# The Deposit Business at Large vs. Small Banks

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# Motivation and Research Goals

- Large and small banks differ significantly in how they operate their deposit franchises.
- Difference in deposit rates, rate elasticities, customer bases, and market strategies.
- Large banks: invest in technology and are multi-market.
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  - Document differences in pricing, customer bases, market, and balance sheet between large and small banks.
  - Explain the relationship between bank size and deposit pricing based on preferences and technology.
- Trade-offs:
  - Large banks face higher fixed costs for superior service but use uniform pricing.
  - Small banks can offer higher rates but face higher rate sensitivities and lower service quality.

# Preview of Results and Contributions

- Large banks operate in high-income, densely populated markets with less rate-elastic customers.
- Small banks offer higher deposit rates, especially where large banks are absent.
- Small and large banks differ in assets and liabilities composition: small banks hold more liquid assets and agricultural loans.
- Empirical evidence supports uniform pricing by large banks.
- Structural model links bank size, pricing strategies, and market location decisions.

# Literature

- Deposit pricing and competition [1]
- Bank valuation and deposit franchises [2]
- Bank industry equilibrium models [3]
- Technology adoption and services [4]
- Uniform price setting [5]

[1] Drechsler et al. (2017, 2021), Jiang et al. (2023), Egan et al. (2017), Xiao (2020), Granja and Paxiao (2024).
[2] Minton et al. (2019), Egan et al. (2022)
[3] Corbae and D'Erasmo (2021, 2013), Wang et al. (2022).
[4] Haendler (2023), Sarkisyan (2023).
[5] Granja and Paxiao (2024), Gentzkow and Shapiro (2014).

# Model

# Demand for banking services

- $k \in \{1, ..., K\}$ local markets with mass of $M_k$ depositors.

- Each depositor is endowed with one dollar.

- Depositor $i$ in $k$ and maximize utility:

$$\max_{j \in \mathcal{B}_k} \quad \mu_{ib} = \alpha_k (r_j - r_f) + \beta_k x_j + \epsilon_{ijk} = -\alpha_k s_j + \beta_k x_j + \epsilon_{ijk} \tag{1}$$

  - $r_j$ is the deposit interest rate on bank $j$ (uniform),
  - $r_f$ is the competitive risk-free rate,
  - $x_j$ are bank characteristics,
  - $\epsilon_{ijk}$ is the idiosyncratic taste for bank $j$ that distributes as a T1EV.

- Total demand is $D_{jk} = M_k d_{jk}$. Market share of bank $j$ in $k$ is:

$$d_{jk} = \frac{\exp(-\alpha_k s_j + \beta_k x_j)}{1 + \sum_{j' \in \mathcal{B}_k} \exp(-\alpha_k s_{j'} + \beta_k x_{j'})}$$

# Banks

- Bank $j$'s problem is:

$$\max_{x_j, b_{jk}, s_j} \quad \sum_{k \in \mathcal{M}_j}^{K} \left( (s_j - c) D_{jk} - \kappa_k \right) b_{jk} - \chi x_j \tag{2}$$

  - $b_{jk} = 1$ if the banks decides to operate in $k$,
  - $c$ is the variable costs of servicing deposits (marginal?),
  - $\kappa$ is the cost of opening a branch in $k$,
  - $\chi$ is the cost of of additional financial services $x_j \in \{0, 1\}$, and,
  - $\mathcal{M}_j$ is the set of markets in which bank $j$ operates $(k : b_{jk} = 1)$.

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- The deposit rate that maximizes profits is:

$$\sum_{k \in \mathcal{M}_j}^{K} D_{jk} + (s_j - c) \sum_{k \in \mathcal{M}_j}^{K} \frac{\partial D_{jk}}{\partial s_j} = 0 \tag{3}$$

$$s_j = c - (\eta_j^s)^{-1}$$

- where $\eta_j^s$ is the weighted semielasticity of demand for bank $j$, $\eta_j^s = \sum_{k \in \mathcal{M}_j}^{K} \frac{\alpha_k D_{jk}(1 - d_{jk})}{\sum_{k \in \mathcal{M}_j}^{K} D_{jk}}$.

# Model implications

- Assumptions:
  - $b_{jk} = 1$ if and only if $(s_j - c)D_{jk} > \kappa$.
  - Single-market banks do not invest in financial services, $x_j = 0$.

- Entry in a market means acquiring an existing branch at market value $\kappa$.

- Equilibrium: Given the parameters $\theta = \{\alpha_k, \beta_k, c, \kappa, \chi, M_k\}_{k=1}^{K}$, the equilibrium is a set of choices $j^*_{ik}$, $b^*_{jk}$, $x_j$ and $s^*_j$ such that it solves (1) and (2) for all $i$, $j$ and $k$, market clears and free entry holds.

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- Proposition 1. (Free-entry condition) The free-entry condition in market $k$ is such that the number of single-market banks (superscript $S$) entering market $k$ is given by

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

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

# Model implications

- *Large banks*, $L$, operate in multiple markets and invest in financial services.
- *Small banks*, $S$, operate in one market and do not invest in financial services.
- Proposition 2. (Small banks operate in one market) If $x_j = 0$, then $|\mathcal{M}_j| = 1$.

# Model implications

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

- Proposition 3. (Collocation markets' demand)
  *Collocations markets*, $C$, are those where both large and small banks operate. If $i \in C$, the ratio of deposits supplied by small and large banks is given by

$$\frac{D_{jk}^S}{D_{jk}^L} = \exp(\alpha_k(s^L - s^S) - \beta_k)$$

  where $C = \{k : \exists j, b_{jk} = 1 \text{ and } |\mathcal{M}_j| > 1\}$.
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  $\rightarrow$ Small banks have smaller spreads and large banks benefit from financial services.

- Proposition 4. (Deposit spreads and average spread semi-elasticity) $s_i < s_j$ if and only if $|\eta^s_i| > |\eta^s_j|$. $\rightarrow$ For small banks with lower spreads, the semi-elasticity of demand is higher.

# Model implications

- Proposition 5. (Large banks' location) Bank $j$ does not locate in market $k$ if

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

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$\rightarrow$ Large banks locate in markets with $\alpha_k$ far away (lower) than their $\eta_j^s$.

- Proposition 6. (Collocation markets) If $k \in \mathcal{M}_j$ and $\ell \notin \mathcal{M}_j$, then

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

$\rightarrow$ Markets without large banks large banks have distant $alpha_k$ from $\eta_j^s$.

# Model implications

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

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

- Thus,

$$\frac{\partial s_k^S}{\partial \alpha_k}\frac{\partial \alpha_k}{\partial HHI_k} < 0 \text{ and } \frac{\partial s_k^S}{\partial \kappa_k}\frac{\partial \kappa_k}{\partial HHI_k} > 0$$

→ Markets with larger $\alpha$, have lower spreads and higher HHIs.
→ Markets with higher $\kappa$, have higher spreads and higher HHIs.

# Data

- Data sources:
  - Call Reports
  - SOD from the FDIC
  - RateWatch data
  - Data Axle's U.S. Consumer Database, micro income households.
  - Census data on income.
- Sample: unbalanced annual panel of U.S. commercial banks from 2001 to 2019.
- Large banks are the 14 largest banks by assets.
- For estimation, counties are clustered using BFS algorithms, resulting in $\approx 543$.

# Empirically testing assumptions and predictions

# Rate-setting behavior of large and small banks

- Sources of variation by regressing: $Rate_{branch,t}\text{FE} + \epsilon_{branch,t}$.
- Most of the variation in deposit rates is across banks/year.

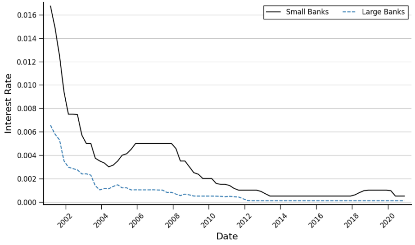
| | CHECK $2.5K | | SAV $2.5K | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| FE | Time | Bank×Time | Time | Bank×Time |
| Observations | 52,618,184 | 51,125,529 | 54,525,429 | 52,999,174 |
| R-squared | 0.351 | 0.915 | 0.474 | 0.942 |
| | 12M CD $10K | | MM $25K | |
| | (5) | (6) | (7) | (8)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

# Rate-setting behavior of large and small banks

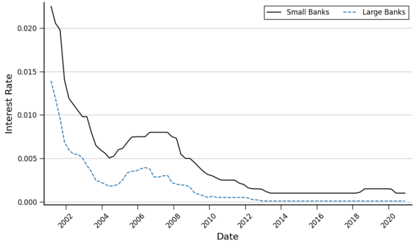
| | CHECK \$2.5K | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| FE | Bank×Time | Large×Time | HHI×Time | Population×Time |
| Observations | 51,125,529 | 49,897,464 | 51,125,529 | 50,160,286 |
| R-squared | 0.874 | 0.140 | 0.010 | 0.011 |
| | SAV \$2.5K | | | |
| | (5) | (6) | (7) | (8) |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

- Two-step regressions, first time, then bank and market characteristics.
- Suggest bank and bank size, not market characteristics, drive rating.

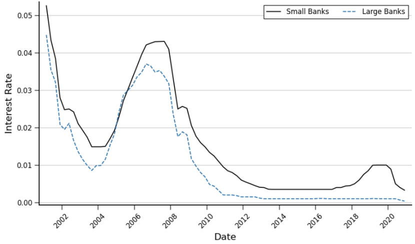
# Smaller banks set higher rates than larger banks



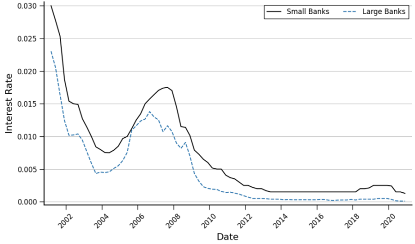

(a) CHECK $2.5K




(b) SAV $2.5K




(c) 12M CD $10K



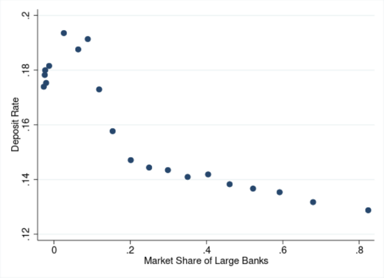

(d) MM $25K

# Smaller banks set higher rates than larger banks

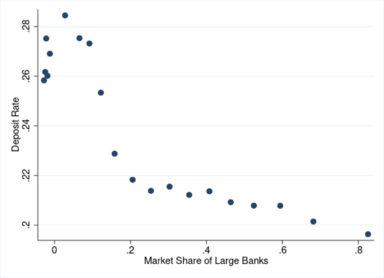
| | CHECK \$2.5K (1) | SAV \$2.5K (2) | 12M CD \$10K (3) | MM \$25K (4) |
|---|---|---|---|---|
| large | $-0.002^{***}$ | $-0.003^{***}$ | $-0.005^{***}$ | $-0.003^{***}$ |
| | $(2.501e-05)$ | $(2.952e-05)$ | $(3.601e-05)$ | $(4.367e-05)$ |
| T-FE | Yes | Yes | Yes | Yes |
| Observations | 4,197,967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

# Deposit rates and market shares of large banks

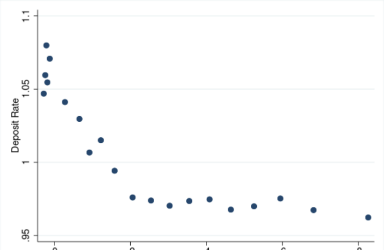
- Small banks located in areas where large banks have higher market shares.

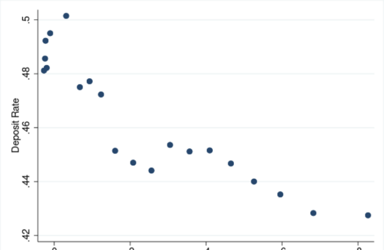



(a) CHECK \$2.5K




(b) SAV \$2.5K



# Large banks are concentrated in large markets

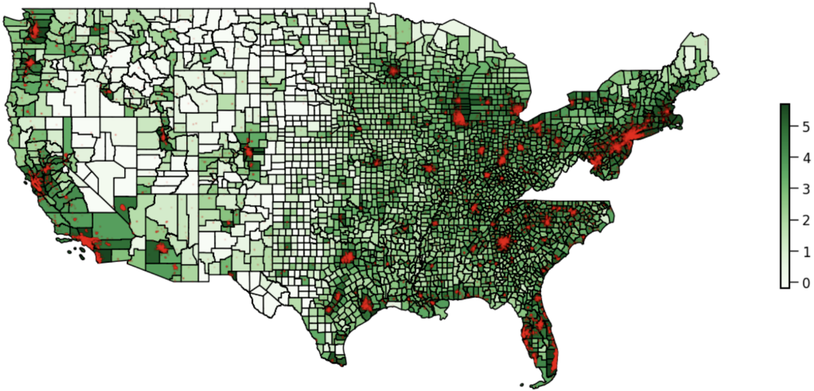
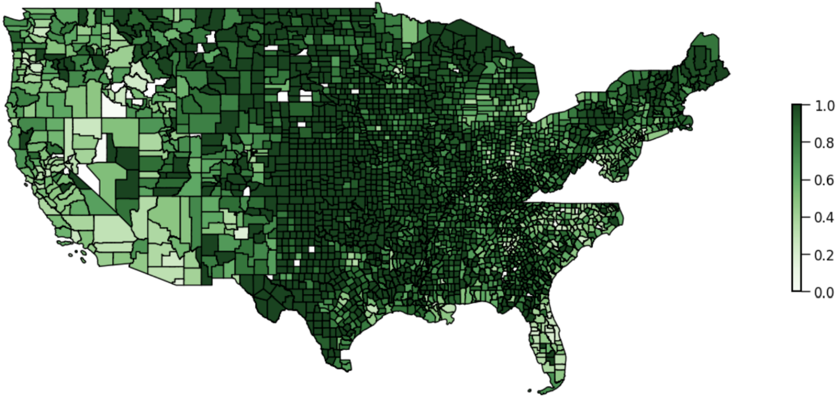


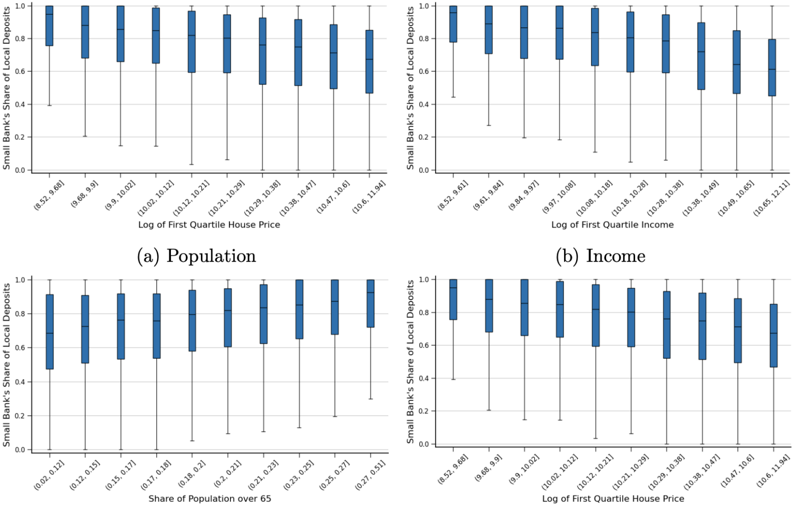

Figure 3: **Branch location of large banks and county population.** This map displays the branch locations of large banks in 2019 in red, and the log of population density in shades of green with dark green indicating a higher population density. The location data are from FDIC's Summary of Deposits.

# Smaller banks have more branches in small markets



# Customer demographics

- Small banks: less populated, more elderly, less income, and lower housing prices.



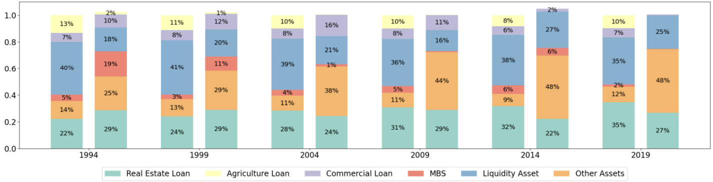

(a) Population (b) Income

(c) Old population (d) Housing price

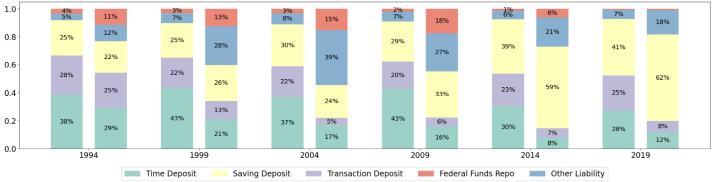
# Customer demographics

- Small banks hold more liquid assets and agricultural loans.

- Large banks hold more saving deposits while small banks hold more time and transaction 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)

# Estimation

# Estimation

- Large banks are the 14 largest banks.
- Bonds are the outside option
- The utility specification is

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

  - where $D_i$ is customer demographics, $\nu_i \sim N(0,1)$, and $\epsilon_{i,j,k,t}$ is a Type I EV.

- The market share of product $j$ in a county cluster $k$ at time $t$ is

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

# Instruments and Identification Argument

- Solution: Use supply shocks ($Z_{j,k,t}$) as instruments:
  - Staff salaries to total assets (prior year).
  - Non-interest expenses to total assets (prior year).
  - Local labor costs (county-level, weighted by deposits).

- Assumption: Customers do not respond to cost changes, but banks adjust rates.

- Estimation: IV-GMM following BLP (1995).

# Summary Statistics

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

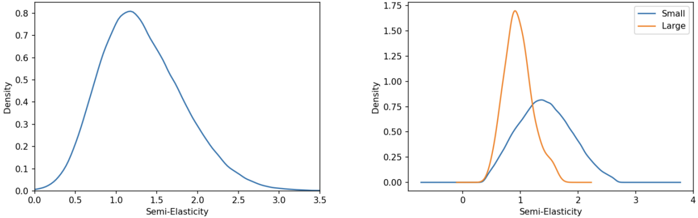
Table 4: **Summary statistics.** This table reports the summary statistics of the data used in the estimation.

# Estimation results

| Parameter | | Estimation | SE |
|---|---|---|---|
| Deposit Rate | $\alpha$ | 1.171 | (0.046) |
| Large×Market Average Income | $\beta_1$ | 0.015 | (0.001) |
| Log(Employee per Branch) | $\beta_2$ | 0.476 | (0.019) |
| Log(Branch Number) | $\beta_3$ | 0.133 | (0.016) |
| *Heterogeneous rate Sensitivity:* | | | |
| Log(Household Income) | $\Pi$ | -0.533 | (0.014) |
| Rate Sensitivity Dispersion | $\sigma$ | 0.957 | (0.038) |
| Observation | 296,174 | | |
| Adjusted $R^2$ | 0.540 | | |

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

# Rate semi-elasticities




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

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

# Rate semi-elasticities and market shares

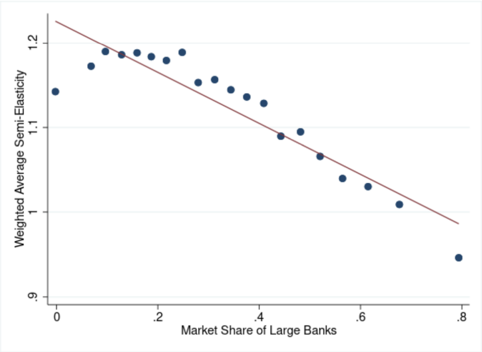



Figure 10: **Rate semi-elasticity and large bank local share.** This figure presents the relationship between rate semi-elasticity and market share of large banks from the BLP estimation data using Call Report data, controlling for year fixed effects. The semi-elasticities are cluster-year averages,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

# Rate semi-elasticities analysis

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

- Similar residual analysis with two stages.
- The semi-elasticity-time FE accounts for between 12 % and 26.5% of the variation in deposit rates.

# Conclusions

- Deposit rate setting reflects differences in customer preferences and bank technologies, not just market power.
- Large banks' concentration may arise from fixed costs of superior financial-service technologies (e.g., ATMs, software).
- Variations in deposit pricing highlight heterogeneous production functions for deposit franchises.

Thank you!