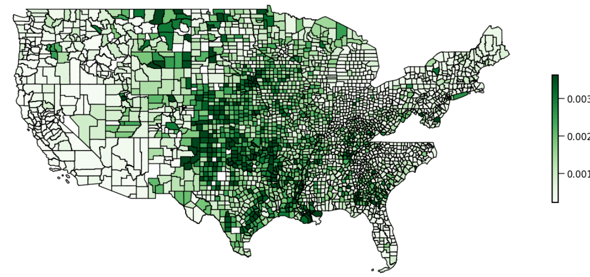
5.2 Balance sheet composition

In addition to serving distinct geographic areas and demographic populations, large and small banks vary in the composition of their balance sheets. This variation is indicative of the different business models of large and small banks, and the different financial products

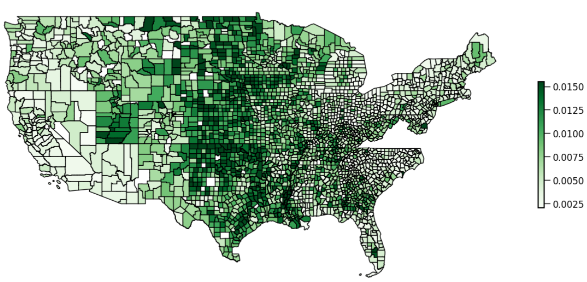
[29]See, for example, `https://www.federalreserve.gov/econres/scfindex.htm`.



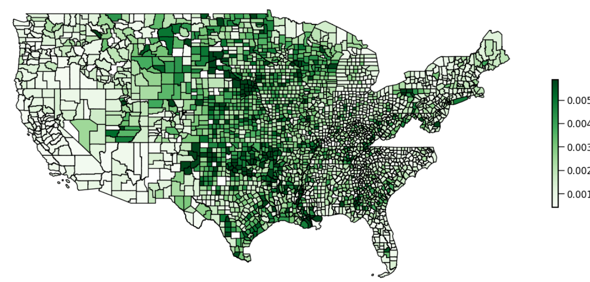
(a) CHECK $2.5K



(b) SAV $2.5K



(c) 12M CD $10K

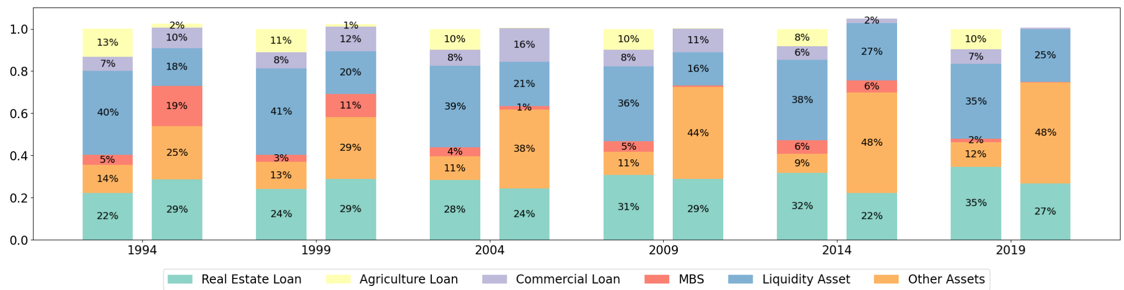


(d) MM $25K

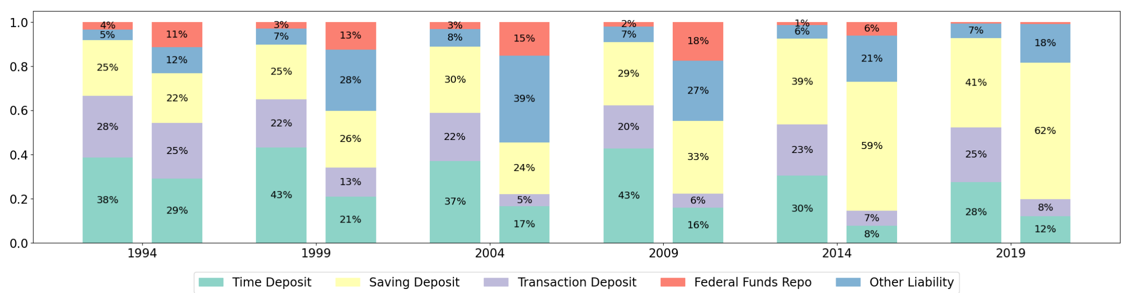
Figure 6: **Geographic distribution of deposit rates.** These maps display the deposit rates of Checking accounts of $2,500, Saving accounts of $2,500, 12 Month CDs of $10,000, and Money Market Accounts of $25,000 in 2019 using RateWatch data. The deposit rates are collapsed at county level weighted by branch deposit balance. The rates are winsorized at the 95th Percentile. The intensity of the color represents the level of deposit rates, with deeper shades indicating a higher county-level rate. The location data are from FDIC's Summary of Deposits.

and services they offer to cater to the specific needs and preferences of their respective clients.

Figures 7a and 7b display the asset and liability structures of banks with asset sizes in the lowest decile and the 14 large banks, highlighting significant differences in their compositions. Large banks tend to hold more real estate loans, accounting for about 50% of their total assets in recent years. In contrast, small banks allocate 20% more of their assets to liquid assets, such as cash, treasuries, government bonds, and Federal funds repurchase agreements. This is consistent with small banks facing more volatile deposit balances, and maintaining higher levels of liquidity to accommodate potential withdrawals. Small banks also allocate 10% more of their assets to agricultural loans, consistent with the idea that small banks support more farmers and rural populations.



(a) Asset structure: lowest asset decile (left) vs 14 large banks (right)



(b) Liability structure: lowest asset decile (left) vs 14 large banks (right)

Figure 7: **Asset and liability structure.** These figures display the asset and liability structures of banks based on Call Report data from 1994 to 2019. The asset (liability) share is calculated by dividing the specific asset (liability) of interest by the total assets (liabilities) at the bank level, and then plotting the average for each bank group. The left bar in each group represents data for banks with total assets below the lowest decile, while the right bar corresponds to the 14 large banks.

Figure 7b illustrates the differences in liability structures between large and small banks. While deposits constitute the majority of liabilities for both types of banks, their deposit product compositions vary significantly. Large banks display a growing share of savings deposits, which include money market accounts, reaching around 50% in recent years, compared to just 21% in small banks. Small banks, on the other hand, hold relatively more time deposits, which offer the highest deposit rates, and substantially more transaction deposits, such as checking accounts. These differences suggest that small banks serve a customer base with smaller deposit balances who choose a different mix of deposit products than the customers of large banks. Another notable difference is that large banks have more diverse funding sources beyond deposits. In most years, large banks borrow more from Federal funds repos than small banks, making them less dependent on deposit funding.

5.3 Market selection conclusions

In summary, the asset and liability structures of small and large banks are consistent with segmentation between their customer bases and with differences in rate-setting behavior arising from variation in the production functions of large and small banks. We find that large banks typically operate in densely populated markets with higher household income, housing prices, and fewer elderly individuals and they hold more complex financial assets, consistent with technological differences between large and small banks.

6 Large vs. small banks: rate semi-elasticities

In this section we provide evidence that rate semi-elasticities vary systematically across large vs. small banks. Empirically, rate semi-elasticities are substantially higher at small bank branches, meaning that depositors of small banks withdraw deposits at a higher rate as deposit rates decline and the spread of deposit rates below the Federal funds rate increases. These empirical findings support the key result of our model that customers of large banks exhibit lower rate semi-elasticities.

To estimate rate semi-elasticities, we employ methods from the industrial organization literature following Egan et al. (2017), Xiao (2020), and Wang et al. (2022). Egan et al. (2017) find higher insured and uninsured deposit rates lead to higher market share, and that the elasticities of both deposit rates are fairly small. Their sample consists of the 16 largest banks, and thus their finding that the depositors are relatively inelastic aligns with our finding that large banks have low rate elasticities. Xiao (2020) finds that higher deposit rates lead to a higher market share, and the rate elasticity for banks is a lot lower than that of non-banks. Wang et al. (2022) develops a large-scale DSGE model in order to study both supply of and demand for deposits. While they also estimate a deposit-demand elasticity, they do not distinguish between elasticities at small and large banks, which is the main focus of our study.

6.1 Estimating rate semi-elasticities

Defining markets. We define markets based on counties to capture local-branch customer preferences. The idea is that customers choose banks based on their local availability and accessibility, with households in San Francisco being more likely to opt for banks with branches in San Francisco relative to banks operating exclusively in New York. The distribution of the US population across counties is highly skewed, with some very large counties and a long tail of very small counties. Given our interest in the differences across banks of different sizes and technologies, and counties with different demographics and preferences, we cluster small and less-populated counties together. This approach enables us to create markets that are comparable in scale, and allows us to keep the small banks rather than dropping them from the sample or grouping them in another way.[30]

We employ the breadth-first search algorithm (see Even and Even, 2011; Zhou and Hansen, 2006) to construct county clusters for low-population counties. Our algorithm systematically searches through the county network to identify suitable county groupings. We first identify counties with populations below the 95$^{\text{th}}$ percentile as candidates to be grouped with contiguous neighboring counties. Starting with the smallest county as the "target" county, we identify neighboring counties and prioritize merges to candidate contiguous counties that afford the shortest centroid distance between the two counties and have similar population density. The process is iterative, and continues merging counties until the total population of the created cluster surpasses the 95$^{\text{th}}$ percentile threshold or the total land area of the cluster exceeds area of the largest U.S. county (San Bernardino County).

Our procedure results in 3,075 counties being organized into 531 clusters. Figure 8 shows the boundary of county clusters. We define a county cluster k in year t as a market k, t. We aggregate branches to the bank level.

Estimation model setup. Following Wang et al. (2022), there is measure one of customers in each county-cluster year. In each cluster-year market (denoted by k, t), each customer i is endowed with one dollar, and can make a discrete choice to allocate this dollar to bonds (denoted by $j = 0$ and used as the outside good or numeraire), deposits in one of the banks (denoted by $j = 1, \ldots, J$) that are available in their (cluster-year) market, or cash (denoted by $j = J + 1$). We set bonds as the outside option, whose return is the Federal funds rate. The normalized deposit rate at bank j in county cluster k in year t is the deposit

[30] Wang et al. (2022) combine all banks with market shares less than 0.001% or less than 10 branches into one bank.

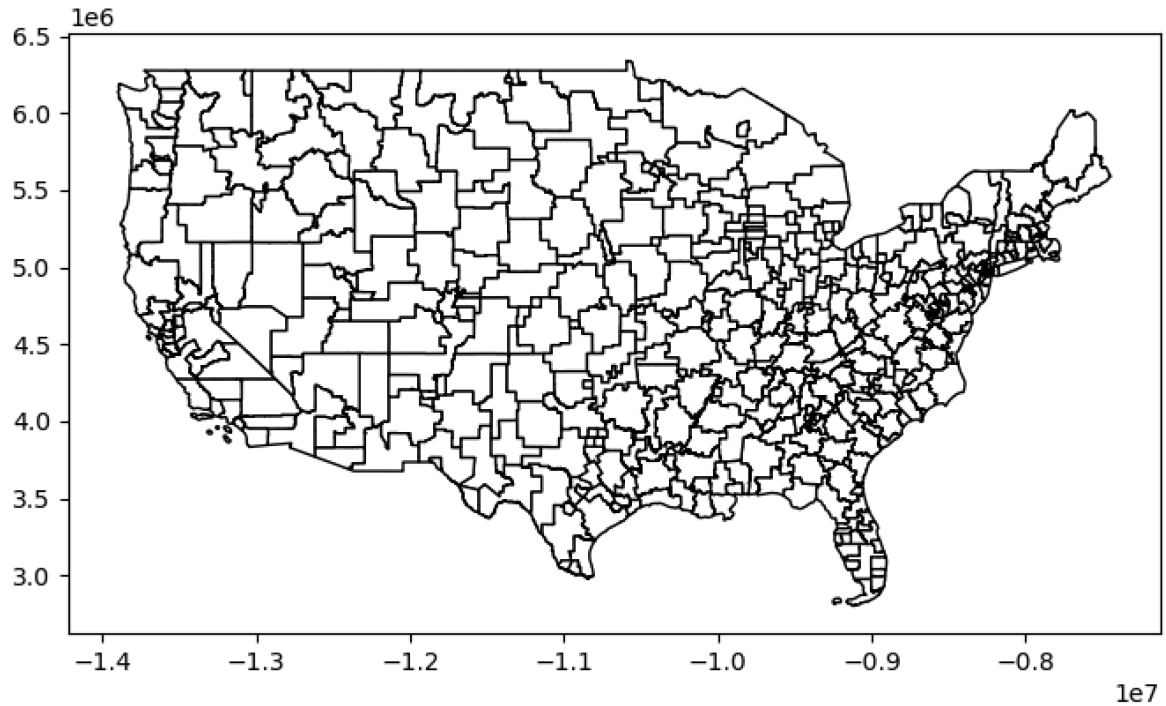


Figure 8: **County cluster map.** This map shows the boundary of the county clusters.

spread $s_{j,k,t} \equiv r_t^f - r_{j,k,t}$, where we use the the Federal Funds rate as a proxy for the risk-free rate. Customers allocate funds to deposits based on bank-cluster-year characteristics $X_{j,k,t}$ and the deposit spread $s_{j,k,t}$. The customer chooses their allocation to cash, bonds and deposits to maximize their indirect utility,

$$U_{i,j,k,t} = -\alpha_i s_{j,k,t} + \beta X_{j,k,t} + \xi_{j,k,t} + \epsilon_{i,j,k,t},$$

where $\xi_{j,k,t} = \xi_j + \xi_{k,t} + \Delta\xi_{j,k,t}$ consists of bank fixed effects ξ_j, market fixed effects $\xi_{k,t}$, and unobserved product characteristics $\Delta\xi_{j,k,t}$, where $\Delta\xi_{j,k,t} = \xi_{j,k,t} - \xi_j - \xi_{k,t}$. We allow customers to have heterogeneous rate sensitivity, represented by a normal distribution dependent on customer demographic D_i, i.e., $\alpha_i = \alpha + \Pi D_i + \sigma\nu_i$, where $\nu_i \sim N(0,1)$. The shock term $\epsilon_{i,j,k,t}$ is a stochastic term capturing customer-product specific shocks, which we assume follow a Type I extreme-value distribution with $F(x) = e^{-e^{-x}}$.

The full utility specification is

$$\begin{aligned} U_{i,j,k,t} &= -\alpha s_{j,k,t} - (\Pi D_i + \sigma\nu_i) s_{j,k,t} + \beta X_{j,k,t} + \xi_{j,k,t} + \epsilon_{i,j,k,t} \\ &= \delta_{j,k,t} - (\Pi D_i + \sigma\nu_i) s_{j,k,t} + \epsilon_{i,j,k,t}, \end{aligned} \tag{21}$$

where $\delta_{j,k,t} = \alpha(r_{j,k,t} - r_t^f) + \beta X_{j,k,t} + \xi_{j,k,t}$ is the mean utility of product j across all customers in market k, t and $\xi_{j,k,t}$ is the common unobserved demand shock to all customers for product j.

The logit choice probability that a customer i selects product j in market k, t is expressed as follows:

$$\begin{aligned} d_{i,j,k,t} &= \int_i \mathbb{1}_{i,j,k,t} \, dF(\epsilon_{i,j,k,t}) \\ &= \frac{\exp(\delta_{j,k,t} + (\Pi D_i + \sigma \nu_i) s_{j,k,t})}{1 + \sum_{l=1}^{J+1} \exp(\delta_{l,k,t} + (\Pi D_i + \sigma \nu_i) s_{l,k,t})}, \end{aligned} \tag{22}$$

where the indicator variable takes a value of one if bank j's deposits in county cluster c during year t provide the highest utility to customer i compared to all other products. The second line is derived from the indirect utility defined in Equation (21) and the distribution of $\epsilon_{i,j,k,t}$.

Therefore, the market share of product j in a county cluster k at time t can be represented as

$$\begin{aligned} d_{j,k,t}(X_{j,k,t}, s_{j,k,t}; \alpha, \Pi, \beta, \sigma) &= \int d_{i,j,k,t} \, dF_D(D) \, dF_\nu(\nu) \\ &= \frac{1}{N} \sum_{i=1}^{N} \frac{\exp(\delta_{j,k,t} + (\Pi D_i + \sigma \nu_i) s_{j,k,t})}{1 + \sum_{l=1}^{J+1} \exp(\delta_{l,k,t} + (\Pi D_i + \sigma \nu_i) s_{l,k,t})}, \end{aligned} \tag{23}$$

where $F(D)$ denotes the distribution function of observed demographics D_i, $F(\nu)$ denotes the distribution function of unobserved heterogeneous rate sensitivity ν_i, and σ captures the size of dispersion. The second line of Equation (23) serves as an approximation of the integral. D_i and ν_i, $i = 1, \ldots, N$, are N draws from $F(D)$ and $F(\nu)$, respectively.

Identification. A standard identification challenge in demand estimation is the endogenous determination of the price, in this case the deposit rate. This endogeneity implies that $\Delta\xi_{j,k,t}$ is not independent from $s_{j,k,t}$, leading to biased estimates if market shares are directly regressed on prices or rates. To address the endogeneity problem, we employ supply shocks $Z_{j,k,t}$ as instrumental variables. Following Wang et al. (2022) and Dick (2008), we use the ratio of staff salaries to total assets in the prior year, the ratio of non-interest expenses on fixed assets to total assets in the previous year, and local labor cost as supply-shock instruments. The local labor costs are constructed based on annual wage in commercial banking industry at county level from Bureau of Labor Statistics. We calculate the weighted average wage across counties where the bank operates, with weights based on the bank's local deposits.

The fundamental assumption supporting this IV strategy is that customers are unlikely to be aware of these changes in costs, and thus unlikely to modify their demand in response to them, while banks should adjust rates in response to changes in their marginal costs.

We estimate $\theta \equiv (\alpha,\beta,\Pi,\sigma)$ following Nevo (2000) and Conlon and Gortmaker (2020). For given values of (Π, σ), we numerically solve $\delta_{j,k,t}(\Pi, \sigma)$ by contraction mapping introduced by Berry, Levinsohn, and Pakes (1995). Upon obtaining $\delta_{j,k,t}$, we utilize linear IV GMM regression of the mean utility equation,

$$\delta_{j,k,t}(\Pi, \sigma) = \alpha(r_{j,k,t} - r_t^f) + \beta X_{j,k,t} + \xi_j + \xi_{k,t} + \Delta\xi_{j,k,t}. \tag{24}$$

The moment condition of the mean utility equation is derived from the exclusion restriction that the supply shocks are expected to be orthogonal to the unobserved product characteristics in Equation (24):

$$E[Z_{j,k,t}\, \Delta\xi_{j,k,t}(\theta)] = 0. \tag{25}$$

With W as a consistent estimate of $E[Z'\, \Delta\xi\, \Delta\xi' Z]$, the GMM estimator is

$$\hat{\theta} = \underset{\theta}{\operatorname{argmin}}\, \Delta\xi(\theta)' Z W^{-1} Z' \Delta\xi(\theta). \tag{26}$$

Based on the estimation, we calculate the rate semi-elasticity of bank j in market k, t by

$$\hat{\eta}^r_{j,k,t} \equiv \frac{\%\Delta \hat{d}_{j,k,t}}{\Delta r_{j,k,t}} = \frac{\partial \hat{d}_{j,k,t}}{\partial r_{j,k,t}} \cdot \frac{1}{\hat{d}_{j,k,t}} = \frac{1}{\hat{d}_{j,k,t}} \int \hat{\alpha}_i \hat{d}_{i,j,k,t}(1 - \hat{d}_{i,j,k,t})\, dF_D(D)\, dF_\nu(\nu), \tag{27}$$

where $\hat{d}_{i,j,k,t}$ is the fitted value of Equation (22) and $\hat{d}_{j,c,t}$ is the fitted market share of bank j in market k, t. Note that we use rate semi-elasticity here for clarity, which is equivalent to the negative of the spread semi-elasticity used in the model.

Estimation data. We estimate rate semi-elasticities using deposit rates data from the Call Reports spanning 2001 to 2019. These rates are determined at the bank-year level by dividing the deposit interest expense by the total deposits. We assume the bank applies uniform rates across all its branches, an assumption that is consistent with our model assumption $r_{j,k} = r_j$ and supported by the empirical findings detailed in Section 4. We assume that total customer wealth is composed of cash, investments in treasury securities, money market funds, and deposits. Following the prior literature, we utilize macro aggregates from FRED (Federal Reserve Economic Data) to proxy for the share of cash, bonds, and overall deposits in customers' portfolios over time. To allocate aggregate holdings across counties, we assume that non-deposit wealth at the market level is proportional to total personal income in the market obtained from the Bureau of Economic Analysis.

Our measure for customers' demographic D_i includes household income, randomly drawn from Data Axle's U.S. Consumer Database. The unobserved heterogeneous rate sensitivity ν_i is drawn from a standard normal distribution. For each market k, t we draw 500 households, i.e., $N = 500$ in Equation (23). The bank characteristics $X_{j,k,t}$ include the interaction between the large banks dummy variable and the average personal income in the market, the logarithm of the number of branches the bank owns and the logarithm of the number of employees per branch. The average personal income data is from Bureau of Economic Analysis. Table 4 shows the summary statistics of the data used in the estimation.

	N	Mean	Std	25%	Median	75%
Deposit rates	296,174	1.216	1.055	0.370	0.853	1.866
Market income ($thousand)	296,174	41.262	13.937	32.265	38.791	46.664
Large banks	296,174	0.123	0.329	0	0	0
Log(Employee per branch)	296,174	2.601	0.763	2.296	2.618	2.956
Log(Branch number)	296,174	3.278	2.504	1.386	2.565	5.075
Instrument Variables						
Salaries to assets (%)	296,174	1.804	0.890	1.396	1.684	2.042
Non-interest expenses on fixed assets to assets (%)	296,174	0.430	0.231	0.300	0.394	0.517
Local labor cost	296,174	10.486	2.053	10.587	10.828	11.098
Household Draws						
Log(Income)	5,307,000	3.745	0.918	3.178	3.850	4.394

Table 4: **Summary statistics.** This table reports the summary statistics of the data used in the estimation.

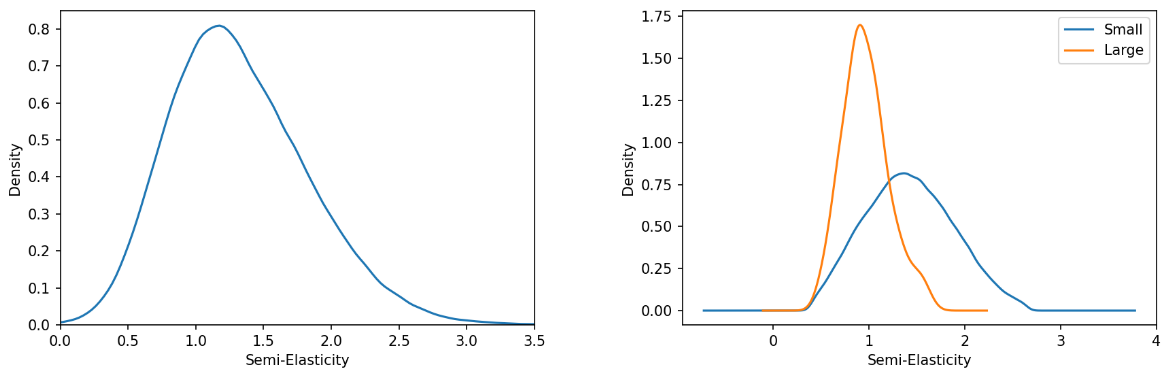
Estimation results. Table 5 displays our estimation results. It reveals that the mean rate sensitivity is 1.171. This indicates that a 1% increase in the deposit rate leads to a 1.171% increase in the market share of bank j in a market comprising households with average income, assuming other factors remain constant. Furthermore, Table 5 corroborates our earlier findings by demonstrating that households with higher incomes exhibit lower sensitivity to changes in deposit rates. Specifically, a one standard deviation increase in household income corresponds to a 0.490 decline in α_i. Additionally, the estimated β coefficients underscore the importance of financial services for customers. β_1 indicates that in markets with higher average income, households place greater value on large banks. Specifically, holding other features constant, holding other features constant, large banks in San Francisco (with an average income of \$135,000 in 2020) can offer a deposit rate that is 1.09% lower than large banks in Champaign (with an average income of \$50,000 in 2020) to achieve the same level of customer satisfaction. The estimation also indicates that customers place higher value on banks with more employees per branch and a larger number of branches. Furthermore, markets with higher average personal income show a stronger preference for large banks, suggesting that these markets particularly appreciate the customer support and a menu of financial services that large banks provide.

Parameter		Estimation	SE
Deposit Rate	α	1.171	(0.046)
Large×Market Average Income	β_1	0.015	(0.001)
Log(Employee per Branch)	β_2	0.476	(0.019)
Log(Branch Number)	β_3	0.133	(0.016)
Heterogeneous rate Sensitivity:			
Log(Household Income)	Π	-0.533	(0.014)
Rate Sensitivity Dispersion	σ	0.957	(0.038)
Observation	296,174		
Adjusted R^2	0.540		

Table 5: **Demand estimation.** This table reports the estimates of demand parameters. The sample includes all U.S. commercial banks from 2001 to 2020. The data is from the Call Reports, the Summary of Deposits, Data Axle, Bureau of Economic Analysis, and Bureau of Labor Statistics. Large × Market Average Income is the interaction between the large banks dummy variable and the average personal income in the market, Log(Branch Number) is the logarithm of total number of branches held by the bank, and Log(Employee per Branch) is the logarithm of average number of employees per branch.

6.2 Rate semi-elasticities: large vs. small banks

With our parameter estimates in hand, we generate rate semi-elasticity estimates using Equation (27). Figure 9 presents the distributions of rate semi-elasticities. The left panel illustrates the distribution of semi-elasticities for all banks across all markets, revealing a left-skewed pattern. The right panel separates the distribution of average semi-elasticities for large and small banks. For the majority of large banks, semi-elasticity estimates cluster around 0.9, suggesting that deposit demand is relatively inelastic. This observation aligns with our model's prediction that large banks predominantly operate in markets with median semi-elasticity values. In contrast, the distribution for small banks shows a wider range and a notable concentration in the right tail, centering around 1.4 with a great variation. This indicates that customers at small banks exhibit higher rate elasticities, meaning their deposit balances are more sensitive to changes in deposit rates. These findings support our model's prediction that small banks are typically situated in areas with higher semi-elasticity.



(a) Full sample (b) Large vs. small

Figure 9: **Density of rate semi-elasticities.** This figure plots the density graph of estimated rate semi-elasticities. The left figure shows the distribution of semi-elasticities of all banks in all markets, weighted by the deposit balance. The right figure shows the distribution of deposit-weighted average semi-elasticity of large and small banks. Orange denotes large banks, and blue denotes small banks.

Table 6 displays the summary of rate semi-elasticities generated by our IV estimation and Equation (27). We calculate the average semi-elasticity for each bank j at year t, weighted by the deposits in the clusters where the bank operates. That is, for a bank j with N branches in a given year t, the average elasticity $\hat{\eta}^r_{j,t} = \sum_{k \in \mathcal{M}_j} \frac{d_{k,j,t}}{D_{j,t}} \cdot \hat{\eta}^r_{j,k,t}$, where $\hat{\eta}^r_{j,k,t}$ denotes the rate semi-elasticity of bank j located in cluster k at time t. Table 6 masks substantial differences across large vs. small banks. Small banks have higher average semi-elasticities, with deposit increases of 1.425% corresponding to a 1% relative increase in deposit rates, while at large banks the deposit increase associated with a 1% increase in rates is 0.965%. The semi-elasticity for small banks is higher than that for large banks, indicating that customers of small banks are more sensitive to changes in deposit rates. Additionally, small banks exhibit more extreme values in their semi-elasticity estimates. The empirical difference between the semi-elasticity estimates for large and small banks match the prediction in Proposition 4 in our model that states that large banks face lower deposit rate semi-elasticities than small banks.

Figure 10 plots the relationship between cluster-year average semi-elasticities, weighted by bank deposits, and the market share of large banks within each county cluster. A clear correlation emerges, showing that in areas with a higher concentration of large banks, demand

	N	Mean	Std	10%	25%	Median	75%	90%
Small	99,884	1.425	0.494	0.799	1.077	1.406	1.753	2.065
Large	236	0.965	0.239	0.677	0.811	0.937	1.094	1.295
All	100,120	1.424	0.494	0.799	1.075	1.405	1.752	2.064

Table 6: **Rate semi-elasticity.** This table presents summary statistics for calculated rate semi-elasticity.

tends to be more inelastic, which supports Proposition 6.

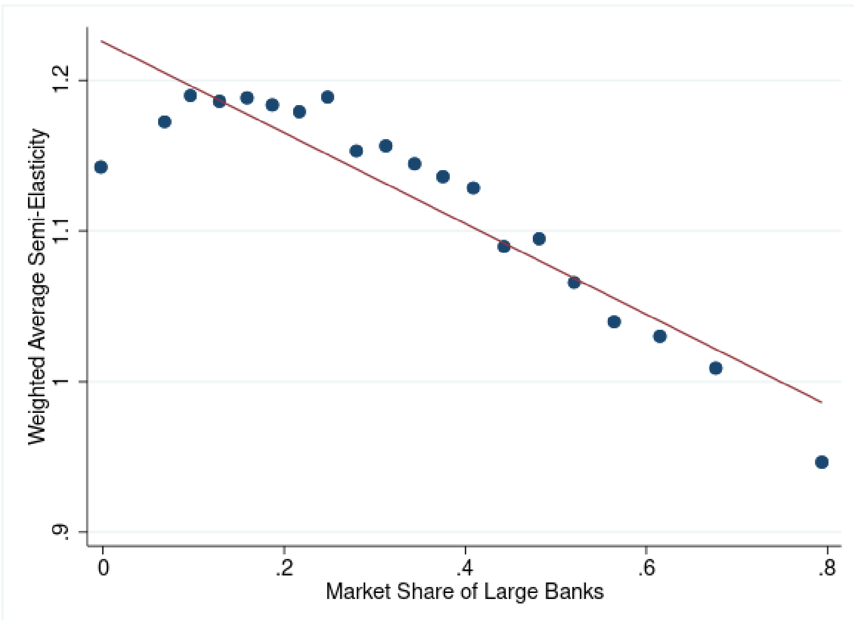


Figure 10: **Rate semi-elasticity and large bank local share.** This figure presents the relationship between rate semi-elasticity and market share of large banks from the BLP estimation data using Call Report data, controlling for year fixed effects. The semi-elasticities are cluster-year averages, weighted by bank deposits.

Our evidence documenting differences in rate semi-elasticities between large and small banks provides support for the key results from our model. The higher rate semi-elasticities at small banks is consistent with these banks serving a different customer base than that of large banks, and operating a different deposit business model as a result.

6.3 Deposit demand estimation: further analysis

In this subsection, we present further analysis on the deposit demand estimation. We show that semi-elasticity has more explanatory power for rate variation.

Semi-elasticity and rate variation Since our model indicates that banks set deposit rates based on households' local-market rate semi-elasticities, we carry out a residual analysis similar to the analysis reported in Table 2 to determine whether the residuals from the first stage regression (such as Equation (20) above) are associated with our BLP semi-elasticity estimates. For each bank, we calculate the average estimated semi-elasticity across the markets in which it operates, weighted by the deposit balances in those markets. We then run regressions of the first stage residuals on an indicator for the 14 large banks (Large $\times$ Time) and a second regression of the first stage residual on the estimated semi-elasticity interacted with Time ($\hat{\eta}^r \times$ Time). The data consist of weekly deposit rates for the three RateWatch deposit products 12M CD $10K, MM $25K, and SAV $2.5 over the period from 2001 to 2019. The results of these regressions are reported in Table 7. As shown, the semi-elasticity-time fixed effects account for 21.3% of the variance for CHECK $2.5K rates, 23.5% for SAV $2.5K, 26.5% of 12M CD $10K rates, and 12.1% for MM $25K, which is higher than the large-time fixed effects. This table provides further support for our model result that banks set deposit rates according to the rate semi-elasticity they face.

7 Conclusion

A comprehensive understanding of how banks set deposit rates is essential for researchers and policymakers. Prior work has emphasized market power and de-emphasized differences in customer preferences and the deposit-business technologies of banks. We argue that large and small banks operate different production functions for their deposit franchises, and serve customers with different preferences over deposit rates vs. financial services. We provide a parsimonious model illustrating these ideas and extensive empirical evidence supporting the idea that much of the variation in deposit pricing behavior across banks may be due to variation in preferences and technologies, as opposed to being driven purely by pricing power derived from the large observed degree of concentration in the banking industry. Indeed, such concentration may be the result of large fixed costs that are required in order for large banks to offer superior financial-service technologies, such as ATM networks and consumer-facing software solutions to customers who value such services highly.

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	CHECK \$2.5K			
	(1)	(2)	(3)	(4)
FE	Large×Time	$\hat{\eta}^r$×Time	Income×Time	HHI×Time
Observations	45,767,311	46,156,131	46,156,131	46,156,131
R-squared	0.140	0.213	0.057	0.102
	SAV \$2.5K			
	(5)	(6)	(7)	(8)
FE	Large×Time	$\hat{\eta}^r$×Time	Income×Time	HHI×Time
Observations	47,351,172	47,769,100	47,769,100	47,769,100
R-squared	0.152	0.235	0.052	0.091
	12M CD \$10K			
	(9)	(10)	(11)	(12)
FE	Large×Time	$\hat{\eta}^r$×Time	Income×Time	HHI×Time
Observations	47,959,169	48,380,984	48,380,984	48,380,984
R-squared	0.215	0.265	0.066	0.117
	MM \$25K			
	(13)	(14)	(15)	(16)
FE	Large×Time	$\hat{\eta}^r$×Time	Income×Time	HHI×Time
Observations	45,217,703	45,631,076	45,631,076	45,631,076
R-squared	0.109	0.121	0.029	0.022

Table 7: **Residual analysis.** This table tests the contribution of semi-elasticity to rate variations after removing time variation, implementing a two-step analysis and reporting the results of the second stage. The data consist of weekly deposit rates from RateWatch, covering the period from 2001 to 2020 at the branch level. The selected deposit products include checking accounts with a balance of \$2,500 (Check \$2.5K), savings accounts with a balance of \$2,500 (SAV \$2.5K), 12-month CDs with a balance of \$10,000 (12M CD \$10K), and money market accounts with a balance of \$25,000 (MM \$25K). The incorporated fixed effects are a large bank indicator (with "Large" as a dummy for the 14 large banks defined above), the estimated semi-elasticity ($\hat{\eta}^r$), bank-level weighted average county-income and HHI fixed effects all interacted with time effects.

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Appendix

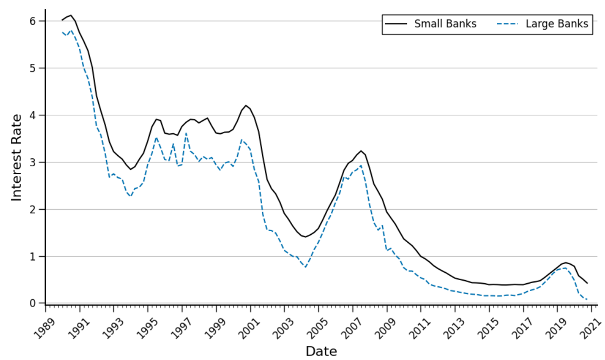
A Call Report corroboration of RateWatch results

To corroborate the RateWatch deposit pricing differentials between large and small banks that are reported in the body of paper, we carry out a similar analysis using the bank-level deposit rates from Bank Call Reports where we calculate deposit rates by dividing interest expense on deposit products by their deposit balance. Figure A.1 plots the deposit rates of the median large bank vs. the median small bank based upon the Call Report data. As shown, both small and large banks' deposit rates vary with the Federal funds rates, though all banks' deposit rates tend to be well below the Federal funds rate. This is consistent with depositors valuing the financial services of deposits generally.

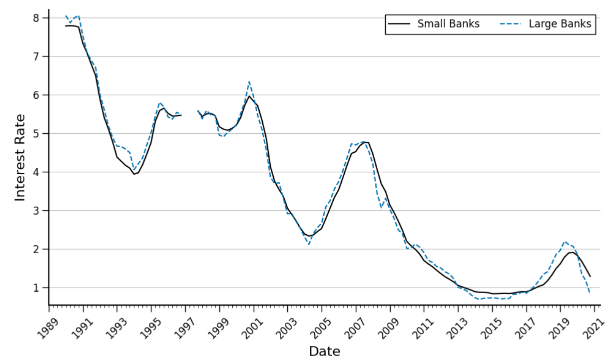
Panel (a) of Figure A.1 displays the deposit rates on total deposits, revealing that small banks tend to set higher deposit rates than large banks. The gap between small and large-bank deposit rates appears to widen when the Federal funds rate drops, and narrows during the zero-rate period after 2009. Since banks set different rates on various deposit products, the differences in small vs. large deposit rates on average could be the result of differences in deposit-product composition between large and small banks. To show that large vs. small rate differences also characterize product-level deposit rates, the other subfigures plot the deposit rates on time deposits, savings deposits, and transaction deposits, respectively, demonstrating that small banks also set higher rates by product types. While time deposit rates are more similar between large and small banks, and align more closely with Federal funds rates, large banks still set relatively lower rates on time deposits. Savings deposits (including savings accounts and money market accounts) rates exhibit similar patterns in large vs. small rate differences as total deposits. Transaction deposits (including checking accounts) rates also show persistent rate gaps between large and small banks.

Table A.1 presents the rate gaps between large and small banks, determined through regression analysis. We regress the implied deposit rates from Call Report Data on the large bank indicator variable and year fixed effects from 2001 to 2020. On average, the total deposit rates of large banks are 0.378% lower than those of small banks. When examining different types of deposit products, large banks set lower deposit rates on saving deposits, with no statistically significant difference found for time and transaction deposits at the 5% level. These findings, together with those in 2 (discussed below) align with results obtained from the RateWatch data.

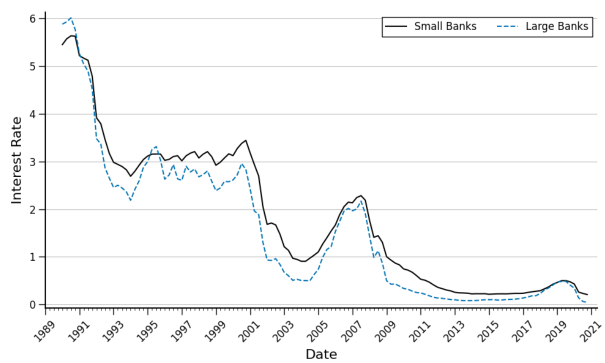
In addition, we verify the findings in Figure 2 using Call Report data and Summary of Deposits Data from 2001 to 2019. By calculating implied deposit rates for each branch



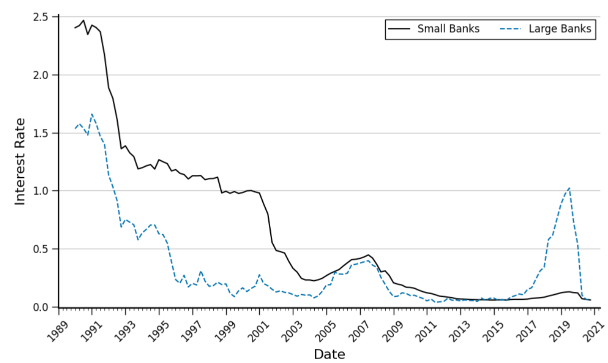
(a) Total deposits



(b) Time deposits



(c) Savings deposits



(d) Transaction deposits

Figure A.1: **Deposit rates of large vs. small banks (Call Report data).** The figures present the time series of the deposit rates of the median large bank compared to the median small bank, using bank-level deposit rates calculated from Call Reports covering the period from 1985 to 2020. The charts display the implied deposit rates for total deposits, time deposits, saving deposits, and transaction deposits. The blue (dotted) lines denote large banks, and the black (solid) lines denote small banks.

	TOT (1)	TRANS (2)	SAV (3)	TIME (4)
large	-0.383^{***}	0.014	-0.288^{***}	0.056^{*}
	(0.033)	(0.023)	(0.034)	(0.029)
T-FE	Yes	Yes	Yes	Yes
Observations	116,326	115,149	115,495	115,866
R-squared	0.790	0.259	0.675	0.901

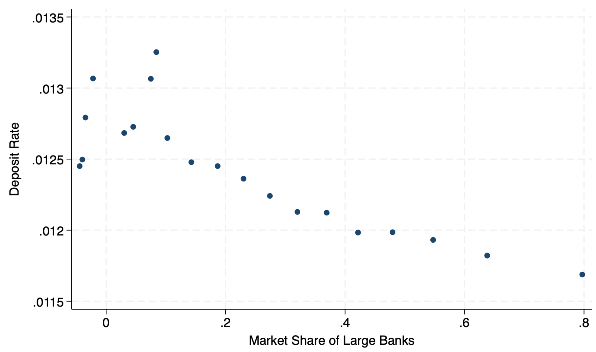
Table A.1: **Deposit rate differences between large and small banks (Call Report Data).** This table estimates the average deposit rate difference between large and small banks using Call Report data from 2001 to 2020. The 14 large depository institutions are defined above and the dependent variables are the implied deposit rates for total deposits, time deposits, saving deposits, and transaction deposits. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

using Call Report data, we examine the relationship between the deposit rates of branches owned by small banks and the market share of large banks in those markets. Figure A.2 demonstrates that small banks in markets dominated by large banks set lower deposit rates. This pattern holds across different types of deposits, including total deposits, time deposits, savings deposits, and transaction deposits.

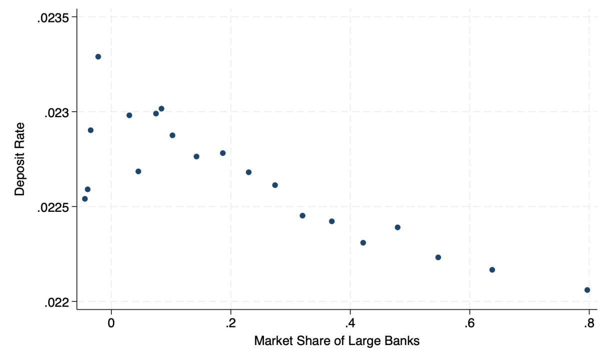
B Large banks as top 1% of assets

For robustness, we present results using an alternative definition of large banks using banks in the top 1% of assets. Table B.1 replicates the findings of Table 5 using this alternative definition. The average point estimate of rate sensitivity closely mirrors that in Table 5. Figure B.1 depicts the semi-elasticity distribution, illustrating that, as expected, small bank elasticities under the alternative size definition also have a fatter left tail. The shape of the distribution for large banks is also relatively unaffected by the alternative definition of a large bank.

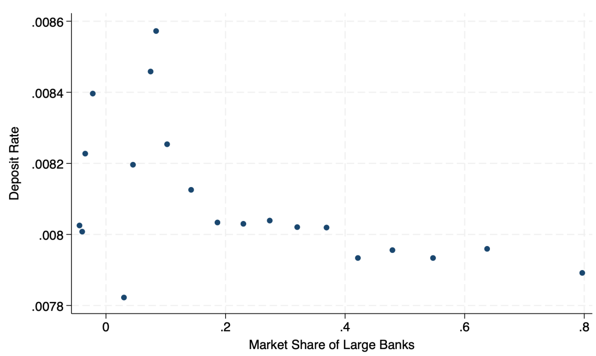
Figure B.2 illustrates the correlation between the average semi-elasticity within a cluster and the market share of large banks for each cluster, echoing the findings presented in Figure 10. Regions dominated by a higher proportion of large banks typically exhibit less elastic deposit rate elasticities. Together, these results indicate that altering the definition of large banks does not significantly affect the overall analysis.



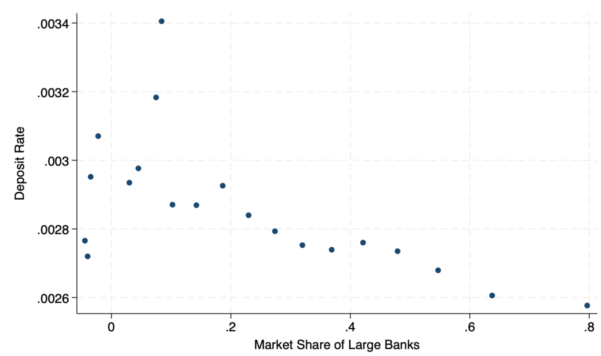
(a) Total deposits



(b) Time deposits



(c) Savings deposits



(d) Transaction deposits

Figure A.2: **Small-bank deposit rates vs. large-bank market share (Call Report and Summary of Deposits Data).** These figures illustrate the relationship between deposit rates of small banks and the market share of large banks in the local market where small banks operate, using Call Report data from 2001 to 2019 at branch-level, and controlling for year fixed effects. The charts display the implied deposit rates for total deposits, time deposits, saving deposits, and transaction deposits. The market share of large banks is calculated at the zip-code level by dividing the total deposits held by large banks by the total deposits within the zip-code from Summary of Deposits.

Parameter		Estimation	SE
Deposit Rate	α	1.169	(0.046)
Large×Market Average Income	β_1	0.006	(0.001)
Log(Employee per Branch)	β_2	0.471	(0.019)
Log(Branch Number)	β_3	0.126	(0.016)
Heterogeneous rate Sensitivity:			
Log(Household Income)	Π	-0.690	(0.019)
Rate Sensitivity Dispersion	σ	0.915	(0.036)
Observation	296,174		
Adjusted R^2	0.542		

Table B.1: **Demand estimation.** This table reports the estimates of demand parameters. The sample includes all U.S. commercial banks from 2001 to 2020. The data is from the Call Reports, the Summary of Deposits, Data Axle, Bureau of Economic Analysis, and Bureau of Labor Statistics. Deposit Spread is the difference between federal funds rate and deposit rates, Large indicates if the bank has assets above the 99% percentile, Large×Market Average Income is the interaction between the large banks dummy variable and the average personal income in the market, Log(Branch Number) is the logarithm of total number of branches held by the bank, and Log(Employee per Branch) is the logarithm of average number of employees per branch.

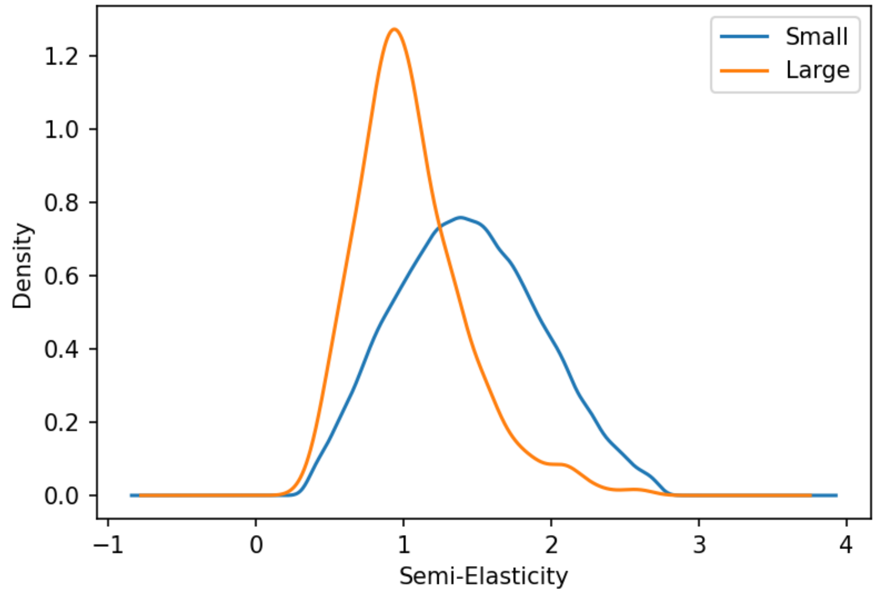


Figure B.1: **Density of rate semi-elasticities.** This figure plots the density graph of estimated deposit rate semi-elasticities of large and small banks. The observations are the deposit-weighted average semi-elasticities at the bank-year level. Orange denotes large banks, and blue denotes small banks.

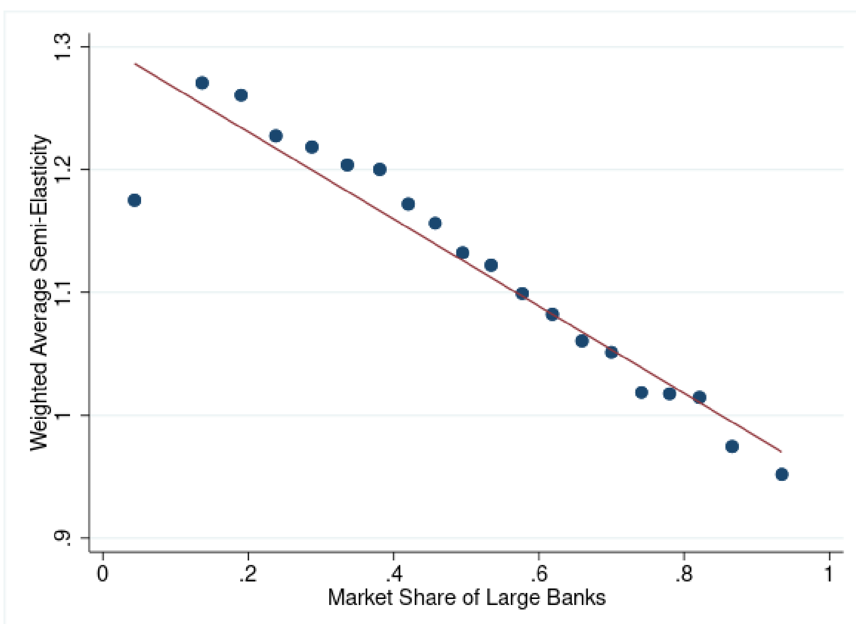


Figure B.2: **Rate semi-elasticity and large bank local share.** This figure presents the relationship between semi-elasticity and market share of large banks from the BLP estimation data using Call Report data. The semi-elasticities are cluster-year averages, weighted by bank deposits.