

The Deposit Business at Large vs. Small Banks*

Adrien d’Avernas[†] Andrea L. Eisfeldt[‡] Can Huang[§]
Richard Stanton[¶] Nancy Wallace^{||}

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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 liquidity 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 exhibit lower demand elasticities with respect to deposit rate spreads. 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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[†]Stockholm School of Economics, adrien.davernas@hhs.se.

[‡]UCLA Anderson School of Management and NBER, andrea.eisfeldt@anderson.ucla.edu.

[§]Gies College of Business, U.I. Urbana-Champaign, canhuang@illinois.edu.

[¶]Haas School of Business, U.C. Berkeley, stanton@haas.berkeley.edu.

^{||}Haas School of Business, U.C. Berkeley, wallace@haas.berkeley.edu.

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 (while small banks do not), offer lower deposit rates than small banks, have branches that cover different geographies than small banks, and experience significantly lower demand elasticities with respect to deposit rates (not due to more uninsured deposits), and they are more likely to be located in markets with less deposit-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 also document a “financial-sophistication puzzle” in deposits: despite locating in areas with demographics associated with greater financial sophistication, large-bank customers receive lower deposit rates and display *lower* deposit-price elasticities.¹ This result is surprising, particularly in light of the results in [Campbell \(2006\)](#) that younger, more educated, higher-income households with more-expensive houses exercise mortgage-prepayment options *more* optimally when considering the mortgage-prepayment option as a financial option on mortgage spreads. In mortgage markets, consumers with demographics correlated with higher financial sophistication earn higher financial returns by prepaying more optimally. By contrast, customers of large banks accept lower deposit rates and withdraw their deposits more slowly as deposit spreads widen. Thus, in deposit markets with demographics correlated with *greater* financial sophistication, customers earn *lower* deposit rates on average. Our result for deposit rates also stands in contrast to the findings in [Smith, Zidar, and Zwick \(2023\)](#) that wealthier households typically earn greater returns in both fixed income and other asset classes.

We offer an explanation of the different businesses of deposits at large and small banks that is based on banks’ market selection as a function of customer preferences and bank technologies. We argue that customers of large banks value superior liquidity services more highly, and as a result display lower deposit-rate elasticities. Thus, deposit-withdrawal options are exercised as a function of both deposit spreads and the relative value customers place on liquidity services offered. Large banks charge higher spreads but offer liquidity services that reduce the relative value of withdrawing deposits as spreads widen.

¹That is, the urban, high-income, high-housing-wealth, younger customers of large banks make more suboptimal deposit withdrawal decisions from the view that deposit withdrawals are options on deposit spreads.

To provide intuition for our empirical findings, we present a simple model of the deposit business at large and small banks.² We assume that large banks set uniform rates and offer lower deposit rates than small banks do. We provide robust empirical support of these assumptions in the data. We allow banks to pay a fixed cost to become large and provide liquidity services that are superior to those of small banks, perhaps by offering more convenient online banking, more ATMs, or other infrastructure that allows for faster or lower-cost access to deposits, following the findings in [Haendler \(2022\)](#) regarding small banks' sluggish adoption of mobile-banking services and [Sarkisyan \(2023\)](#), who shows that small-bank deposits rose in Brazil after the Pix payment system was introduced due to the improvement in liquidity services. The tradeoff inherent in being a large bank, aside from the fixed cost, is the constraint of uniform rates.

From our simple model we generate two key predictions that we test in the data. The first prediction is for market selection by large and small banks. Large banks locate branches where customers value their superior liquidity services. Small banks choose to locate in places where customers put a lower value on better liquidity services relative to higher deposit rates.³ The second prediction of our model compares the relative demand elasticities of large and small banks. In particular, we show that small banks face higher demand elasticities with respect to deposit rates than large banks do.

Understanding the business of deposits at large and small banks is crucial for understanding bank valuations. 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' deposit liability relative to total bank liabilities is positively correlated with bank values.⁴ [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 \(2020\)](#) shows 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 elasticities of their customers, large banks have *lower* valuation ratios ([Minton et al. \(2019\)](#), [Atkeson et al. \(2018\)](#)). This

²For quantitative industry equilibrium models of banking, see the important contributions of [Corbae and D'Erasmus \(2021, 2013\)](#); [Wang, Whited, Wu, and Xiao \(2022\)](#); [Bianchi and Bigio \(2022\)](#).

³For an equilibrium model of how banks become large and the role of deregulation, see [Corbae and D'Erasmus \(2022\)](#).

⁴See also [Calomiris and Nissim \(2014\)](#) for a related empirical study of bank valuation ratios.

fact cuts against explanations of large banks’ pricing behavior that rely on high profitability.

In sum, deposit franchises are a key driver of bank asset values, and the financial stability of the banking system rests on the value of bank assets relative to liabilities. Thus, a comprehensive understanding of the deposit business at large vs. small banks is an important input into measuring financial stability. Our deposit-rate-setting framework contributes to our understanding of recent bank failures and to discussions regarding bank-interest-rate risks.⁵ 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.⁶ 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 hedging benefits (Drechsler et al., 2021) and a shorter duration. We note that the greater potential fragility of small banks is despite the fact that small banks have a smaller fraction of uninsured deposits.

Recently, [Begenau and Stafford \(2022b\)](#) initiated a debate regarding one of the findings in a series of very important contributions to the study of deposit markets, monetary policy, and bank risk exposures ([Drechsler, Savov, and Schnabl, 2017](#); [Drechsler et al., 2021](#)). We confirm the uniform pricing result in [Begenau and Stafford \(2022b\)](#),⁷ but emphasize it does not rule out deposit market power or the main contribution in [Drechsler et al. \(2017\)](#) and [Drechsler et al. \(2021\)](#) on the transmission of monetary policy to bank lending and the exposure of banks to interest rate risk. The main findings in [Drechsler et al. \(2017\)](#) and [Drechsler et al. \(2021\)](#) are that deposit rates are low and insensitive to market rates. They show that the low sensitivity to market rates creates a deposit channel for the transmission of monetary policy to bank lending, and also reduces the exposure of banks to interest rate risk. A secondary finding concerns the mechanism for this behavior. [Drechsler et al. \(2017\)](#) argue that it is due to deposit market power. They use market concentration (HHI) as an instrument for deposit market power to test this mechanism. They also use a bank’s “deposit beta” as a comprehensive measure of deposit market power. [Begenau and Stafford \(2022b\)](#) find that many banks set uniform deposit rates, which they argue goes against the deposit market power mechanism. Our contribution emphasizes that banks do not compete solely

⁵See [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, Savov, and Schnabl \(2021\)](#) 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.

⁶See [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.

⁷See also [Granja and Paixão \(2022\)](#), and the older literature including [Calem and Nakamura \(1998\)](#), [Radecki \(1998\)](#), [Radecki \(2000\)](#), [Biehl \(2002\)](#), [Heitfield and Prager \(2004\)](#), and [Park \(2009\)](#).

on rates and that large and small banks operate different deposit business models.

The literature on competition in deposit markets is extensive and diverse. In the early 1960s, retail banking markets were commonly seen as local. Studies revealed that deposit interest rates were correlated with local levels of bank competition,⁸ leading antitrust regulators to focus on local competition levels. However, research in the 1980s and 1990s began to question these conclusions, especially in light of banking deregulation, which permitted banks to have multiple branches,⁹ leading to substantial growth in the average size of banks and an accompanying decrease in their number.¹⁰

As the size of banks changed, so did their behavior. [Mester \(1987\)](#) noted that allowing bank branching might increase competition because firms interact at multiple locations, and [Calem and Nakamura \(1998\)](#) showed theoretically that allowing bank branching may lead to banks setting constant rates across large regions. Using 1996–97 deposit and loan data from the Bank Rate Monitor, Inc., [Radecki \(1998\)](#) found that this was indeed the case, with many major banks setting constant rates across large regions, and the local-level correlations previously observed had vanished. Later studies confirmed these findings using more recent data, demonstrating that while large banks tend to set uniform rates across extensive regions, smaller banks base their rates on local competitive conditions (see, for example, [Radecki, 2000](#); [Biehl, 2002](#); [Heitfield, 1999](#); [Heitfield and Prager, 2004](#); [Park and Pennacchi, 2009](#)). [Park and Pennacchi \(2009\)](#) suggested that this uniformity in rates may also be encouraged by the growth of the Internet, with large banks unwilling to upset consumers who would be offered a relatively unattractive rate due to their location.

These older results on uniform pricing appear to have been largely overlooked in the more recent literature, which, like the early literature, has once again focused on the relationship between cross-sectional variation in local bank competition and monetary policy. Two exceptions are [Begenau and Stafford \(2022a\)](#) and [Granja and Paixão \(2022\)](#), which offer a new emphasis on uniform pricing. We confirm the main result in [Begenau and Stafford \(2022a\)](#) of uniform pricing by large banks and put this finding into the context of the extensive prior literature on this subject. Our contribution is to offer a framework that highlights the differences in the deposit business models of large vs. small banks and to structurally link their pricing behaviors, location choices, and customer elasticities, to these different deposit business models.

Prior research documents a number of other differences between large and small banks.

⁸See, for example, [Berger and Hannan \(1989\)](#); [Hannan \(1991, 1997\)](#); [Hannan and Berger \(1991\)](#); [Neumark and Sharpe \(1992\)](#); [Rhoades \(1992\)](#); [Sharpe \(1997\)](#).

⁹See [Berger, Kashyap, and Scalise \(1995\)](#); [Demyanyk, Ostergaard, and Sørensen \(2007\)](#)

¹⁰[Bassett and Brady \(2002\)](#) document a reduction from more than 14,000 banks in 1985 to about 8,300 in 2000.

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. We confirm their results and show that, consistent with Egan et al. (2017), banks with a higher fraction of uninsured deposits have a higher deposit-rate elasticity. Given that large banks have a higher fraction of uninsured deposits, but a lower deposit-rate elasticity, these results demonstrate that it is unlikely that the share of uninsured deposits is driving our results documenting elasticity differences between large and small banks. 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 leverage increases with bank size.¹¹ Our complementary focus is on the different business models for deposits at large vs. small banks.

Confirming both older and more recent findings, our paper documents uniform rate policies, particularly among large banks. Our analysis uses weekly deposit rates at the branch level from RateWatch, revealing limited rate variation within banks. Bank size is the primary contributor to rate variation, emphasizing differences between large vs. small banks. Local market conditions, such as HHI and demographics, have little impact on deposit rate setting. While rates do vary with HHI for small banks (the majority of bank branches), HHI does not matter much for aggregate deposits, because large banks make up the majority of the deposit market.

An important empirical moment for comparing large and small banks is the higher average rate of small vs. large banks. Large banks set lower deposit rates for all deposit products. Additionally, 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.

How do 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 the product market competition as occurring within counties but between differentiated products. Large banks typically operate in mar-

¹¹See 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.

kets with similar characteristics, primarily in densely populated urban areas with higher household income, housing prices, and fewer elderly individuals. This supports the idea that large banks serve locations with customers who have a higher willingness to pay for superior liquidity technologies and are less concerned about low deposit rates, while small banks locate where customers are more sensitive to deposit rates.

The large vs. small differentiation among banks is also evident 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, whereas small banks hold more transaction deposits.

To document that large-bank customers exhibit lower deposit-demand elasticities, we conduct a structural estimation of banks' demand 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. Banks are differentiated by offered deposit rates and the quality of liquidity services. Large banks are characterized by superior liquidity services, consistent with [Haendler \(2022\)](#) and [Sarkisyan \(2023\)](#), while small banks provide higher deposit rates. 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 demand elasticity in each local market, finding that large banks experience significantly lower demand elasticities and are more likely to be located in markets with less-elastic customers.¹²

The remainder of this paper is organized as follows: We start by presenting and analyzing our model in [Section 2](#) to gain intuition. [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](#) discusses the different market selection of large and small banks, [Section 6](#) presents estimates of deposit-demand elasticities, and [Section 7](#) concludes.

¹²A 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.

2 Model

In this section, we present a parsimonious model of banking for large and small banks to illustrate the relationships between the technologies of banks' deposit businesses and the preferences of customers and provides equilibrium predictions for deposit rate differences, bank location choices, and deposit elasticities. In this model, we build on [Drechsler, Savov, and Schnabl \(2017\)](#) and extend it to include heterogeneity in households' preferences and banks' liquidity services.

The economy is divided into M local markets, indexed by i . In each local market, the representative household maximizes utility over final wealth, W_i , and deposits, D_i , according to a CES aggregator:

$$U_i = \left(W_i^{\frac{\eta_i-1}{\eta_i}} + \phi D_i^{\frac{\eta_i-1}{\eta_i}} \right)^{\frac{\eta_i}{\eta_i-1}}, \quad (1)$$

where ϕ is a share parameter and $\eta_i > 1$ is the elasticity of substitution between wealth and deposits. Households in market i can choose from N_i different banks, and we define the set of banks with a branch in market i by \mathcal{B}_i . Thus, deposits in market i are themselves a composite good produced by a set of banks:

$$D_i = \left(\frac{1}{N_i} \sum_{k \in \mathcal{B}_i} \lambda_k D_{ik}^{\frac{\eta_i-1}{\eta_i}} \right)^{\frac{\eta_i}{\eta_i-1}}, \quad (2)$$

where we assume that η_i is also the elasticity of substitution between different banks. Thus, η_i denotes not only the ease of substituting between deposit and wealth but also the substitutability between banks. While this is assumption that η_i always exceeds 1 contradicts the measurements in the following sections, these simplifications enable us to gain useful insights into the underlying economic mechanisms at play.

In this aggregator, each bank k has mass $\frac{1}{N_i}$ and produces deposits at a rate D_{ik} , resulting in amount $\frac{D_{ik}}{N_i}$. The share parameter λ_k denotes the relative preference for liquidity services and are defined as

$$\lambda_k \equiv \begin{cases} 1 & \text{if bank } k \text{ does not offer liquidity services,} \\ \lambda > 1 & \text{if bank } k \text{ offers liquidity services.} \end{cases} \quad (3)$$

Thus, the model emphasizes market heterogeneity in the elasticity, instead of share parameters, because we are mostly interested in differences in deposit spreads across market, which are not affected by λ .

Households can also invest in another asset offering a common risk-adjusted rate of return r . Given the deposit spread of bank k in market i , $s_{ik} = r - r_{ik}$, the household's budget equation can be written as

$$W_i = W_{i0}(1 + r) - D_i s_i, \quad (4)$$

where $s_i \equiv \frac{1}{N_i} \sum_{k \in \mathcal{B}_i} \frac{D_{ik}}{D_i} s_{ik}$ is the weighted average deposit spread. Banks earn profits by raising deposits and investing in assets, earning the competitive rate r . Bankers choose to open banks and whether to invest in a technology that provides liquidity services to its customers. This technology encompasses services such as mobile apps, large number of branches and ATMs, or credit card services, and requires the investment of a large fixed cost $\chi > 0$. In addition to the fact that large banks offer widespread brick-and-mortar branch and ATM networks, [Haendler \(2022\)](#) offers substantial evidence that smaller banks are slower to adopt and offer liquidity-enhancing and time-savings technologies for depositors and [Sarkisyan \(2023\)](#) shows that the introduction of Pix increased small-bank deposits by improving their liquidity services.¹³ Second, bankers then decide whether to open a branch in each available county. Finally, the bank sets its interest rate with the constraint that it is the same across all of its branches: $s_{ik} = s_k$. We discuss and provide empirical support for this constraint in Section 4.

We can write the profit maximization problem of bank k as

$$\max_{\ell_k, b_{ik}, s_k} \sum_i \left((s_k - c) \frac{D_{ik}}{N_i} - \kappa \right) \mathbb{1}\{b_{ik} = 1\} - \chi \mathbb{1}\{\ell_k = 1\} \quad (5)$$

where c is the variable cost of servicing deposits, $b_{ik} = 1$ if the bank decides to pay the fixed cost κ to open a branch in county i , and $\ell_k \in \{0, 1\}$ is the decision to invest in the liquidity technology at cost χ . The deposit rate is set to maximize the bank's profits, which gives

$$\sum_{i \in \mathcal{M}_k} D_{ik} + (s_k - c) \sum_{i \in \mathcal{M}_k} \frac{\partial D_{ik}}{\partial s_k} = 0, \quad (6)$$

where \mathcal{M}_k is the set of markets where bank k opens a branch: $\mathcal{M}_k \equiv \{i : b_{ik} = 1\}$. Given households' preferences, the demand and demand elasticity for bank i 's deposits are given

¹³See [Choi and Rocheteau \(2023\)](#) for a model in which banks can increase market power by learning about consumers' liquidity needs, for example using "big data."

by

$$D_{ik} = W_{i0} \frac{1+r}{1+s_i^{1-\eta_i}} \left(\frac{\phi \lambda_{ik}}{s_{ik}} \right)^{\eta_i} \quad \text{and} \quad \frac{\partial D_{ik}}{\partial s_{ik}} \frac{s_{ik}}{D_{ik}} = -\eta_i. \quad (7)$$

Thus, we can rewrite condition (6) as

$$s_k = \frac{\widehat{\eta}_k}{\widehat{\eta}_k - 1} c, \quad (8)$$

where $\widehat{\eta}_k$ is the deposit-weighted average demand elasticity faced by bank k :

$$\widehat{\eta}_k \equiv \frac{\sum_{i \in \mathcal{M}_k} D_{ik} \eta_i}{\sum_{i \in \mathcal{M}_k} D_{ik}}. \quad (9)$$

We assume a simple rule for the decision to open a branch in a market:¹⁴

$$b_{ik} = 1 \quad \text{if and only if} \quad (s_k - c) \frac{D_{ik}}{N_i} \geq \kappa. \quad (11)$$

Thus, bank k operates in market i if the additional branch's revenues would cover the fixed cost κ . Finally, free entry conditions pin down the quantity of banks entering each market.

Lemma 1 (Small banks operate in one market) *If $\ell_k = 0$, then there exists only one market i such that $b_{ik} = 1$ and $b_{jk} = 0$ for all $j \neq i$.*

In Lemma 1, we present an initial insight. If a bank operates branches in multiple markets, it must set a uniform deposit rate across those markets. Consequently, if a bank opts not to invest in liquidity technology, a banker would be better off by establishing separate banks capable of setting different deposit rates than opening a single bank with multiple branches in several markets. Therefore, we can distinguish between two types of banks: large banks (L) that invest in liquidity services and operate across various markets by opening multiple branches, and small banks (S) that do not invest in liquidity services and only open a branch

¹⁴A comprehensive optimization rule should include the impact of a branch on total profits. That is, $b_{jk} = 1$ if

$$0 \leq \sum_{j \in \mathcal{M}_{-i}} \left((\widetilde{s}_k - c) \frac{\widetilde{D}_{jk}}{N_j} - \kappa \right) - \sum_{j \in \mathcal{M}_{-i}} \left((s_k - c) \frac{D_{jk}}{N_j} - \kappa \right) \leq (s_k - c) \frac{D_{ik}}{N_i} - \kappa, \quad (10)$$

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

in a single market. These results highlight the trade-off between bearing the cost of liquidity-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.

Below, we provide propositions that hold in any equilibrium based on the optimality conditions and the free entry conditions.¹⁵ To simplify the exposition of the results, we make three assumptions on the set of parameters. The first assumption in Assumption 1 guarantees at least one small bank opens in every market. The second assumption prevents large banks from dominating all markets due to a large liquidity share benefit. The third assumption ensures households never leverage to invest in deposits. We sometimes use an index S or L to denote choice variables pertaining to small or large banks, respectively.

Assumption 1 (There are small banks in all markets) *The set of parameters,*

$$\theta \equiv \{\chi, \kappa, c, \phi, W_{i0}, \eta_i, \lambda_i | i \in I\},$$

is such that

$$\min \left\{ \frac{W_i}{\kappa} \left(\frac{\phi}{\eta_i} \right)^{\eta_i} \left(\frac{\eta_i - 1}{\eta_i} \right)^{\eta_i - 1} c^{1 - \eta_i} \middle| i \in I \right\} \geq 1, \quad (12)$$

$$\phi \lambda \leq c, \quad (13)$$

and

$$\lambda \leq \frac{\bar{\eta}}{\bar{\eta} - 1}, \quad (14)$$

where $\bar{\eta} \equiv \max_i \{\eta_i | i \in I\}$ and $I = \{1, 2, \dots, M\}$.

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 the set of markets \mathcal{C} where both small and large banks operate: $\mathcal{C} = \{i : b_i^L = 1\}$. Proposition 1 provides a condition for such markets:

Lemma 2 (Free entry conditions) *The free entry conditions for small banks are such that*

$$N_i = \frac{W_i}{\kappa} \left(\frac{\phi}{\eta_i} \right)^{\eta_i} \left(\frac{c}{\eta_i - 1} \right)^{1 - \eta_i} - \theta_i \quad \forall i \in I, \quad (15)$$

¹⁵The equilibrium is potentially not unique as location choices b_{ik} could lead large banks to invest in very different markets.

where $\theta_i \in [0, 1)$.

Lemma 2 provides the equilibrium number of banks entering each market. The value θ_i arises from the fact that N_i needs to be an integer. The wealth of a market might increase, but not sufficiently to warrant the entry of an additional bank. This residual θ_i could have an impact on the equilibrium size of the market per bank W_i/N_i in very small markets, but becomes vanishingly small as W_{i0} increases. To ease the exposition of our results, we now assume $\theta_i = 0$.

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

$$\frac{D_i^S}{D_{ik}^L} = \left(\frac{1}{\lambda} \frac{s_k^L}{s_i^S} \right)^{\eta_i}. \quad (16)$$

Lemma 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 liquidity services λ . And, as demonstrated in Lemma 4, 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.

Lemma 4 (Deposit spreads and market elasticity) *Given (8), $s_i^S < s_k^L$ if and only if $\eta_i > \widehat{\eta}_k^L$.*

However, although small banks establish branches in every market, large banks may choose not to do so in markets with significantly different 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 1 further demonstrates that large banks never establish branches in markets with excessively high elasticities. Therefore, a key prediction of the model is that noncollocation markets are characterized by high elasticities, and large banks prefer to locate in markets with low elasticities.

Proposition 1 (Large banks' location) *Given the deposit spread s_k^L , large banks locate in all markets i satisfying*

$$(s_k^L - c) \frac{W_i}{N_i} \left(\frac{\phi \lambda}{s^L} \right)^{\eta_i} \geq \kappa. \quad (17)$$

and there exists $\tilde{\eta}$ such that

$$b_{ik}^L = 0 \quad \text{if} \quad \eta_i > \tilde{\eta}. \quad (18)$$

Finally, Proposition 2 offers a key prediction: Small banks charge higher spreads in collocation markets. In our model, the decision for large banks to enter a market is driven by whether the elasticity of substitution between bank deposits and wealth is sufficiently low, allowing them to capture greater benefits from liquidity services rather than relying on high deposit spreads. Markets where these large banks enter, characterized by low elasticities, are also markets where small banks can charge higher spreads. Thus, in our model, the presence of large banks does not necessarily indicate heightened competition for small banks, but rather markets where the demand for deposits is less elastic.

Proposition 2 *If $i \in \mathcal{C}$ and $j \notin \mathcal{C}$, then $\eta_i < \eta_j$ and*

$$s_i^S > s_j^S. \quad (19)$$

In the next sections we first verify the assumptions of our model, namely that banks tend to set uniform rates and that large banks tend to offer lower deposit rates. Then, we test the predictions of our model conditional on these assumptions holding in the data. We show that large banks tend to locate in areas in which demand elasticity is likely to be weaker. Finally, we show that large banks face lower demand elasticities than small banks do.

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.¹⁶ 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 2019.¹⁷ The fourteen banks are all designated as either Systemically Important Financial Institutions

¹⁶See <https://www.federalreserve.gov/newsevents/pressreleases/files/bcreg20090424a1.pdf>.

¹⁷The 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>).

(SIFIs) or U.S.-domiciled Global Systemically Important Financial Institutions (G-SIBs).¹⁸ We designate all branches that are acquired by these institutions over our analysis period of 2000 to 2019 as ‘large-bank branches’ post-acquisition.¹⁹ 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 2019, 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.²⁰ We focus on the three deposit products with the greatest coverage in RateWatch, namely 12-month CD with a balance of \$10,000 (12M CD \$10K), money-market account with a balance of \$25,000 (MM \$25K), and savings account with a balance of \$2,500 (SAV \$2.5K). 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 that are 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 2019.

The Call Report data also reports aggregates of deposit products such savings deposits

¹⁸Under 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 Committee on Banking Supervision (BCBS) and national authorities of the Group of Twenty (see <https://www.bis.org/bcbs/publ/d445.pdf>).

¹⁹In the appendix to the paper, 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.

²⁰Although 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.

and time deposits, in contrast to the more narrowly defined specific deposit product types that are reported in RateWatch.²¹ The savings deposits data include all interest bearing bank accounts that allow the depositor to make transfers from the account without regard to the number of transfers made. 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.

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 demand-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.²²

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 2019 and is available at the household level using latitudinal and longitudinal ge-identifiers.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

²¹Definitions for time deposits and savings deposits are reported in Part 204 of the Reserve Requirements of the Depository Institutions (see <https://www.ecfr.gov/current/title-12/chapter-II/subchapter-A/part-204>).

²²The zipcode-level HHIs were computed as the sum of squares of bank deposit shares, i.e. HHI in Zipcode $z = \sum_{\text{banks } b \text{ in } z} \frac{Deposit_b^2}{Deposit_z}$.

²³Data 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.

our model on bank rate-setting behavior. We first use the precisely defined deposit product-types reported in RateWatch and then corroborate those findings using the Call Report data for all U.S. banks but using broader categories of more heterogeneous deposit product-types.

4.1 RateWatch evidence

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

$$\text{Rate}_{branch,t} = FE + \epsilon_{branch,t}. \quad (20)$$

$\text{Rate}_{branch,t}$ is the weekly product-type deposit rate at the branch level from RateWatch between 2001 and 2019 and the fixed effects, FE , are measured as either Time or Bank \times Time.

The results from the regression analysis of Equation 20 are reported in Table 1. Columns 1 and 2 concentrate on the 12M CD \$10K rates. The R^2 indicates that 87.8% 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 and rates for SAV \$2.5K. These two deposit products exhibit more rate variation across branches and banks, with only around 60% of variation explained by time fixed effects. However, bank-time fixed effects still account for almost all of the rate variation, at 95%. 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.

	12M CD \$10K		MM \$25K		SAV \$2.5K	
FE	(1) Time	(2) Bank \times Time	(3) Time	(4) Bank \times Time	(5) Time	(6) Bank \times Time
Observations	46,443,692	44,766,046	43,920,768	42,343,777	45,846,684	44,174,299
R-squared	0.878	0.988	0.610	0.950	0.557	0.949

Table 1: **Rate variation within banks.** The data consist of weekly deposit rates from RateWatch, covering the period from 2001 to 2019 at the branch level. The selected deposit products include 12-month CDs with a balance of \$10,000 (columns 1 and 2), money market accounts with a balance of \$25,000 (columns 3 and 4), and savings accounts with a balance \$2,500 (columns 5 and 6). Odd-numbered columns incorporate week fixed effects, while even-numbered columns include bank-week fixed effects.

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 liquidity 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 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

$$Rate_{branch,t} = \alpha_t + \epsilon_{branch,t} \quad (21)$$

$$\hat{\epsilon}_{branch,t} = FE + \varepsilon_{branch,t} \quad (22)$$

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. As a baseline, we test bank-time fixed effects in the second step, finding that 90% of the remaining rate variation can be accounted for by bank-time in all three products. By contrast, time-varying local HHI and local population have little explanatory power for rate variance, with only 2% for CD and savings rates, and less than 1% for money market account rates. Instead, bank size has more explanatory power for rate variation. Using the SCAP/CCAR set of 14 large banks, we find that large \times time fixed effects explain 21.5% of the remaining variance of CD rates, 10.7% of money market rates, and 15.4% of savings rates, which is over 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.

We quantify the deposit rate differences between small and large-banks in two ways. First, we show the time series of weighted average deposit rates of the median large bank compared

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

²⁵See the large literature on uniform pricing by chain stores (see, for example, DellaVigna and Gentzkow, 2019) and online retailers (<https://thebillionpricesproject.com/datasets/> and Cavallo, 2018).

12M CD \$10K				
	(1)	(2)	(3)	(4)
FE	Bank×Time	Large×Time	HHI×Time	Population×Time
Observations	44,766,046	44,766,046	44,749,523	44,266,697
R-squared	0.909	0.215	0.018	0.026
MM \$25K				
	(5)	(6)	(7)	(8)
FE	Bank×Time	Large×Time	HHI×Time	Population×Time
Observations	42,343,777	42,343,777	42,328,766	41,862,179
R-squared	0.879	0.107	0.005	0.007
SAV \$2.5K				
	(9)	(10)	(11)	(12)
FE	Bank×Time	Large×Time	HHI×Time	Population×Time
Observations	44,174,299	44,174,299	44,158,357	43,680,242
R-squared	0.896	0.154	0.024	0.027

Table 2: **Residual analysis.** This table tests the contribution of local market characteristics 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 2019 at the branch level. The selected deposit products include 12-month CDs with a balance of \$10,000 (12M CD \$10K) shown in columns 1–4, money market accounts with a balance of \$25,000 (MM \$25K) shown in columns 5–8, and savings accounts with a balance of \$2,500 (SAV \$2.5K shown in columns 9–12. Fixed effects incorporated are bank-time, large-time (with “Large” as a dummy for the 14 large banks defined above), HHI-time (calculated at zip-code level), and population-time fixed effects.

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), and for savings deposits of \$2.5k (SAV \$2.5K). Second, we regress the weighted average deposit rates by bank of the three products on the large indicator variable and time fixed effects.

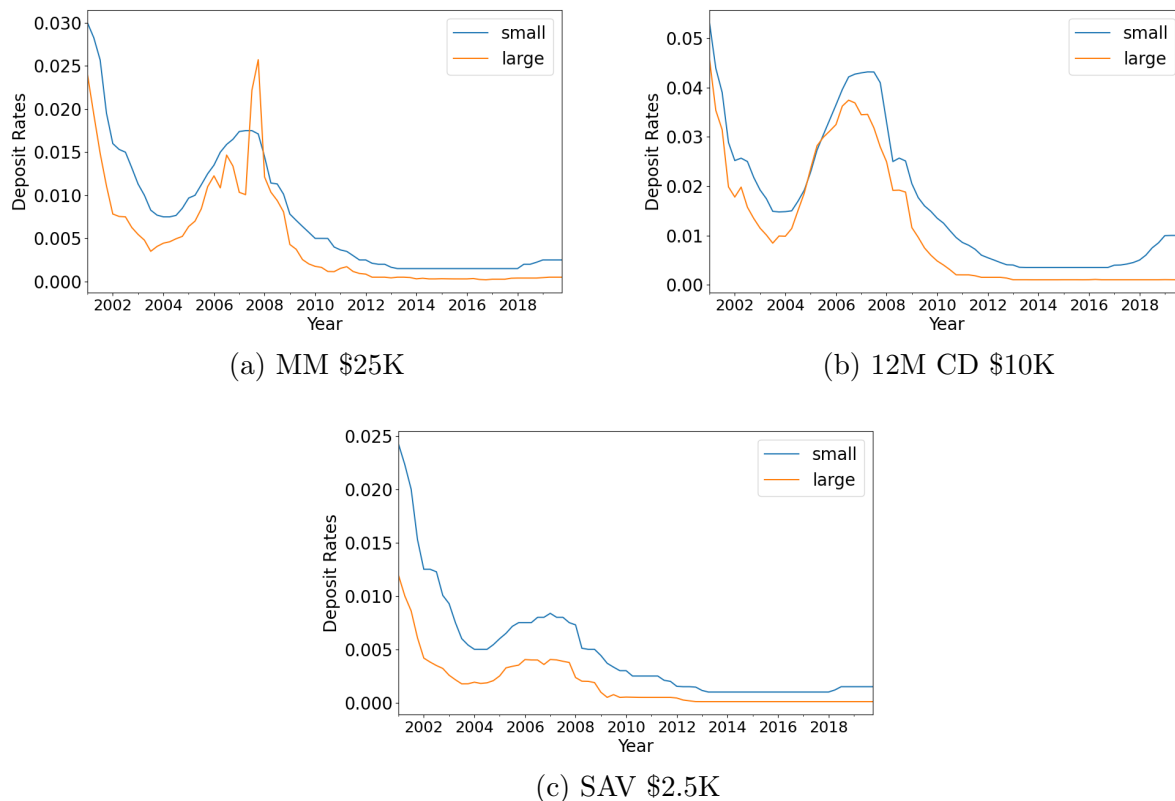


Figure 1: **Deposit rates of large vs. small banks (RateWatch data).** The figures show the time series of weighted average deposit rates of the median large bank compared to the median small bank using the RateWatch data from 2001 to 2019. The charts display rates for money market accounts with a balance of \$25,000 (MM \$25K), 12-month CDs with a balance of \$10,000 (12M CD \$10K), and savings accounts with a balance of \$2,500 (SAV \$2.5K). The blue lines denote small banks and the orange lines denote large banks.

The results of these regressions are reported in Table 3. As shown in columns 1 of Table 3, large banks set 12M CD \$10K rates 0.49% lower than small banks after controlling for time fixed effects. The remaining columns implement the same tests, revealing that large banks set rates 0.24% lower for MM \$25K accounts and 0.31% lower for SAV \$2.5K accounts. Consistent with this, the average rates are lower than those for MM \$25K accounts. However, the difference between large and small-bank deposit rates is even more substantial for SAV \$2.5K accounts. Overall, large banks offer lower rates across all three products.

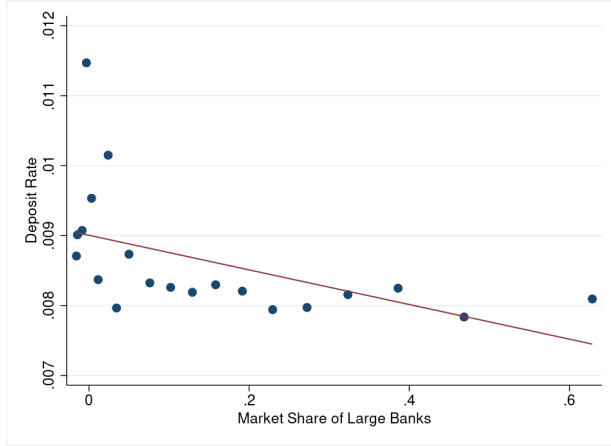
	12M CD \$10K		MM \$25K		SAV \$2.5K	
	(1)	(2)	(3)	(4)	(5)	(6)
Libor	0.719***		0.345***		0.189***	
	(0.000201)		(0.000189)		(0.000149)	
Large	-0.00537***	-0.00485***	-0.00260***	-0.00244***	-0.00329***	-0.00310***
	(6.55e-05)	(3.65e-05)	(6.24e-05)	(4.60e-05)	(4.87e-05)	(3.27e-05)
T-FE		Yes		Yes		Yes
Observations	4,354,051	4,354,051	4,170,821	4,170,821	4,334,833	4,334,833
R-squared	0.746	0.921	0.443	0.698	0.270	0.672

Table 3: **Deposit rate differences between large and small banks.** This table estimates the average deposit rate difference between large and small banks using RateWatch data. 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 12 month CD of \$10,000, money market accounts of \$25,000, and saving account below \$2,500. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

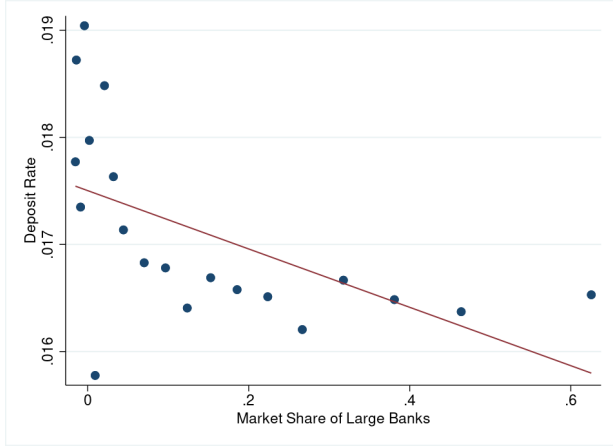
Interestingly, rate disparities also exist between small banks. We document differences in the deposit rates of small banks that either do or do not co-locate with large banks. Small banks located in areas where large banks have a higher market share set relatively lower rates than small banks in areas with a smaller share of large banks. Figure 2 illustrates this fact using deposit rates of small banks from RateWatch, indicating that the deposit rates of all products have a negative relationship with the deposit share of large banks in the areas where the small banks operate. This pattern seems inconsistent with small banks needing to set higher rates to compete effectively against large banks when small banks co-locate with large banks. Instead, small banks co-located with larger banks charge lower rates on average relative to other small banks.

4.2 Call report evidence

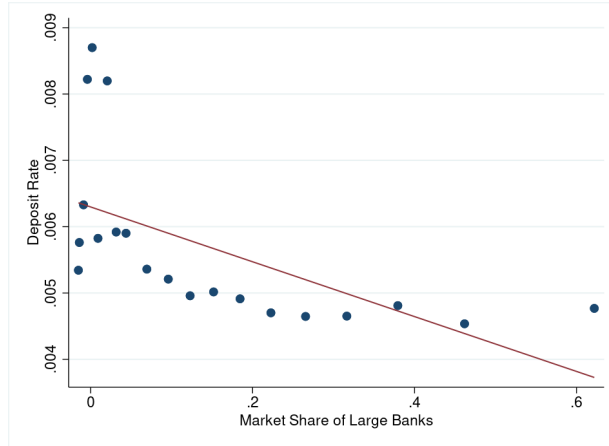
One salient difference between large and small banks is the difference in the levels of their deposit rates. Since banks largely set uniform rates, we focus on the bank-level deposit rates from Bank Call Reports, calculated by dividing interest expense on deposit products by their deposit balance. Figure 3 plots the deposit rates of the median large bank vs. the median small bank. 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 liquidity services of deposits generally.



(a) MM \$25K



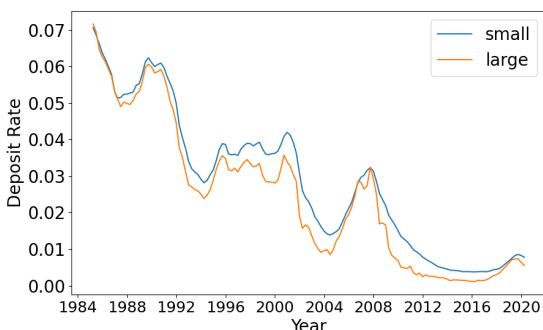
(b) 12M CD \$10K



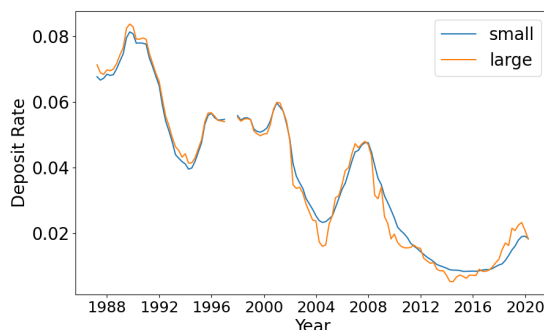
(c) SAV \$2.5K

Figure 2: **Deposit rates and market share of large banks.** 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. Branch-level deposit rates are collapsed at the bank level, weighted by branch deposit balance. The charts display deposit rates of money market accounts of \$25,000, 12 month CD of \$10,000, and saving account below \$2,500. 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 Call Report data.

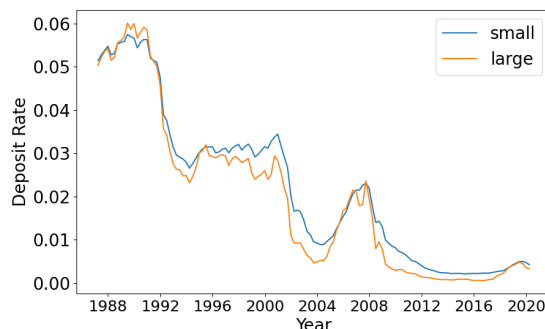
Figure 3a displays the deposit rates on total deposits, revealing that small banks tend to set higher deposit rates than large banks. The gap between small and large-bank deposit rates appears to widen when the Federal funds rate drops, and narrows during the zero-rate period after 2009. Since banks 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 and savings 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.



(a) Total deposits



(b) Time deposits



(c) Savings deposits

Figure 3: **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, and saving deposits. The blue lines denote small banks, and the orange lines denote large banks.

Although large banks set lower deposit rates, they account for the majority of deposits in the US. Figure 4 shows that the total deposit share of the 14 large banks grew steadily, exceeding 50% of total deposits in the US, with growth slowing down after 2009. Large banks hold relatively larger shares in savings deposits and transaction deposits compared to time deposits.

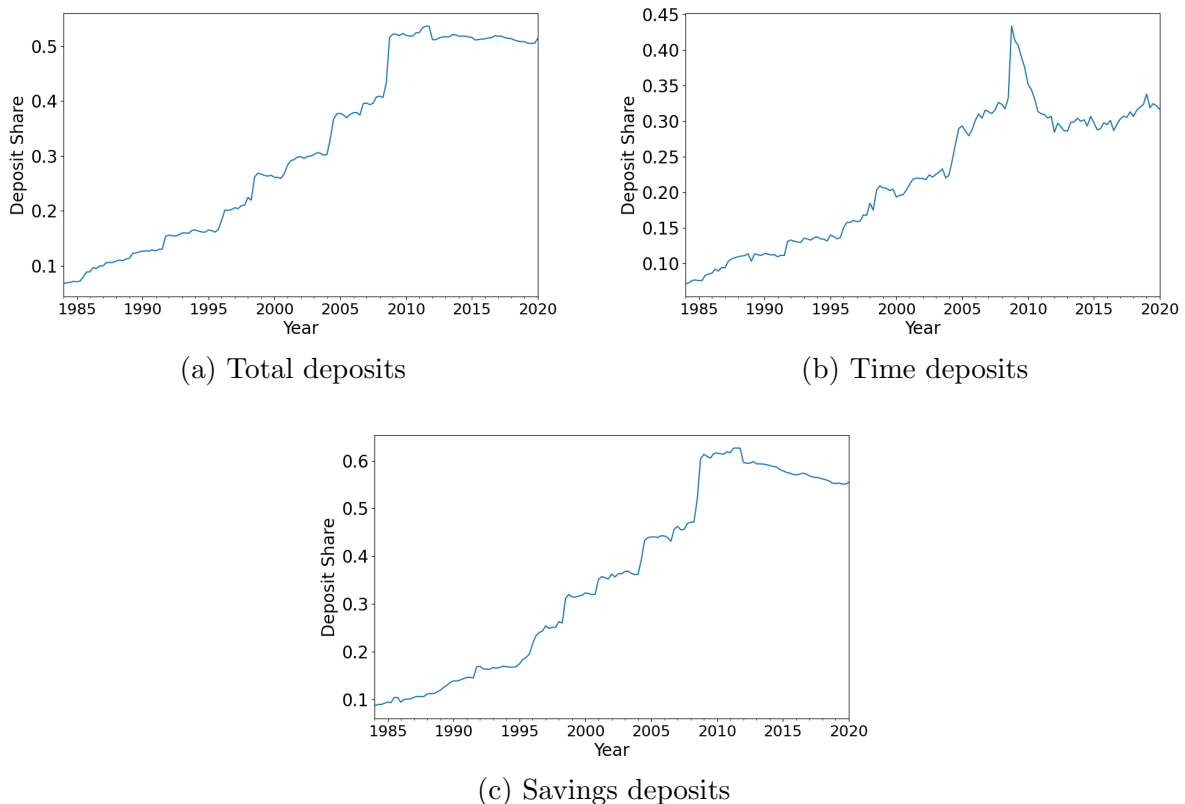


Figure 4: **Deposit share of the 14 large banks.** These figures plot the deposit share of the 14 large banks using Call Report data from 1984 to 2020. The deposit share is calculated by dividing the total deposit held by the 19 large banks by the total national deposit. The figures also display the large bank deposit share for time deposits, saving deposits, and transaction deposits.

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, which supports the fundamental assumption in the model and the estimation in Section 6. Additionally, the RateWate and Call Report data suggest that small banks persistently set higher rates than large banks in all deposit product-types, related to the Lemma 4. Finally, the RateWatch

data indicates that the deposit rates of all deposit product-types have a negative relationship with the local-market deposit share of large banks, consistent with Proposition 2, and from the Call Report data that large banks hold relatively larger shares in total deposits.

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 liquidity-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.²⁶ 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 et al. \(2023\)](#) 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 “financial returns” (including only the deposit rate earned) in exchange for superior liquidity 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

²⁶See [Sakong and Zentefis \(2023\)](#) 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.

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.

Figure 5 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 6 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 7 presents bin-scatter 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 average of demographic characteristics at the zip-code level, controlling for year fixed effects, on the x-axis. Bands of one standard deviation above and below the mean are shaded in light gray. These figures show that small banks hold a higher market share in areas characterized by lower population density, lower household income, lower housing prices, and a higher proportion of individuals over 65 years of age.

These graphs suggest differences in the customer bases of large and small banks. Large

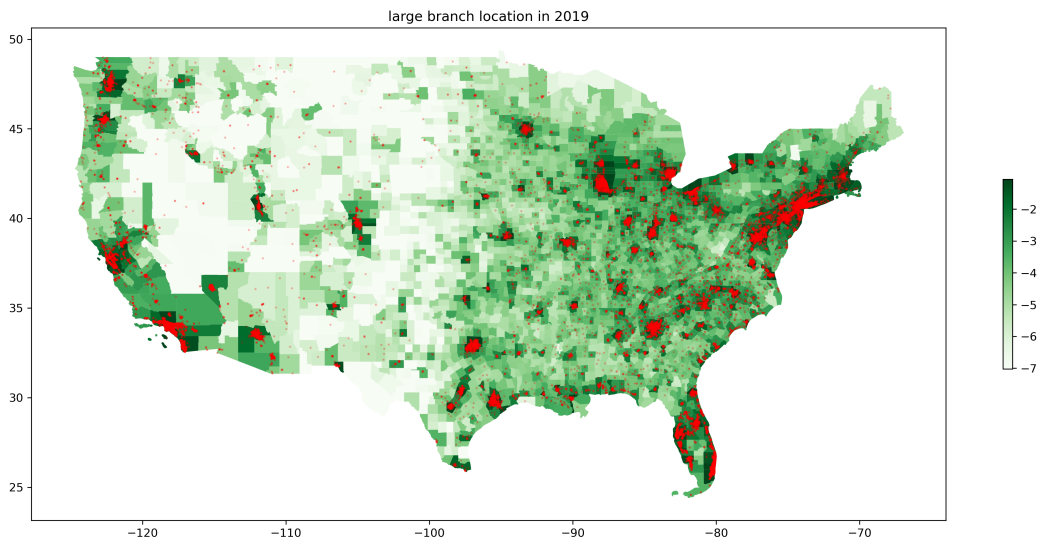


Figure 5: **Branch location of large banks and county population.** This map displays the branch locations of large banks in 2019 in red, and population in shades of green with dark green indicating a higher population. The location data are from FDIC’s Summary of Deposits

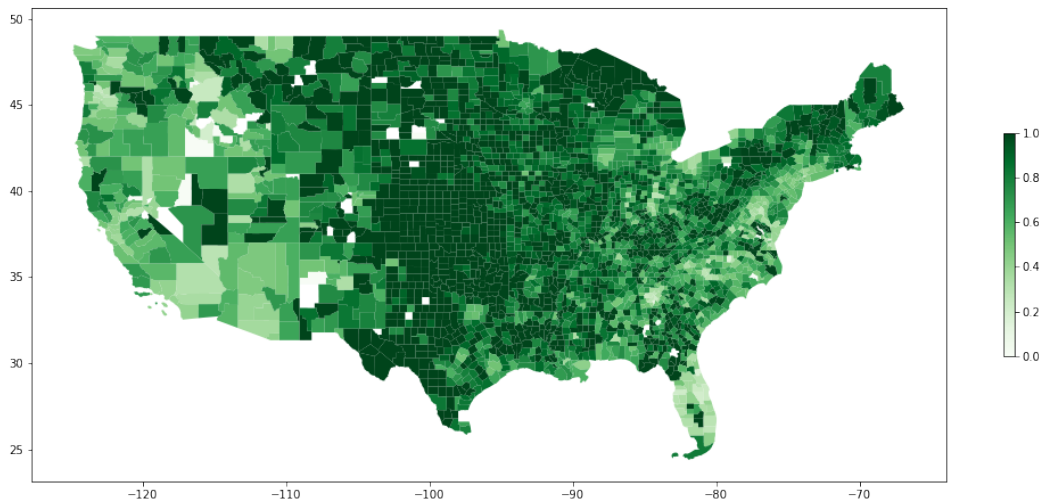


Figure 6: **Share of branches held by small banks.** This map displays the share of branches held by small banks at the county level in 2019. The share of small banks’ branches is calculated by dividing the number of branches held by small banks by the total number of branches in the county. The intensity 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.

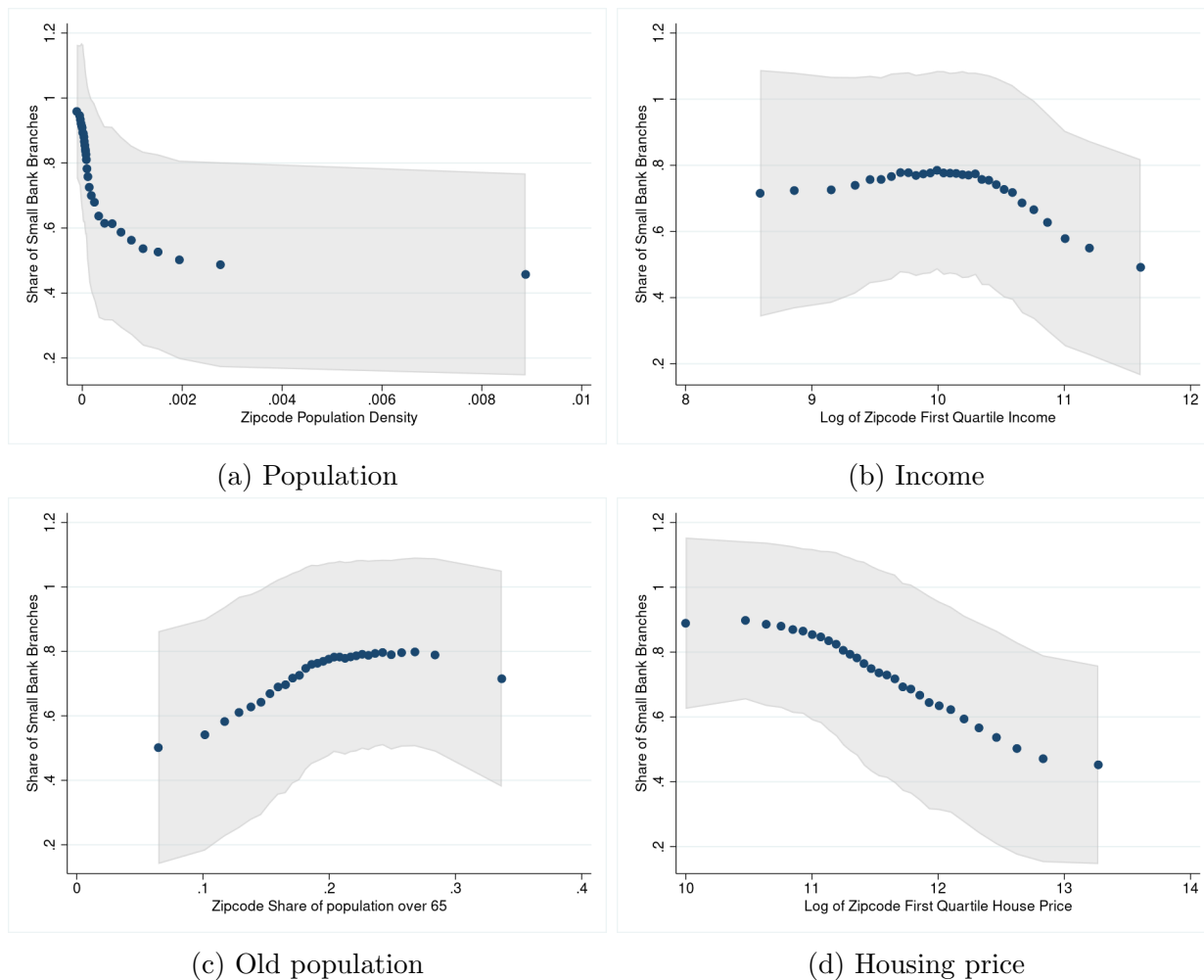


Figure 7: **Small bank share and demographics.** These figures examine the relationship between the share of small bank branches and local population, income, elderly population, and housing prices from 2006 to 2019. Demographic data are sourced from Data Axle at the zip-code level. Income and housing 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 Zipcode. The grey area in the figures illustrates one standard deviation below and above the average.

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 liquidity services (as well as complex financial services beyond deposits) of large banks. Small banks operate in less populated areas with lower average incomes, lower house prices, and an older demographic.²⁷ Although 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 liquidity services but are a smaller fraction of overall wealth.²⁸ 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 liquidity-services 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 liquidity-services 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 8 displays the average deposit rates weighted by branches' deposit shares by county using RateWatch data from 2019. This figure can be compared with Figure 6, 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, 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 liquidity 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 liquidity services but

²⁷Jiang, Yu, and Zhang (2022) 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.

²⁸See, for example, <https://www.federalreserve.gov/econres/scfindex.htm>.

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

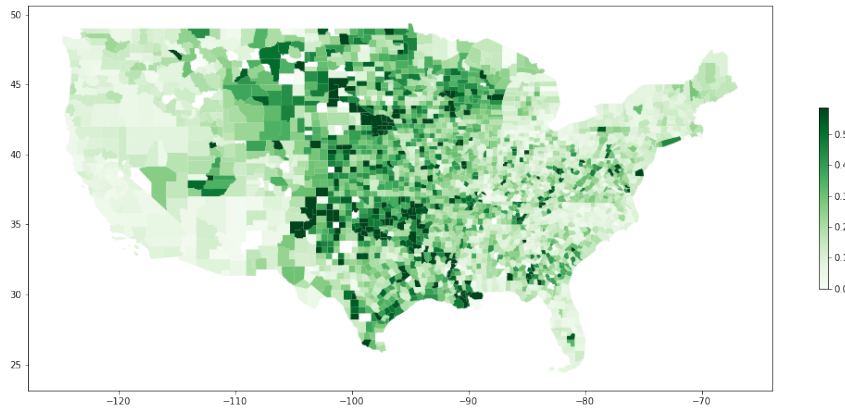
Figures 9a and 9b display the asset and liability structures of banks with asset sizes in the lowest decile and the 14 large banks, highlighting significant differences in their compositions. Large banks tend to hold more real estate loans, accounting for about 50% of their total assets in recent years. 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.

Figure 9b 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.

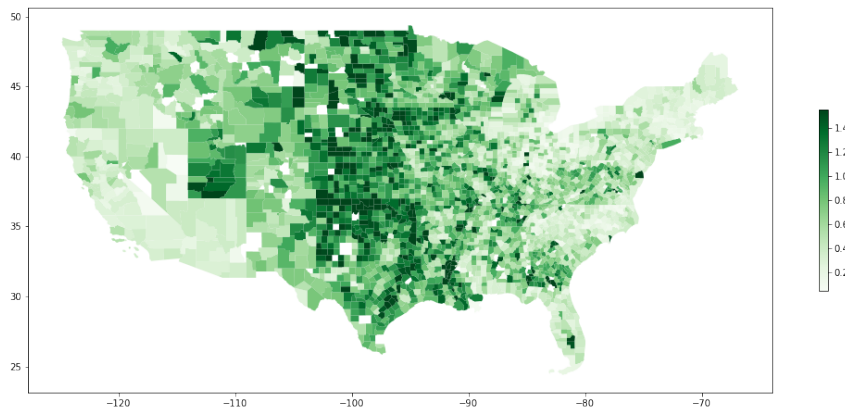
In summary, the asset and liability structures of small and large banks are consistent with segmentation between their customer bases and with differences in rate-setting behavior arising from variation in the production functions of large and small banks.

5.3 Market selection conclusions

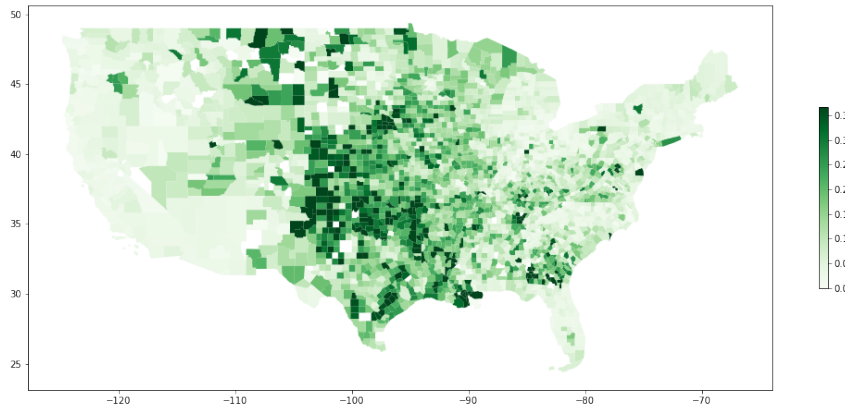
We find support for Lemma 4, with above findings that large banks typically operate in densely populated markets with higher household income, housing prices, and fewer elderly individuals. In addition, large banks hold more complex financial assets, consistent with the



(a) Money Market Accounts of \$25K

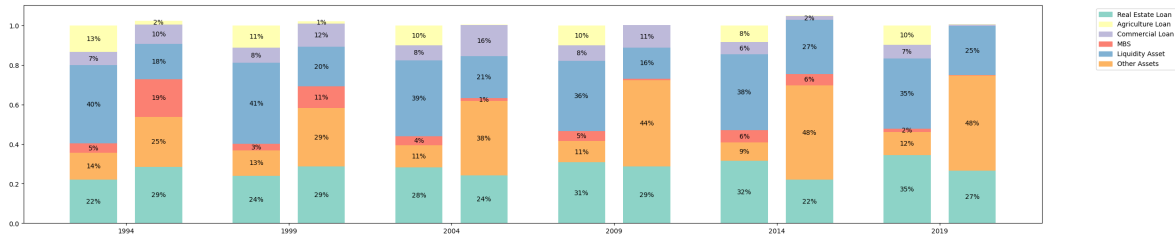


(b) 12 Month CDs of \$10K

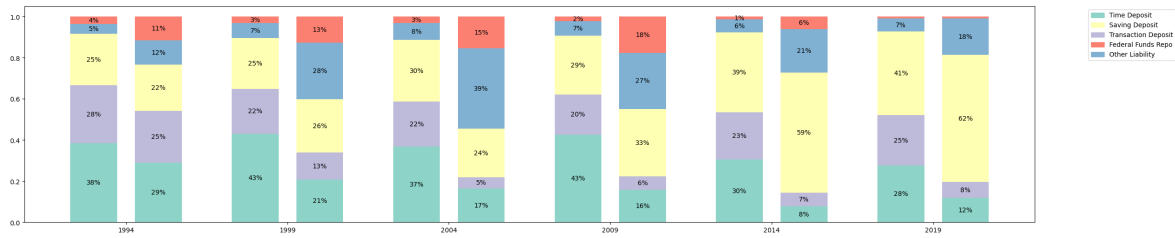


(c) Saving Accounts of \$2.5K

Figure 8: **Geographic distribution of deposit rates.** These maps display the deposit rates of Money Market Accounts of \$25,000, 12 Month CDs of \$10,000, and Saving accounts below \$2,500 in 2019 using RateWatch data. The deposit rates are collapsed at county level weighted by branch deposit balance. 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.



(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 9: 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.

technological difference between large and small banks and supporting Lemma 3.

6 Large vs. small banks: deposit demand elasticities

In this section we provide evidence that deposit demand elasticities vary systematically across large vs. small banks. Empirically, deposit demand elasticities are substantially more negative 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. Thus, our empirical findings support the key result of our model that customers of large banks exhibit lower deposit demand elasticities with respect to deposit rates.

To estimate 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 deposit elasticities. Xiao (2020) finds that higher deposit rates lead to a higher market share, and the deposit-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 demand 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.²⁹

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 95th 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 95th 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 481 clusters. [Figure 10](#) shows the boundary of county clusters. In estimation, we exclude clusters with less than 10 years of data to maintain a sufficient sample size for each market. This added exclusion results in a final selection of 468 clusters for estimation. We define a county cluster c in year t as a market c, t . We aggregate branches to the bank level.

	Mean	Std	Min	25%	Median	75%	Max
Land Area (km^2)	15914.66	18901.61	7.86	1975.24	7888.72	21058.40	92605.14
Population (thousand)	637.57	672.36	2.47	295.05	601.80	751.94	9818.61
Total Personal Income (\$billion)	39.36	48.61	0.12	16.29	29.60	45.68	635.76
Deposit HHI	0.13	0.10	0.02	0.07	0.11	0.15	1.00
Total County Clusters	481						
Population Cutoff (thousand)	560.84						
Area Cutoff (km^2)	51975.91						

Table 4: **County Cluster Summary Statistics.** This table reports the summary statistics of the characteristics of county clusters.

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 c, 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

²⁹[Wang et al. \(2022\)](#) combine all banks with market shares less than 0.001% or less than 10 branches into one bank.

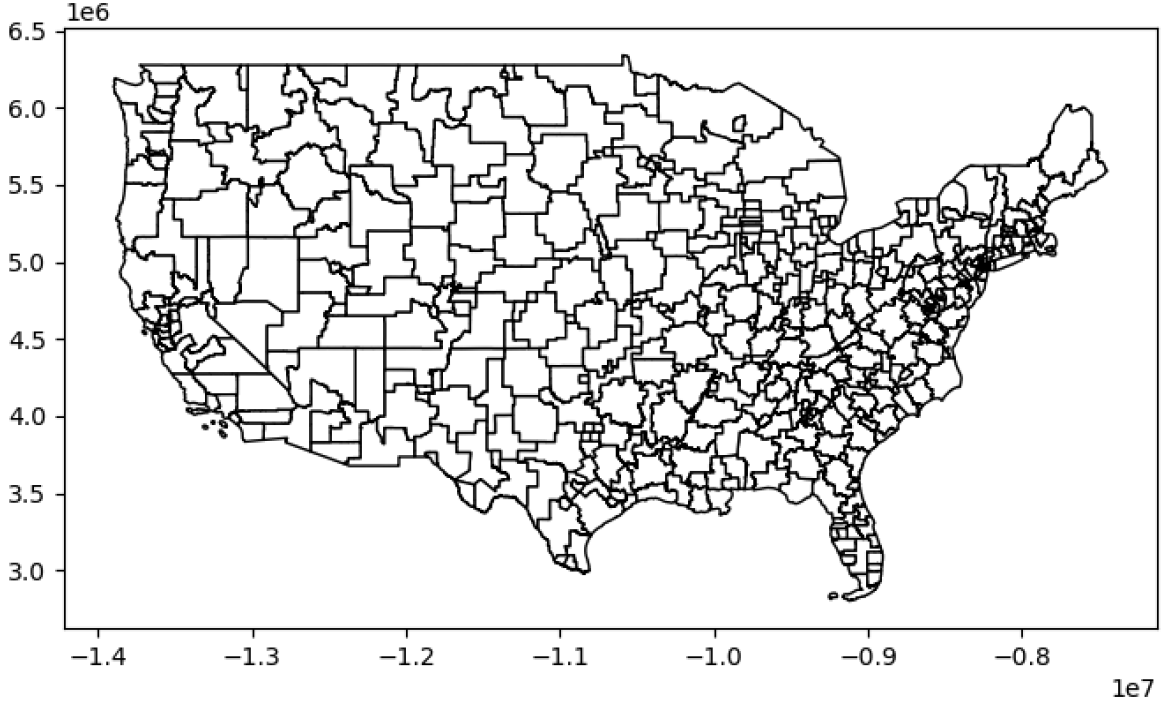


Figure 10: **County Cluster Map.** This map shows the boundary of the county clusters.

the banks (denoted by $j = 1, \dots, J$) that are available in their (cluster-year) market, or cash (denoted by $j = J + 1$). We set bonds as the numeraire and study deposit pricing relative to bonds that we assume return the Federal funds rate. The normalized deposit rate at bank j in county cluster c in year t is the deposit spread $\tilde{r}_{j,c,t} \equiv r_t^{\text{ff}} - r_{j,c,t}$, i.e., the spread of deposit rates below the Federal Funds rate. Customers allocate funds to deposits based on bank-cluster-year characteristics $X_{j,c,t}$ and the deposit spread $\tilde{r}_{j,c,t}$. We normalize the rate earned by holding cash to zero, so the normalized rate is the full opportunity cost relative to bonds that earn the Federal funds rate. The customer chooses their allocation to cash, bonds and deposits to maximize their indirect utility,

$$U_{i,j,c,t} = \alpha_i \tilde{r}_{j,c,t} + \beta X_{j,c,t} + \xi_{j,c,t} + \epsilon_{i,j,c,t},$$

where $\xi_{j,c,t} = \xi_j + \xi_{c,t} + \Delta\xi_{j,c,t}$ consists of bank fixed effects ξ_j , market fixed effects $\xi_{c,t}$, and unobserved product characteristics $\Delta\xi_{j,c,t}$, where $\Delta\xi_{j,c,t} = \xi_{j,c,t} - \xi_{c,j} - \xi_{c,t}$. We allow customers to have heterogeneous price 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 $\epsilon_{i,j,c,t}$ 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

$$\begin{aligned} U_{i,j,c,t} &= \alpha \tilde{r}_{j,c,t} + (\Pi D_i + \sigma \nu_i) \tilde{r}_{j,c,t} + \beta X_{j,c,t} + \xi_{j,c,t} + \epsilon_{i,j,c,t} \\ &= \delta_{j,c,t} + (\Pi D_i + \sigma \nu_i) \tilde{r}_{j,c,t} + \epsilon_{i,j,c,t} \end{aligned} \quad (23)$$

where $\delta_{j,c,t} = \alpha \tilde{r}_{j,c,t} + \beta X_{j,c,t} + \xi_{j,c,t}$ is the mean utility of product j across all customers in market c, t and $\xi_{j,c,t}$ 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 c, t is expressed as follows:

$$\begin{aligned} s_{i,j,c,t} &= \int_i \mathbb{1}_{i,j,c,t} dF(\epsilon_{i,j,c,t}) \\ &= \frac{\exp(\delta_{j,c,t} + (\Pi D_i + \sigma \nu_i) \tilde{r}_{j,c,t})}{1 + \sum_{k=1}^{J+1} \exp(\delta_{k,c,t} + (\Pi D_i + \sigma \nu_i) \tilde{r}_{k,c,t})}, \end{aligned} \quad (24)$$

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 (23) and the distribution of $\epsilon_{i,j,c,t}$.

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

$$\begin{aligned} s_{j,c,t}(X_{j,c,t}, \tilde{r}_{j,c,t}; \alpha, \Pi, \beta, \sigma) &= \int s_{i,j,c,t} dF(D) dF(\nu) \\ &= \frac{1}{N} \sum_{i=1}^N \frac{\exp(\delta_{j,c,t} + (\Pi D_i + \sigma \nu_i) \tilde{r}_{j,c,t})}{1 + \sum_{k=1}^{J+1} \exp(\delta_{k,c,t} + (\Pi D_i + \sigma \nu_i) \tilde{r}_{k,c,t})}, \end{aligned} \quad (25)$$

where $F(D)$ denotes the distribution function of observed demographics D_i , $F(\nu)$ denotes the distribution function of unobserved heterogeneous price sensitivity ν_i , and σ captures the size of dispersion. The second line of Equation 25 serves as an approximation of the integral. D_i and ν_i , $i = 1, \dots, N$, 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 $\Delta \xi_{j,c,t}$ is not independent from $\tilde{r}_{j,c,t}$, leading to biased estimates if market shares are directly regressed on prices or rates. To address the endogeneity problem, we employ supply shocks $Z_{j,c,t}$ 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 prices 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 $\delta_{j,c,t}(\Pi, \sigma)$ by contraction mapping introduced by [Berry, Levinsohn, and Pakes \(1995\)](#). Upon obtaining $\delta_{j,c,t}$, we utilize linear IV GMM regression of the mean utility equation:

$$\delta_{j,c,t}(\Pi, \sigma) = \alpha \tilde{r}_{j,c,t} + \beta X_{j,c,t} + \xi_j + \xi_{c,t} + \Delta \xi_{j,c,t} \quad (26)$$

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 (26):

$$E[Z_{j,c,t} \Delta \xi_{j,c,t}(\theta)] = 0. \quad (27)$$

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

$$\hat{\theta} = \underset{\theta}{\operatorname{argmin}} \Delta \xi(\theta)' Z W^{-1} Z' \Delta \xi(\theta). \quad (28)$$

Based on the estimation, we calculate the price elasticity of bank j in market c, t by

$$\hat{\eta}_{j,c,t} \equiv \frac{\% \Delta \hat{s}_{j,c,t}}{\% \Delta \tilde{r}_{j,c,t}} = \frac{\partial \hat{s}_{j,c,t}}{\partial \tilde{r}_{j,c,t}} \cdot \frac{\tilde{r}_{j,c,t}}{\hat{s}_{j,c,t}} = \frac{\tilde{r}_{j,c,t}}{\hat{s}_{j,c,t}} \int \alpha_i \hat{s}_{i,j,c,t} (1 - \hat{s}_{i,j,c,t}) dF(D) dF(\nu) \quad (29)$$

where $\hat{s}_{i,j,c,t}$ is the fitted value of Equation (24) and $\hat{s}_{j,c,t}$ is the fitted market share of bank j in market c, t .

Estimation data. We estimate deposit spread 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 $s_{ik} = s_k$ 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 prior 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 measures for customers’ demographic D_i include household income, randomly drawn from Data Axle’s U.S. Consumer Database. The unobserved heterogeneous price sensitivity ν_i is drawn from a standard normal distribution. For each market c, t we draw 100 households, i.e., $N = 100$ in Equation 25. The bank characteristics $X_{j,c,t}$ include the logarithm of the number of branches the bank owns and the logarithm of the number of employees per branch.

Estimation results. Table 5 displays our estimation results. It reveals that the mean price sensitivity is -0.942. This indicates that a 1% increase in the deposit spread leads to a 0.942% reduction 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 0.430 increase in α_i . Additionally, the table indicates that market shares rise with the number of branches and the employees per branch, highlighting the importance of liquidity services for customers.

Parameter		Estimation	SE
Deposit Spread	α	-0.942	(0.048)
Log(Employee per Branch)	β_1	0.587	(0.024)
Log(Branch Number)	β_2	0.096	(0.017)
Income	Π	0.070	(0.017)
Price Sensitivity Dispersion	σ	0.832	(0.008)
Observation		237,848	

Table 5: **Demand estimation.** This table reports the estimates of demand parameters. The sample includes all U.S. commercial banks from 2001 to 2019. The data is from the Call Reports, the Summary of Deposits, Data Axle, and Bureau of Labor Statistics. Deposit Spread is the difference between federal funds rate and deposit rates, Log(Branch Number) is the logarithm of total number of branches held by the bank, Log(Employee per Branch) is the logarithm of average number of employees per branch.

6.2 Deposit demand elasticities: large vs. small banks

With our parameter estimates in hand, we generate bank-county cluster-year elasticity estimates using Equation (30). Table 6 displays the summary of demand elasticities generated by our IV estimation and Equation (30). The panel (a) summarizes elasticities at bank-cluster-year level. The average elasticity is -1.028 , indicating that when the deposit spread decreases relatively by 1%, the deposit quantity on average rises by 1.028%.

This average masks substantial differences across large vs. small banks. Small banks have higher average demand elasticities, with deposit decreases of 1.098% corresponding to a 1% relative increase in deposit spreads, while at large banks the deposit increase associated with a 1% increase in spreads is only 0.579%. The elasticity for small banks is approximately two times that of large banks, suggesting that small bank customers are much more sensitive to deposit rate changes. The empirical difference between the elasticity estimates for large and small banks match the prediction in Lemma 4 in our model that states that large banks face lower deposit rate demand elasticities than small banks.

The panel (b) consolidates observations at the bank-year level, by calculating the average 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 , we compute average elasticity $\bar{\eta}_{j,t} = \sum_{b=1}^N \frac{d_{b,t}}{D_t} \cdot \eta_{j,c(b),t}$ where $\eta_{j,c(b),t}$ denotes the demand elasticity of branch b which located in cluster c at time t . The results are similar to that in panel (a).

(a) Bank-Cluster-Year Level

	N	Mean	Std	1%	10%	25%	Median	75%	90%	99%
Small	197773	-1.098	1.081	-5.070	-2.393	-1.525	-0.775	-0.339	-0.119	-0.011
Large	31171	-0.579	0.600	-2.437	-1.454	-0.863	-0.375	-0.102	-0.019	-0.002
All	228944	-1.028	1.044	-4.910	-2.278	-1.435	-0.727	-0.286	-0.088	-0.008

(b) Bank-Year Level

	N	Mean	Std	1%	10%	25%	Median	75%	90%	99%
Small	75545	-1.227	1.117	-5.200	-2.591	-1.714	-0.910	-0.448	-0.168	-0.014
Large	244	-0.562	0.529	-1.948	-1.369	-0.910	-0.420	-0.116	-0.027	-0.003
All	75789	-1.225	1.116	-5.192	-2.587	-1.711	-0.907	-0.446	-0.166	-0.014

Table 6: **Demand elasticity.** This table presents summary statistics for calculated demand elasticity. Panel (a) displays the elasticities at the bank-cluster-year level. Panel (b) presents the deposit-weighted average elasticities at the bank-year level.

Figure 11 plots the distributions of deposit elasticities for large and small banks. For the majority of large banks, the elasticity estimates are close zero. Zero estimates imply that customers' demand is inelastic, or completely insensitive to changes in deposit rates. In contrast, the distribution of small banks' demand elasticity estimates has considerably more mass in the left tail. Small banks' customers clearly exhibit higher absolute values of deposit elasticities. In other words, the deposit balances at small banks are more sensitive to deposit rate changes. These results confirm the prediction of our model that small banks are located in areas with higher elasticity.

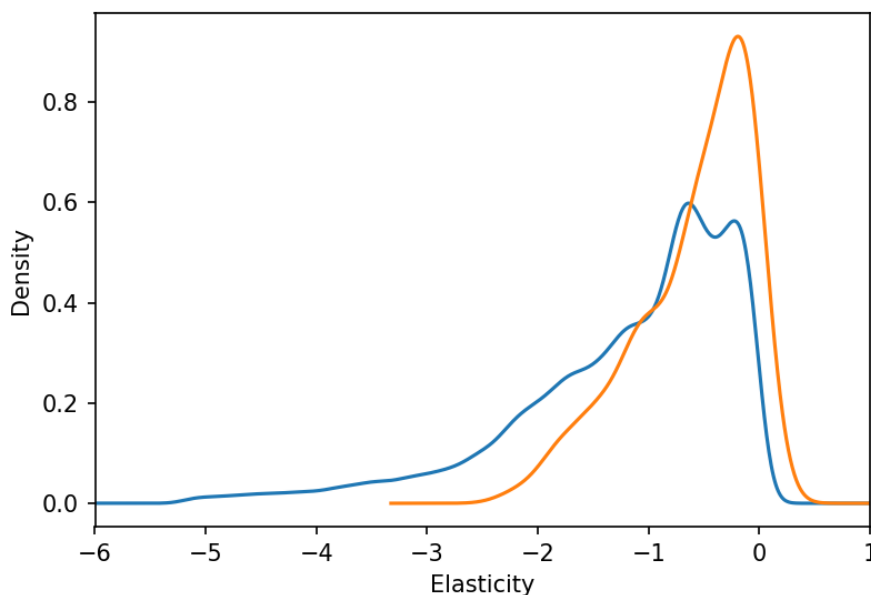


Figure 11: **Density of deposit elasticities.** This figure plots the density graph of estimated deposit demand elasticities of large and small banks. The observations are the deposit-weighted average elasticities at the bank-year level. Orange denotes large banks, and blue denotes small banks.

Figure 12 plots the relationship between cluster-year average 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 tends to be more inelastic, which supports the Proposition 2.

Our evidence documenting differences in demand elasticities between large and small banks provides support for the key results from our model. The higher price 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.

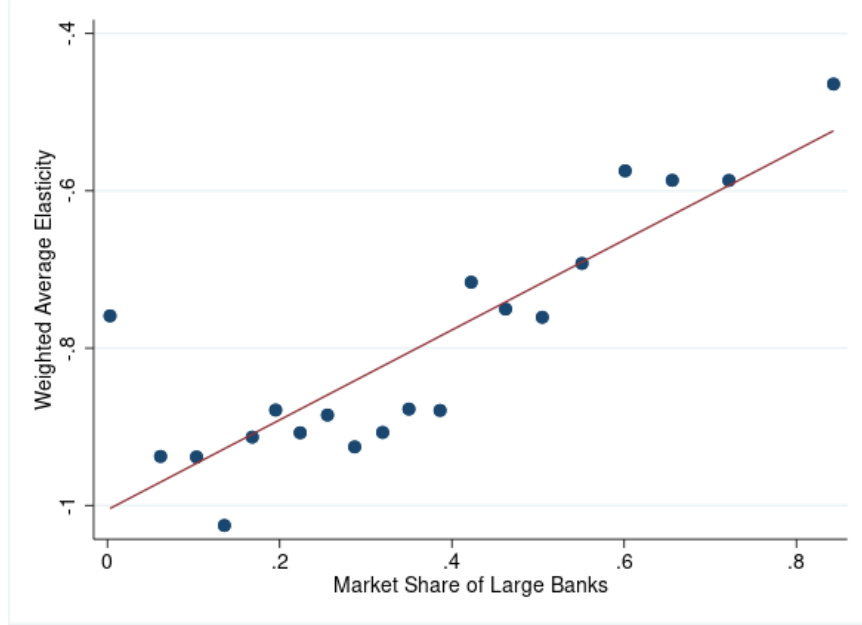


Figure 12: **Deposit elasticity and large bank local share.** This figure presents the relationship between bank demand elasticity and market share of large banks from the BLP estimation data using Call Report data. The elasticities are cluster-year averages, weighted by bank deposits.

6.3 Deposit demand elasticities: further analysis

In this subsection, we present further analysis on the deposit demand elasticities. First, we show that elasticity has more explanatory power for the rate variation. In addition, we find banks with more uninsured deposits face higher demand elasticities, and that large banks have a higher fraction of uninsured deposits. Thus, it is unlikely that variation in the fraction of uninsured deposits is driving our results for the lower elasticities at large vs. small banks.

Elasticity and rate variation Since our model indicates that banks set deposit rates based on households' local-market rate 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 22 above) are associated with our BLP elasticity estimates. In order to shut off the direct effect of price on elasticity, we use the estimated semi-elasticity which is defined as :

$$\hat{\zeta}_{j,c,t} \equiv \frac{\% \Delta \hat{s}_{j,c,t}}{\Delta \tilde{r}_{j,c,t}} = \frac{\partial \hat{s}_{j,c,t}}{\partial \tilde{r}_{j,c,t}} \cdot \frac{1}{\hat{s}_{j,c,t}} = \frac{1}{\hat{s}_{j,c,t}} \int \alpha_i \hat{s}_{i,j,c,t} (1 - \hat{s}_{i,j,c,t}) dF(D) dF(\nu) \quad (30)$$

The semi-elasticity gives the percentage change in market shares in terms of a change in deposit spreads. 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 ($\hat{\zeta} \times$ Time). The data consist of weekly deposit rates for the three RateWatch deposit products 12M CD \$10K, MM \$25K, and SAV \$2.5K 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 26.6% of the variance in 12M CD \$10K rates, 11.6% for MM \$25K, and 23.2% for SAV \$2.5K, 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 price elasticity they face.

	12M CD \$10K		MM \$25K		SAV \$2.5K	
	(1)	(2)	(3)	(4)	(5)	(6)
FE	Large \times Time	$\hat{\zeta} \times$ Time	Large \times Time	$\hat{\zeta} \times$ Time	Large \times Time	$\hat{\zeta} \times$ Time
Observations	44,766,046	42,432,658	42,343,777	40,078,356	44,174,299	41,862,489
R-squared	0.215	0.266	0.107	0.116	0.154	0.232

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 2019 at the branch level. The selected deposit products include 12-month CDs with a balance of \$10,000 (12M CD \$10K), money market accounts with a balance of \$25,000 (MM \$25K), and savings accounts with a balance of \$2,500 (SAV \$2.5K). Fixed effects incorporated are large-time (with “Large” as a dummy for the 14 large banks defined above), and estimated semi-elasticity ($\hat{\zeta}$)-time fixed effects.

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. liquidity 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 liquidity-services technologies, such as ATM networks and consumer-facing software solutions to customers who value such services highly.

Internet Appendix

A Confirming and Refining the Results in Table 2 in Drechsler et al. (2017)

Table A.1 replicates the results in Table 2 of Drechsler et al. (2017), utilizing RateWatch data from 2001 to 2013 to examine the relationship between the Herfindahl-Hirschman Index (HHI) and bank rate-setting behavior. The main regression is

$$\Delta y_{it} = \alpha_i + \eta_{c(i)} + \lambda_{s(i)t} + \delta_{j(i)t} + \gamma \Delta FF_t \times \text{HHI}_i + \epsilon_{it},$$

where Δy_{it} represents the changes in deposit spreads of money market accounts of \$25,000, ΔFF_t denotes the changes in Federal Funds rate, and HHI is the rate-family-level HHI. Following the methodology laid out in Drechsler et al. (2017), we calculate HHI by aggregating the square of deposit-market shares of all banks within a specific county for each year, followed by averaging the results over the entirety of the years.

Column 1 replicates and confirms the main result of Table 2 of Drechsler et al. (2017). Columns 2 through 5 explore potential factors contributing to rate variation, serving as supplementary analyses to Table 1 in the main text. Column 2 reveals that variation in the Federal Funds Rates can account for over half of the variation of observed rate changes. Incorporating the HHI into the third column leads to little improvement to the R-squared value, suggesting that HHI plays a relatively minor role in explaining the variation in deposit rate changes. Analyses presented in Columns 4 and 5, which respectively include all fixed effects and only bank-time fixed effects, reveal that bank-time fixed effects predominantly account for the variation in rate settings, indicating minimal rate variation within banks as shown in the main text.

Lastly, Column 6 examines the rate-setting by large vs. small banks in the context of variation in HHI. The sensitivity of large bank deposit rates does not seem to vary significantly with HHI, which is important because large banks own the majority of deposits. The sensitivity of rates to HHI appears to be driven by small banks, which are much greater in number, but jointly own a minority of deposits.

The original studies in Drechsler et al. (2017) and others incorporate only rate-setting branches from RateWatch. Recognizing that banks may take into account the HHI at all of their branches when setting rates, and the fact that branches flagged as rate-setting by RateWatch may not necessarily be the actual rate setters, we also present results using HHI at the “rate family” level. We classify all branches of a bank operating under the same

	(1) Replication	(2) No FE	(3) No FE	(4) All FE	(5) Bank \times T	(6) Add size
$\Delta FF \times$ HHI	0.0820*** (0.0227)		0.0603** (0.0288)			
ΔFF		0.728*** (0.00378)	0.714*** (0.00780)			
Small \times $\Delta FF \times$ HHI						0.0869*** (0.0239)
Large \times $\Delta FF \times$ HHI						0.0536 (0.0553)
Bank \times T FE	Y	N	N	Y	Y	Y
State \times T FE	Y	N	N	Y	N	Y
Branch FE	Y	N	N	Y	N	Y
County FE	Y	N	N	Y	N	Y
T FE	Y	N	N	Y	N	Y
Observations	107,306	107,306	107,306	107,306	107,306	107,306
R-squared	0.898	0.675	0.675	0.898	0.887	0.898

Table A.1: **Replication of Drechsler et al. (2017) Table 2.** This table replicates Table 2 in Drechsler et al. (2017) using RateWatch data from 2001 to 2013. The main regression is

$$\Delta y_{it} = \alpha_i + \eta_{c(i)} + \lambda_{s(i)t} + \delta_{j(i)t} + \gamma \Delta FF_t \times \text{HHI}_i + \epsilon_{it},$$

where Δy_{it} is changes in deposit spreads of money market accounts of \$25,000, ΔFF_t is changes in Federal Funds rate. HHI measures market concentration at branch family level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

“rate-setter” as a rate family. We calculate the rate-family-level HHI, using each branch’s deposit balance as weights to determine the weighted-average HHI of the family.

Table A.2 replicates Table 2 of Drechsler et al. (2017) using rate-family-level HHI. Column 1 presents the main regression with various fixed effects including bank-time, state-time, branch, county, and time. The result in Column 1 is similar to Drechsler et al. (2017), indicating that banks tend to offer rates that are more sensitive to changes in the Federal funds rate in regions characterized by higher concentration. That is, even using “rate family” data vs. the rate-setters used in the RateWatch data structure, the result of Drechsler et al. (2017) remains. Similarly, the result that small banks appear to drive the finding of a significant interaction between deposit rate sensitivities to the Federal Funds rate and HHI.

	(1) Replication	(2) No FE	(3) No FE	(4) All FE	(5) Bank \times T	(6) Add size
$\Delta FF \times$ HHI	0.0789*** (0.0191)		0.0361* (0.0216)			
ΔFF		0.734*** (0.00285)	0.726*** (0.00600)			
Small \times $\Delta FF \times$ HHI						0.0881*** (0.0208)
Large \times $\Delta FF \times$ HHI						0.0145 (0.0440)
HHI			0.0108*** (0.00322)			
Bank \times T FE	Y	N	N	Y	Y	Y
State \times T FE	Y	N	N	Y	N	Y
Branch FE	Y	N	N	Y	N	Y
County FE	Y	N	N	Y	N	Y
T FE	Y	N	N	Y	N	Y
Observations	184,775	184,775	184,775	184,775	184,775	184,775
R-squared	0.897	0.713	0.713	0.897	0.892	0.897

Table A.2: **Replication of Drechsler et al. (2017) Table 2.** This table replicates Table 2 in Drechsler et al. (2017) using RateWatch data from 2001 to 2019. The main regression is

$$\Delta y_{it} = \alpha_i + \eta_{c(i)} + \lambda_{s(i)t} + \delta_{j(i)t} + \gamma \Delta FF_t \times \text{HHI}_i + \epsilon_{it},$$

where Δy_{it} is changes in deposit spreads of money market accounts of \$25,000, ΔFF_t is changes in Federal Funds rate. HHI measures market concentration at the *rate-family* level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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. We replicate our demand estimation using this alternate definition for large banks.

Table B.1 replicates the findings of Table 5 using the top 1% asset size to define large banks. The average point estimate of price sensitivity closely mirrors that in Table 5.

Table B.2 replicates Table 6 with the alternative large definition. The distribution of elasticities for both large and small banks closely aligns with the results in Table 6. On average, the large banks exhibit lower elasticities. Figure B.1 depicts the 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.

Parameter		Estimation	SE
Deposit Spread	α	-0.934	(0.048)
Log(Employee per Branch)	β_1	0.573	(0.023)
Log(Branch Number)	β_2	0.089	(0.017)
Large	0.137	(0.040)	
Income	Π	0.078	(0.016)
Price Sensitivity Dispersion	σ	0.812	(0.007)
Observation	237,848		

Table B.1: **Demand estimation.** This table reports the estimates of demand parameters. The sample includes all U.S. commercial banks from 2001 to 2019. The data is from the Call Reports, the Summary of Deposits, Data Axle, and Bureau of Labor Statistics. Deposit Spread is the difference between federal funds rate and deposit rates, Log(Branch Number) is the logarithm of total number of branches held by the bank, Log(Employee per Branch) is the logarithm of average number of employees per branch. Large indicates if the bank has assets above the 99% percentile.

(a) Bank-Cluster-Year Level

	N	Mean	Std	1%	10%	25%	Median	75%	90%	99%
Small	176140	-1.141	1.103	-5.152	-2.479	-1.583	-0.808	-0.375	-0.135	-0.012
Large	52804	-0.634	0.660	-2.690	-1.580	-0.950	-0.428	-0.120	-0.027	-0.002
All	228944	-1.024	1.041	-4.876	-2.281	-1.436	-0.725	-0.283	-0.086	-0.007

(b) Bank-Year Level

	N	Mean	Std	1%	10%	25%	Median	75%	90%	99%
Small	74920	-1.229	1.114	-5.178	-2.592	-1.720	-0.913	-0.449	-0.169	-0.014
Large	869	-0.645	0.674	-2.607	-1.531	-1.029	-0.459	-0.136	-0.027	-0.002
All	75789	-1.222	1.111	-5.162	-2.581	-1.712	-0.906	-0.444	-0.165	-0.014

Table B.2: **Demand elasticity.** This table presents summary statistics for calculated demand elasticity. Panel (a) displays the elasticities at the bank-cluster-year level. Panel (b) presents the deposit-weighted average elasticities at the bank-year level. Large indicates if the bank has assets above the 99% percentile.

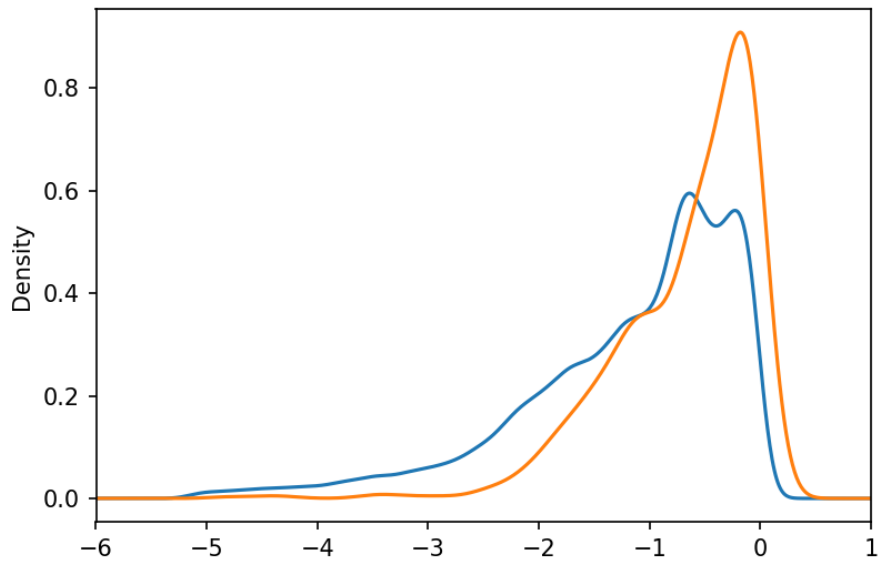


Figure B.1: **Density of deposit elasticities.** This figure plots the density graph of estimated deposit demand elasticities of large and small banks. The observations are the deposit-weighted average elasticities at the bank-year level. Orange denotes large banks, and blue denotes small banks.

Figure B.2 illustrates the correlation between the average elasticity within a cluster and the market share of large banks for each cluster, echoing the findings presented in figure 12. Regions dominated by a higher proportion of large banks typically exhibit less elastic deposit demand elasticities.

Together, these results indicate that altering the definition of large banks does not significantly affect the overall analysis.

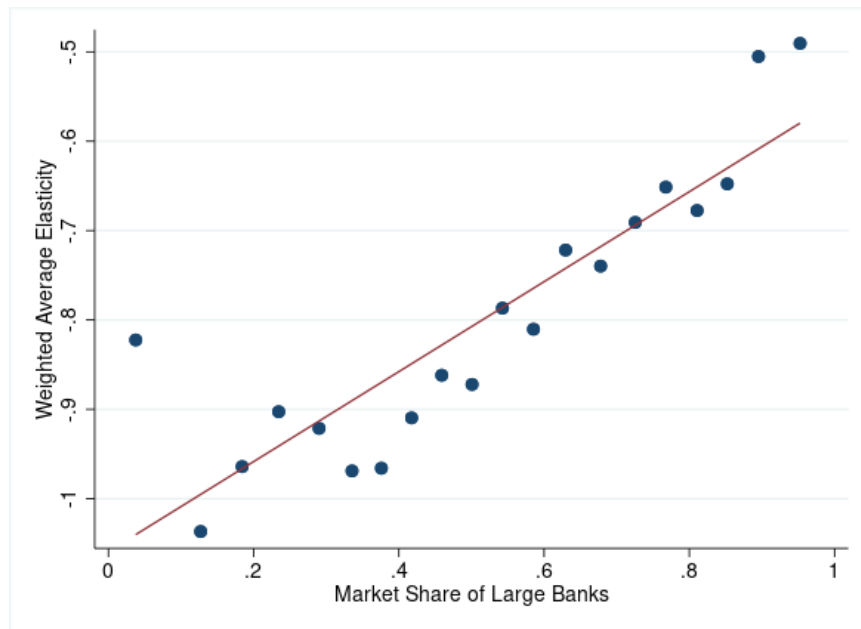


Figure B.2: **Deposit elasticity and large bank local share.** This figure presents the relationship between bank demand elasticity and market share of large banks from the BLP estimation data using Call Report data. The elasticities are cluster-year averages, weighted by bank deposits.

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