The Deposit Business at Large vs. Small Banks

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Motivation and Research Questions

- Large and small banks differ significantly in how they operate their deposit franchises.
- These differences impact deposit rates, rate elasticities, customer bases, and market strategies.
- Main Goals/Questions:
  - How do differences in preferences and technologies drive this behavior, rather than market power?
  - What are the implications for financial stability and bank valuation?
- Trade-offs:
  - Large banks face higher fixed costs for superior service but use uniform pricing.
  - Small banks 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.
- Empirical evidence supports that uniform pricing by large banks is driven by technology and customer preferences.
- Structural model links bank size, pricing strategies, and market location decisions.
- Provides insights into deposit franchises' role in bank valuations and financial stability.

Literature

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

[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).

Model

Demand for banking services

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

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

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

- The deposit rate that maximizes profits is:

$$\sum_{k \in \mathcal{M}_j}^{K} D_{jk} + (s_j - c) \sum_{k \in \mathcal{M}_j}^{K} \frac{\partial D_{jk}}{\partial s_j} = 0$$
$$s_j = c - (\eta_j^s)^{-1} \tag{3}$$

- where η_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

- Assumption: $b_{jk} = 1$ if and only if $(s_j - c)D_{jk} > \kappa$.

- Entry in a market means acquiring an existing branch at market value κ.

- 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.

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

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

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 $\mathcal{L}_k \equiv \{j : b_{jk} = 1 \text{ and } |\mathcal{M}_j| > 1\}$ 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 $|\mathcal{M}_j| = 1$.
- Collocation markets' demand If $i \in C$, the ratio of deposits supplied by small and large banks is given by

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

  where $C = \{k : \exists j, b_{jk} = 1 \text{ and } |\mathcal{M}_j| > 1\}$.
- Proposition 4. (Deposit spreads and average spread semi-elasticity) $s_i < s_j$ if and only if $|\eta^s_i| > |\eta^s_j|$.

Model implications

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

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

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

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

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,

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

- This predictions will be tested.

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.
- For estimation, counties are clustered using BFS algorithms, resulting in ≈ 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.

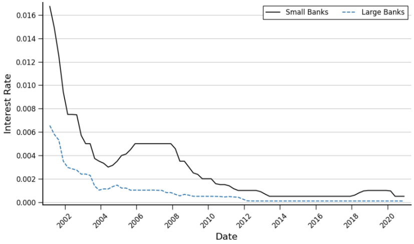
	CHECK $2.5K		SAV $2.5K	
	(1)	(2)	(3)	(4)
FE	Time	Bank×Time	Time	Bank×Time
Observations	52,618,184	51,125,529	54,525,429	52,999,174
R-squared	0.351	0.915	0.474	0.942
	12M CD $10K		MM $25K	
	(5)	(6)	(7)	(8)
FE	Time	Bank×Time	Time	Bank×Time
Observations	55,162,370	53,630,152	51,808,776	50,371,019
R-squared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

Rate-setting behavior of large and small banks

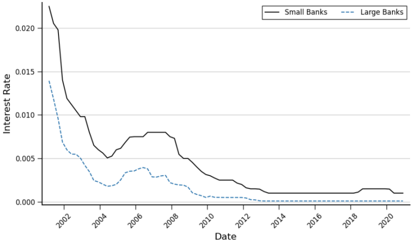
	CHECK \$2.5K			
	(1)	(2)	(3)	(4)
FE	Bank×Time	Large×Time	HHI×Time	Population×Time
Observations	51,125,529	49,897,464	51,125,529	50,160,286
R-squared	0.874	0.140	0.010	0.011
	SAV \$2.5K			
	(5)	(6)	(7)	(8)
FE	Bank×Time	Large×Time	HHI×Time	Population×Time
Observations	52,999,174	51,692,433	52,999,174	52,002,321
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 steps regressions, first time, then bank and market characteristics.
- Suggest bank and bank size, not market characteristics, drive rating.

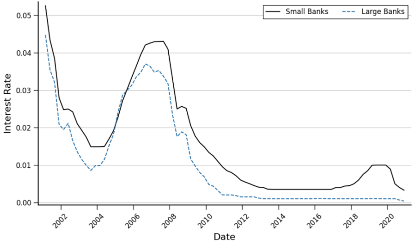
Smaller banks set higher rates than larger banks



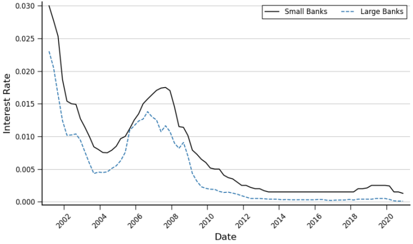
(a) CHECK $2.5K



(b) SAV $2.5K



(c) 12M CD $10K

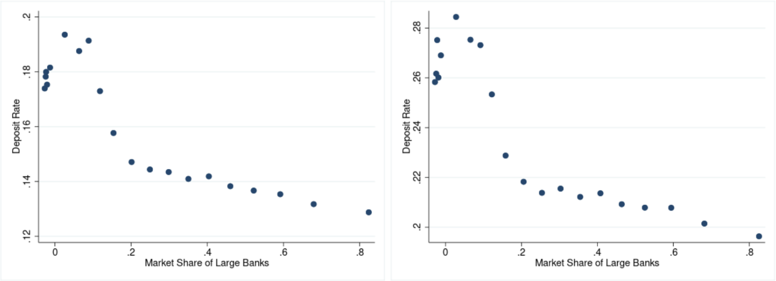


(d) MM $25K

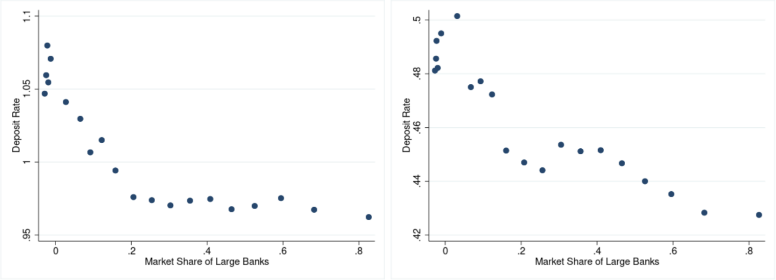
Smaller banks set higher rates than larger banks

	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



(a) CHECK \$2.5K (b) SAV \$2.5K



Large banks are concentrated in large markets

- bla bla

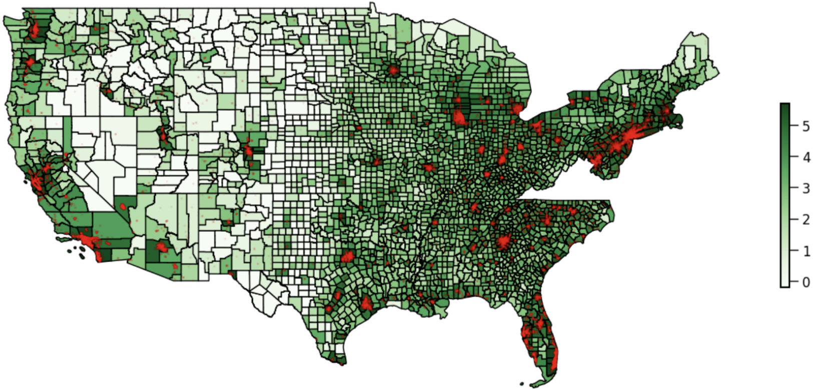
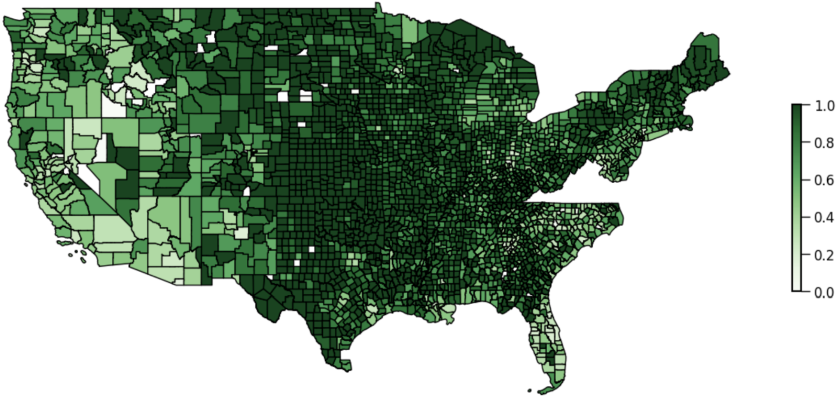


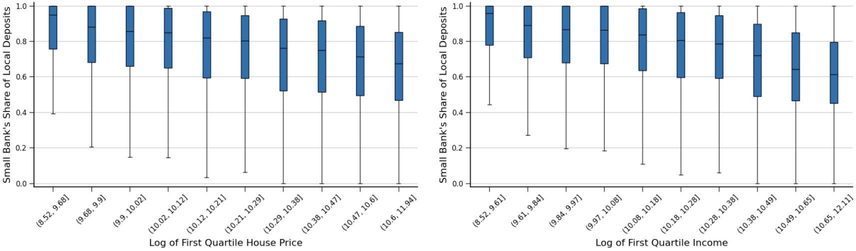
Figure 3: **Branch location of large banks and county population.** This map displays the branch locations of large banks in 2019 in red, and the log of population density in shades of green with dark green indicating a higher population density. The location data are from FDIC's Summary of Deposits.

Smaller banks have more branches in small markets

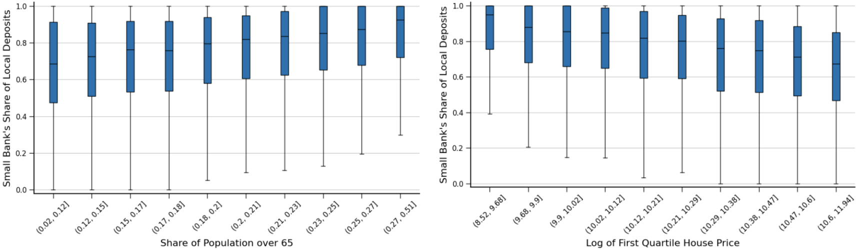


Customer demographics

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

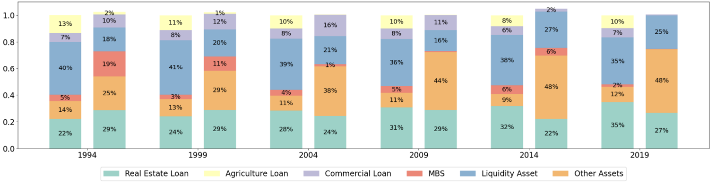


(a) Population (b) Income

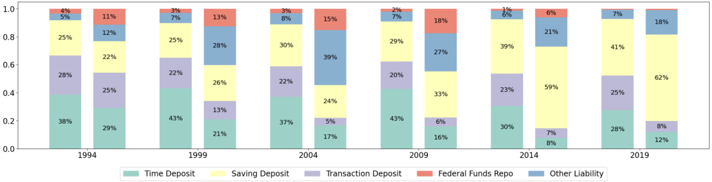


Customer demographics

- 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).

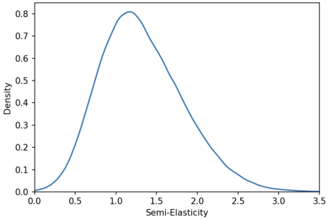
Summary Statistics

	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

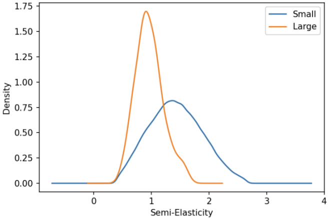
Table 4: **Summary statistics.** This table reports the summary statistics of the data used in the estimation.

Rate semi-elasticities

- Bank expansion into new counties driven by high-income borrowers.



(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

- Bank expansion into new counties driven by high-income borrowers.

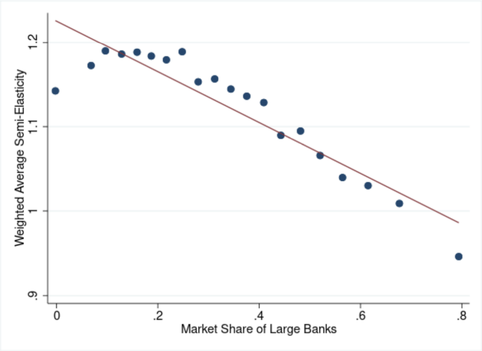


Figure 10: **Rate semi-elasticity and large bank local share.** This figure presents the relationship between rate semi-elasticity and market share of large banks from the BLP estimation data using Call Report data, controlling for year fixed effects. The semi-elasticities are cluster-year averages,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