The Deposit Business at Large vs. Small Banks

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This Paper

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  $\rightarrow$ key driver: heterogeneity of depositors' preferences

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  $\rightarrow$ more sophisticated depositors receive lower deposit rates
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▷ Model with small/large bank location choice and preferences heterogeneity

▷ Measure customer preferences heterogeneity and confirm model's predictions
  $\rightarrow$ demand system with heterogeneous preferences across counties in the U.S.

Literature on Banks' Deposit Business

- Deposit franchise value

  → deposit business differs across banks and driven by preferences

  Calomiris and Nissim (2014), Egan, Hortaçsu, and Matvos (2017), Atkeson, d'Avernas, Eisfeldt, and Weill (2018), Minton, Stulz, and Taboada (2019), Xiao (2020), Ma and Scheinkman (2022), Egan, Lewellen, and Sunderam (2022), Wang, Whited, Wu, and Xiao (2022), Jiang, Matvos, Piskorski, and Seru (2023)

- Market power

  → clarify relation between market power, uniform pricing, and HHI

  Radecki (2000), Biehl (2002), Heitfield and Prager (2004), Park and Pennacchi (2009), Drechsler, Savov, Schnabl (2017, 2021), Begenau and Stafford (2022)

Empirical Facts

Time and Bank Fixed Effects

MMs & CDs

	CHECK \$2.5K		SAV \$2.5K	
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

- RateWatch collected weekly at branch-level 2001-2019

▷ Banks set uniform rates across branches (Begenau and Stafford, 2022)

→ difficult set deposit rates at the branch level
(Heitfield, 1999; Radecki, 2000; Biehl, 2002; Heitfield and Prager, 2004)

→ complaints about regional price dispersion
(DellaVigna and Gentzkow, 2019; Cavallo, 2018)

→ internal competition across branches of the same bank

Residual Variation after Time Fixed Effects

MMs & CDs

CHECK \$2.5K

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

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

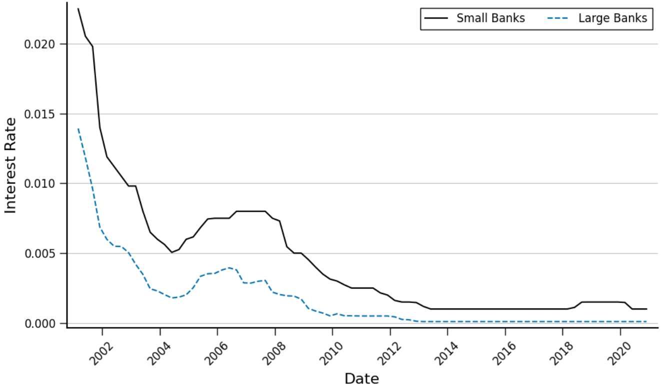
- Large defined as branch of one of the 14 large complex bank holding companies subject to the Supervisory Capital Assessment Program of 2009

▷ Size of bank matters

▷ HHI or population size explains very little variation

Small Banks Offer Higher Deposit Rates

table call

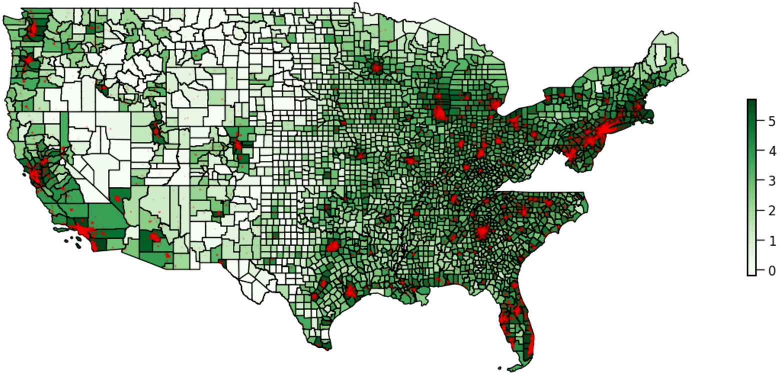


- Large defined as branch of one of the 14 large complex bank holding companies subject to the Supervisory Capital Assessment Program of 2009

▷ Small banks provide rates 30 basis points higher on average

Large Banks Branch Locations and Population

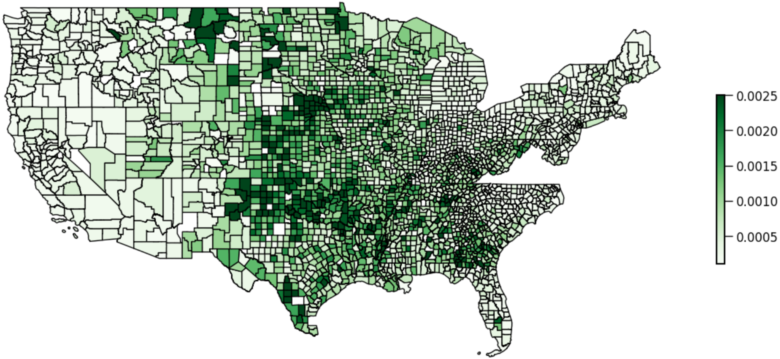
more



- Branch locations of large banks in red and population size in green

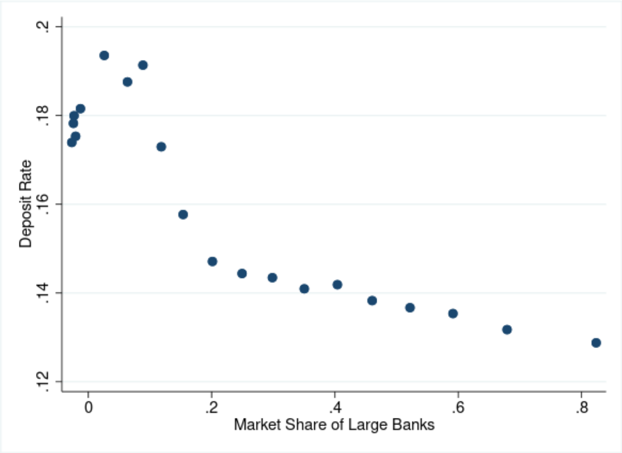
▷ More financially sophisticated depositors receive lower deposit rates

Geography of Deposit Rates



- Higher deposit rates in darker green
  - More highly populated areas with higher average incomes, higher house prices, lower average ages, and higher financial sophistication (Campbell, 2006)

Deposit Rates of Small Banks and Large Banks Market Shares



- Inconsistent with small banks setting higher rates to compete against large banks

Model

Preferences

- Mass M_k of depositors i in market k choose among bank deposits j

$$\max_{j \in \mathcal{B}_k} u_{ijk} = -\alpha_k s_j + \beta_k x_j + \epsilon_{ijk}$$

where s_j is the deposit spread, $x_j \in \{0,1\}$ represents financial services, and

$$\epsilon_{ijk} \sim \exp(-\exp(-\epsilon_{ijk}))$$

▷ Price sensitivity α_k and value of financial services β_k vary across markets

- Market share for deposits of bank j in market k

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

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Banks' Maximization Problem

- Bank j chooses services $x_j \in \{0,1\}$, branches $b_{jk} \in \{0,1\}$, and spread s_j

$$\max_{x_j, s_j} \sum_{k=1}^{K} \left((s_j - c)D_{jk} - \kappa_k\right) \mathbb{1}\{b_{jk} = 1\} - \chi x_j$$

- Constraint to set uniform deposit spread $r - r_j = s_j$ across branches

$$s_j = c + \eta_j^{-1} \qquad \eta_j \equiv \frac{\sum_{k \in \mathcal{M}_j} D_{jk} \alpha_k (1 - d_{jk})}{\sum_{k \in \mathcal{M}_j} D_{jk}}$$

where η_j is the deposit-weighted average demand semi-elasticity faced by bank j

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

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

▷ Free entry condition pins down the number of banks in each market

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Parameters Restrictions and Equilibrium

- The set of parameters $\theta \equiv \{\chi, c, M_k, \kappa_k, \alpha_k, \beta_k\}_{k=1}^{K}$ is such that
  - ▷ Too expensive to invest in financial services for single-market banks

$$\beta_k < \log\left(1 + \frac{\chi}{\kappa_k}\right)\left(1 + \frac{\kappa_k \alpha_k}{M_k}\right)$$

  - ▷ All markets are sufficiently large for at least two single-market banks to open

$$\frac{M_k}{\kappa_k \alpha_\ell} > 1 \;\; \forall k, \ell$$

- We solve for the unique pure strategy Nash equilibrium

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Entry Condition

- The number of single-market banks in market k is given by

$$N_k^S = \left\lfloor \frac{M_k}{\kappa_k \alpha_k} - \sum_{i \in \mathcal{L}_k} \exp\left(-\alpha_k (s_i - s_k^S) + \beta_k x_i\right) + 1 \right\rfloor$$

$$= \frac{M_k}{\kappa_k \alpha_k} - \sum_{i \in \mathcal{L}_k} \exp\left(-\alpha_k (s_i - s_k^S) + \beta_k x_i\right) + 1 - \theta_k \quad \text{if} \quad N_k^S > 0$$

where $\theta_k \in [0,1)$ and $\mathcal{L}_k \equiv \{j : b_{jk} = 1 \text{ and } |\mathcal{M}_j| > 1\}$

- We assume $\theta_k = 0$ and $N_k^S > 0$

- Single-market banks serve as residual:

$$\sum_{i \in \mathcal{B}_k} \exp(-\alpha_k s_i + \beta_k x_i) = \frac{M_k}{\kappa_k \alpha_k} + 1$$

  - ▷ Problem of a bank does not depend on strategy of other multi-market banks

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Results: Competition

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

▷ Two types of banks arise endogenously:

→ small banks that operate in one market and do not provide financial services

→ large banks that operate in many markets and provide financial services

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

$$\log\left(\frac{D_k^S}{D_j^L}\right) = \alpha_k\left(s_j^L - s_k^S\right) - \beta_k.$$

▷ Small banks compete with lower spreads, large banks with financial services

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Results: Location Decisions

- **Large banks' location.** If

$$\frac{\alpha_k}{\eta_j} - \log\left(\frac{\alpha_k}{\eta_j}\right) > 1 + \beta_k x_j + \frac{\kappa_k \alpha_k}{M_k}$$

then bank j does not locate in market k.

▷ Not profitable for large bank to open branch in market k if:

$\rightarrow$ preference for financial services β_k too low

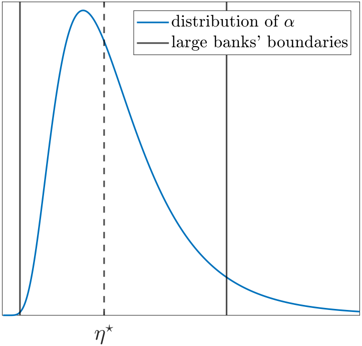
$\rightarrow$ market k elasticity α_k too different from bank's j average elasticity η_j

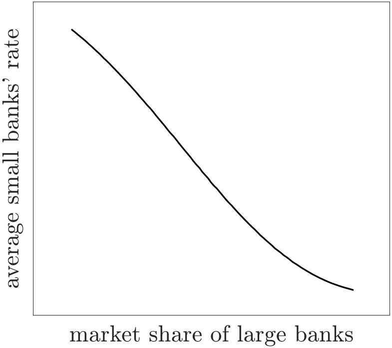
- **Collocation markets.** Assume $M_k/\kappa_k = M_\ell/\kappa_\ell$ and $\beta_k = \beta_\ell$. If $k \in \mathcal{M}_j$ and $\ell \notin \mathcal{M}_j$, then

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

▷ Large banks do not open branches in market with extreme α_k

Results: Small Banks Spreads and Large Banks Market Share





- Large banks target low-α markets with many other similar markets (high density)
- Small banks can offer lower deposit rates in low-α markets

Results: HHI and Deposit Spreads

- **Herfindahl–Hirschman index.** If $k \notin \mathcal{C}$, then

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

  Thus,

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

▷ We should not expect HHI to explain well variation in deposit spreads

Customers’ Preferences

Berry, Levinsohn, and Pakes' (1995) Estimation of Demand

more

- Customers i in market k choose their allocation to cash, bonds, and deposits of bank j to maximize

$$u_{i,k,j,t} = -\alpha_i s_{k,j,t} + \boldsymbol{\beta}\mathbf{X}_{k,j,t} + \xi_{k,j,t} + \varepsilon_{i,k,j,t}$$

$$\alpha_i = \alpha + \gamma \text{INC}_i + \sigma \nu_i$$

where

$$\varepsilon_{i,k,j,t} \sim F(\varepsilon) = e^{-e^{-\varepsilon}} \text{and} \quad \nu_i \sim N(0,1)$$

- Heterogeneous price sensitivities α_i as a function of income INC_i
- Supply shocks as instruments for $s_{k,j,t}$ (Dick, 2008; Wang et al., 2022)
  - ratio of staff salaries to total assets in prior year
  - ratio of non-interest expenses to total assets in prior year
  - local labor cost

▷ Relevance: costs influence pricing

▷ Exclusion restriction: demand insensitive to costs changing

Estimation: BLP Random Parameters Logit Demand Model

- Deposit rates data from Call Reports spanning 2001 to 2019
- FDIC's Summary of Deposits for branch-level deposit balances
- Macro aggregates from FRED to proxy for the share of cash, bonds, and deposits
- Assume non-deposit wealth proportional to total personal income from BEA
- Use household income INC_i randomly drawn from Data Axle's US Consumer Database
- Follow Nevo (2000) and Conlon and Gortmaker (2020) to estimate key parameters $\alpha, \beta, \gamma, \sigma$

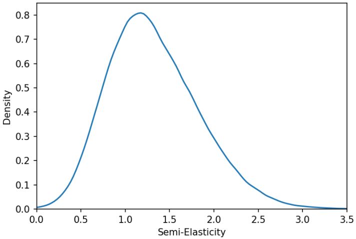
Estimation Results

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

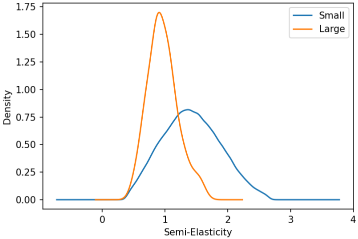
- Rich households much less sensitive to rates: $\Delta\alpha/\Delta\text{sd(INC)} = -0.49$
- Rich households care more about financial services offered by large banks $\beta_1 > 0$

  $\rightarrow$ banks in San Francisco (avg inc. of $135k) can offer deposit rate 1.09% lower than in Champaign (avg inc. of $50k) to achieve same satisfaction

Density of Estimated Rate Semi-elasticities



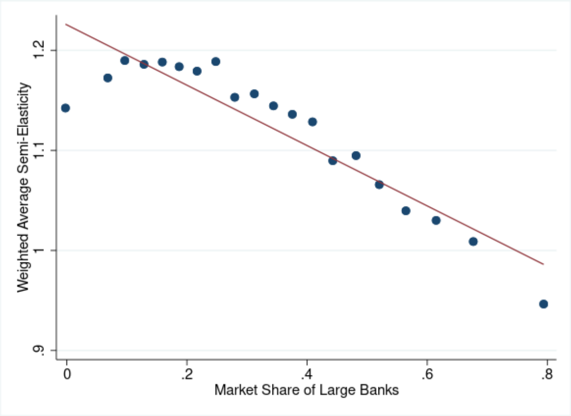
(a) Full sample



(b) Large vs. small

$\rightarrow$ Only small banks locate in high elasticity markets

Financial Sophistication



- Large banks locate in markets with lower elasticities

→ Large banks can charge higher spreads because of lower customers' elasticities

→ High income customers have lower elasticities

Customers' Preferences Drive Deposit Spreads Variation

CHECK \$2.5K			
FE	Large×Time	$\hat{\eta}^r$ ×Time	HHI×Time
Observations	$45,767,311$	$46,156,131$	$46,156,131$
R-squared	0.140	0.213	0.010

- Semi-elasticities

$$\widehat{\zeta}_{k,j,t} \equiv \frac{\%\Delta m_{k,j,t}}{\Delta s_{k,i,t}}$$

→ Explains more deposit variation than size and 20x more than HHI

Conclusion

- Deposit businesses differ at large vs. small banks
  $\rightarrow$ key driver: heterogeneity of depositors' preferences
- Large banks are dominant and expensive
  $\rightarrow$ economies of scale in quality of financial services
- Large banks locate in rich, urban areas
  $\rightarrow$ they seek uniform demand curves
- More sophisticated depositors receive lower deposit rates
  $\rightarrow$ richer households less sensitive to deposit rates
- Small banks offer lower rates when competing with large banks
  $\rightarrow$ large banks locate where demand is less elastic

Time and Bank Fixed Effects

back

	12M CD $10K		MM $25K	
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

Residual Variation after Time Fixed Effects

back

12M CD \$10K				
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				
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

Difference in Rates between Large and Small Banks

back

	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 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, saving account of \$2,500, and checking account of \$2,500. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Share of Branches Held by Small Banks

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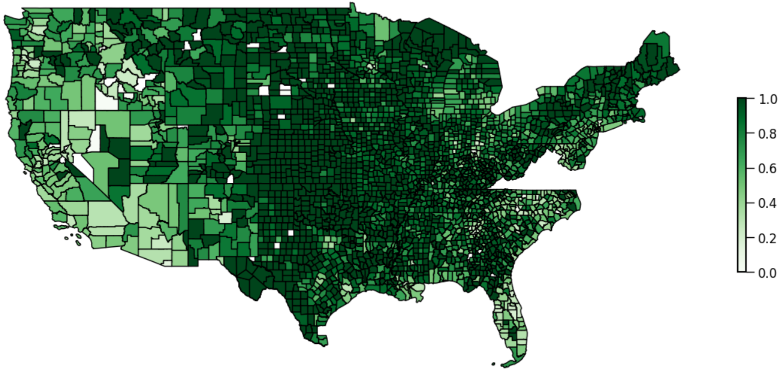
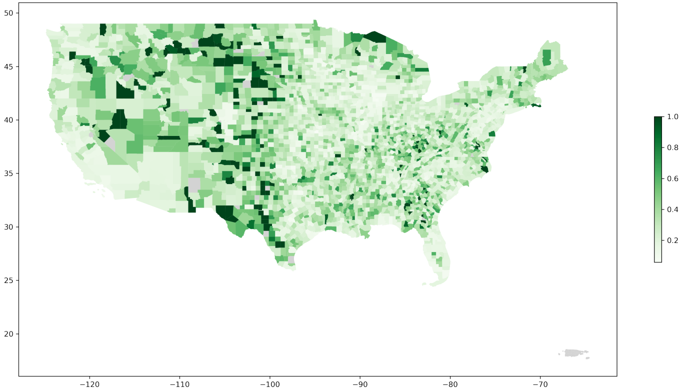


- Concentrate in the middle of the US instead of the coasts

Herfindahl–Hirschman Index per County

back



- Location with higher HHI but small banks still provide higher deposit rates

Share of Small-Bank Branches and Demographics

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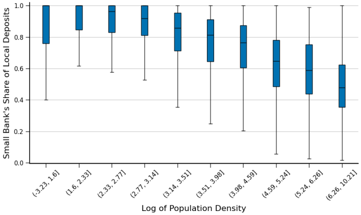
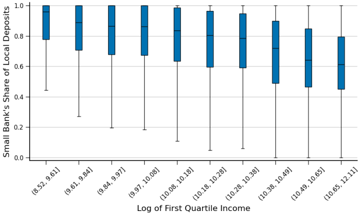
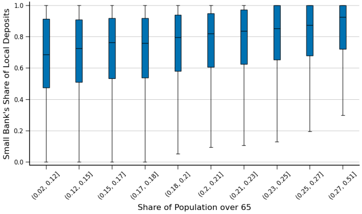


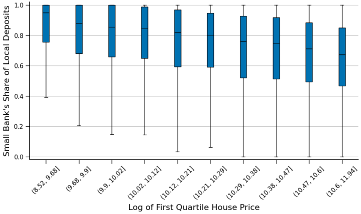
Population Density



Income



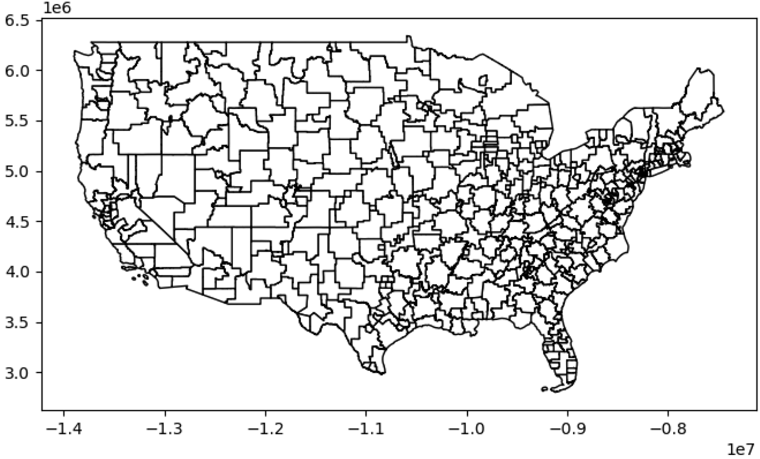
Old population



House prices

County Cluster Map

back



- Breadth-first search algorithm (Zhou and Hansen, 2006; Even and Even, 2011) to construct county clusters for low-population counties

Dreschler, Savov, and Schnabl (2017) Replication

	(1)	(2)	(3)	(4)	(5)
$\Delta FFR \times HHI$	0.029^{***}	0.029^{***}	0.030^{***}	0.033^{***}	0.032^{***}
	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
Observations	195,732	195,732	195,732	195,732	195,732
R-squared	0.841	0.836	0.502	0.787	0.781
Bank x Quarter FE	Yes	Yes	No	No	No
State x Quarter FE	Yes	No	No	Yes	No
Branch FE	Yes	Yes	No	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes

DSS (2017) Table 2 Replication. Δ FFR denotes the quarter-level change in the Federal Funds Target Rate, HHI denotes the county-level deposit HHI.

Dreschler, Savov, and Schnabl (2017) with Semi-Elasticities

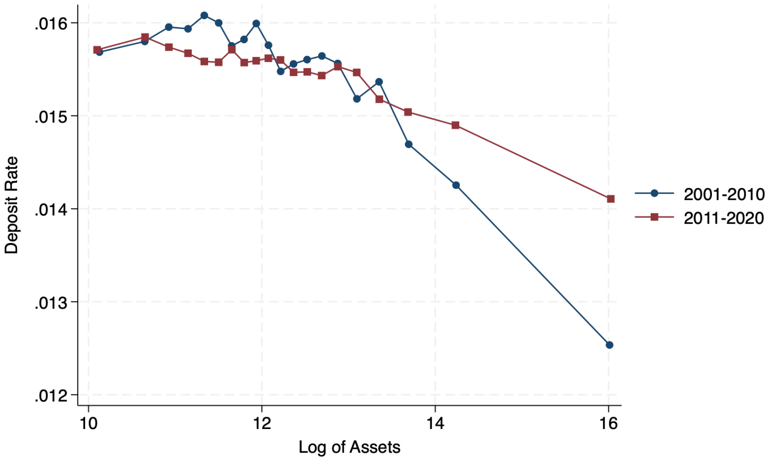
	(1)	(2)	(3)	(4)	(5)
$\Delta FFR \times \widehat{\zeta}$	0.0052^{***}	0.0053^{***}	0.0048^{***}	0.0050^{***}	0.0050^{***}
	(6.67e-05)	(6.91e-05)	(3.72e-05)	(5.75e-05)	(6.18e-05)
Observations	177,454	177,454	177,454	177,454	177,454
R-squared	0.869	0.864	0.587	0.820	0.816
Bank x Quarter FE	Yes	Yes	No	No	No
State x Quarter FE	Yes	No	No	Yes	No
Branch FE	Yes	Yes	No	Yes	Yes o
County FE	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes

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

Deposit rate differences between large and small banks (Call Reports). This table estimates the average deposit rate difference between large and small banks using Call Report data. Rates are computed as the ratio of interest expense over deposits for the totality of deposits (TOT), Transaction Deposits (TRANS), Savings Deposits (SAV), and Time Deposits (TIME) respectively. Rates are winsorized at the 99th percentile.

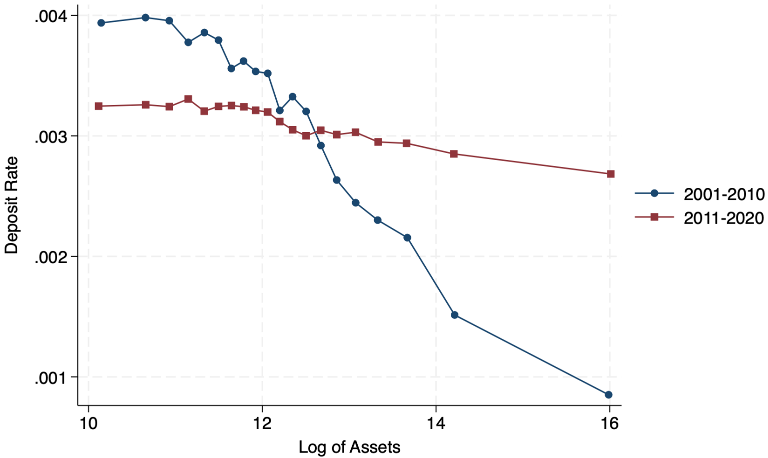
Rates vs. Bank Size CD

back



Binscatter of CD deposit rates (Ratewatch) controlling for quarterly fixed effects

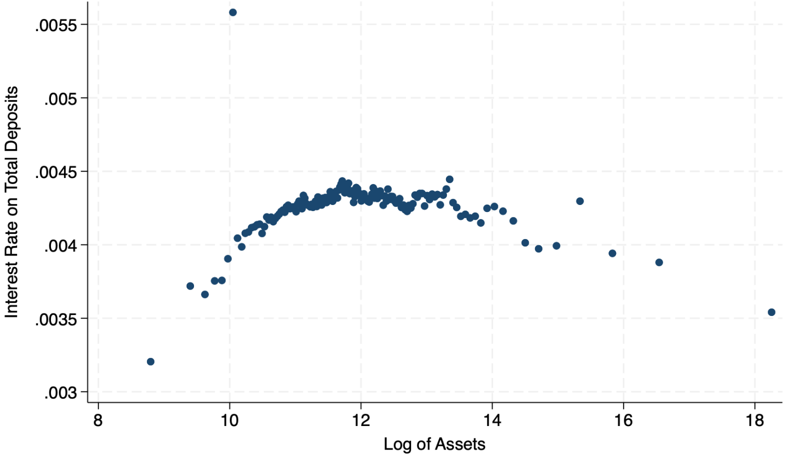
Deposit Rates vs. Bank Size CHECK



Binscatter of checking deposit rates (Ratewatch) controlling for quarterly fixed effects.

Deposit Rates vs. Bank Size

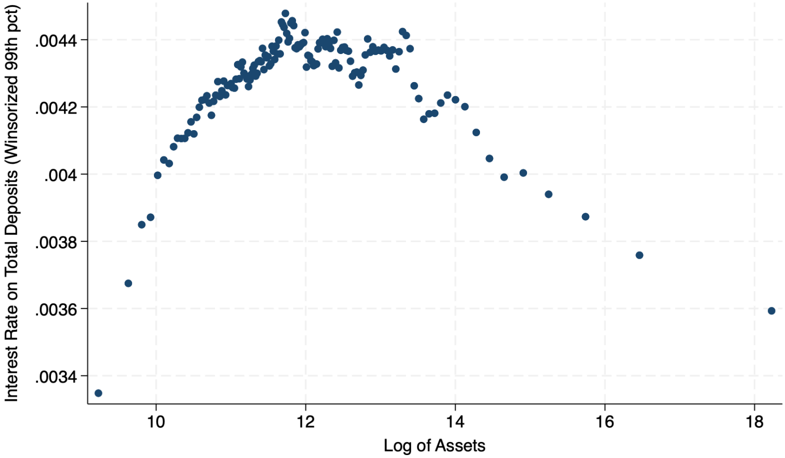
back



Binscatter of deposits interest rates (Call Reports) controlling for quarterly fixed effects.

Deposit Rates vs. Bank Size

back



Binscatter of deposits rates (Call Reports) controlling for quarterly fixed effects and winsorized at the 99th percentile.