# Competition for Neighborhood Deposits

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DC Urban Day
May 2025

# What is the geographic scope of retail banking markets?

- The geographic scope of bank markets is important for measuring and evaluating financial risks, monetary policy effects, bank-merger policy, and credit access...

...however, there is no consensus on the right measurement of geographic scope

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  - Political: Counties (Drechsler et al., 2017; Wang et al., 2022)
  - Statistical: MSAs (Adams et al., 2007; Dick, 2008; Ho and Ishii, 2011), Tracts (Nguyen, 2019)
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  - Heterogeneously determined by each district bank
  - Based on the physical location of branches, not the customers they serve

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# Competition for Neighborhood Deposits

We approach defining banking market based on consumer choice perspective

- For each census tract, a *representative household depositor* allocates a fixed amount of liquid savings (LS) across bank branches and an outside option
- Depositor search radius based on county density and location of branches
- Depositors first choose between Local, Regional, and Nationwide banks, and then branches within these nests
  - All other choices part of 'outside option'
- Each bank uses uniform pricing and has a 'brand' quality
- Branches differ on distance, age, workers, HQ status, and full vs limited service
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# Competition for Neighborhood Deposits

We build on prior approaches to market determination and specifically bank markets

- Classic literature: Elzinga and Hogarty (1973); Horowitz (1981); Stigler and Sherwin (1985)
- Our approach based on Ellickson, Grieco, and Khvastunov (2020)
  - Spatial retail markets for grocery stores
  - Representative customer at tract level allocates income to groceries
  - Aggregate Nested Logit Model to match store revenues
  - Assume firm level unobserved amenities / prices, include firm FEs
- Other approaches in banking:
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# Research agenda

1. Current:
   - Estimate consumer choice model, predict tract/branch allocations of deposits, compute tract-based HHI
2. Early Stages:
   - Do aggregate, branch-based market definitions obscure the effect of mergers on competition for household deposits?
   - To what extent do aggregate market definitions both under-estimate and over-estimate the change in HHI for relevant consumers?
3. Future Work:
   - How does neighborhood competition translate into product and price differences?
   - Do banks in more concentrated neighborhoods have a lower cost of funds?
   - Does neighborhood concentration predict branch entry and exit?
   - How has technology and online banking affected neighborhood competition?

# Results

- Deposit Elasticity wrt Distance, Income
  - Distance Elasticity: switches from positive to negative around 3 miles
  - Med Inc Elasticity: low density tracts have negative/zero income elasticity
- Significant heterogeneity in market concentration *within* standard geographies
  - Tract HHI negatively correlated with Density, Liquid Savings
  - Lower Tract HHI associated with greater rate dispersion
- Fed Markets / Counties may understate consumers affected by concentration
  - Tract based merger screening shows about double affected depositors
- Segmented markets
  - Evidence that local banks are less substitutable than regional or national

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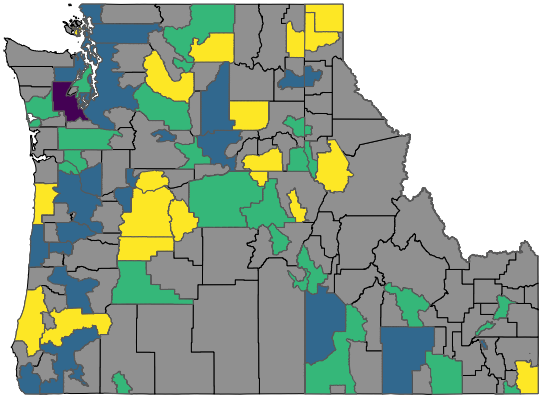
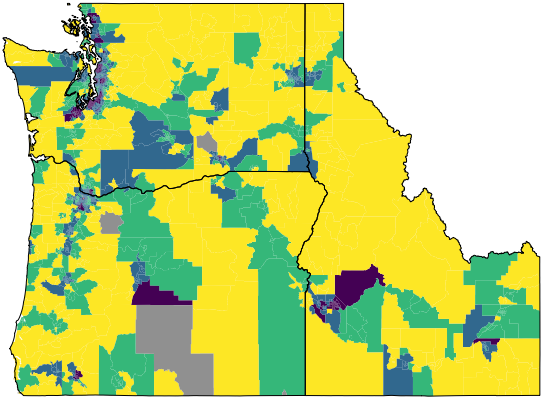
# Spatial Concentration Comparison

## FED Banking Markets



## Tract Based Markets



# Roadmap

1. Model description
2. Estimation and Data description
3. Results
    a. Distance and Tract Income elasticity
    b. Tract HHI: spatial distribution and correlations
    c. Merger Simulation: Tract Markets vs FED Markets vs County

# Model: Notation

- Each bank, $j \in J$, belongs to a nest, $g \in G$
- Each branch, $b \in \mathcal{B}$, is part of a bank $j$ and has characteristics $Y_b$
- Each depositor, $\ell \in \mathcal{L}$, has liquid savings LS, a distance threshold $X$, consumer characteristics $Z$, and location characteristics $W$
- Each depositor allocates savings across all branches within search distance, $\mathcal{B}_\ell = \{b \mid x_{\ell b} < X_\ell\}$, to maximize utility
- We use a stopping algorithm for the search:
  - L County Density $< 5$ person/sqmi : min 10 mi search, min 3 branches, 1 mi buffer
  - M County Density $5 - 75$ person/sqmi : min 5 mi search, min 3 branches, 0.5 mi buffer
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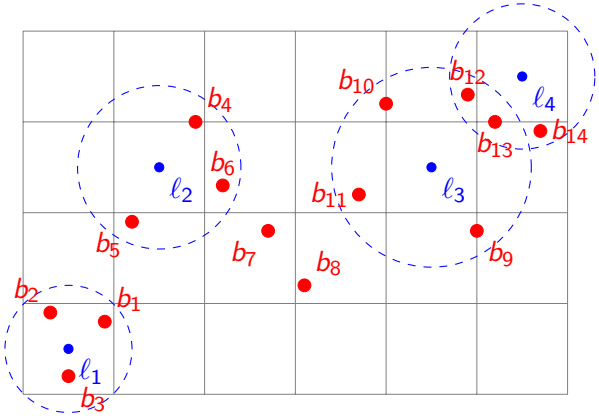
# Branch Choice Model Visualization




- Depositors consider branches within their search radius
- Branches have overlapping-but-idiosyncratic customer sets
- Utility depends on distance, branch characteristics, and depositor characteristics

# Model: Utility

Depositor considers where to allocate each dollar of liquid savings:

- Utility for a dollar ($i$) of liquid savings for $\ell$ at branch $b$:

$$u_{i\ell b} = V(x_{\ell b}, Y_b, Z_\ell; \beta) + \epsilon_{i\ell b}$$

- Utility for a dollar ($i$) of liquid savings for $\ell$ at outside option:

$$u_{i\ell 0} = O(W_\ell, Z_\ell; \pi) + \epsilon_{i\ell 0}$$

# Model: Branch Choice Share, Demand Function

We assume that $\epsilon$ is distributed such that utility maximization leads to a nested logit demand function:

$$\begin{aligned}
\Pr(\iota_{\ell b} = 1) &= \underbrace{\Pr(\iota_{\ell b} = 1 \mid b \in g_b^\ell)}_{\substack{\text{Prob of choosing } b \\ \text{given choice of type } g}} \cdot \underbrace{\Pr(g_b^\ell \subseteq \mathcal{B}_\ell)}_{\substack{\text{Prob of choosing type } g \\ \text{given branches in } \mathcal{B}_\ell}} \\
&= \frac{e^{V_{\ell b}(\beta)/\rho_{g_b}}.}{\left(\sum_{k \in g_b^\ell} e^{V_{\ell k}(\beta)/\rho_{g_b}}\right)} \cdot \frac{\left(\sum_{k \in g_b^\ell} e^{V_{lk}(\beta)/\rho_{m_b}}\right)^{\rho_{g_b}}}{\sum_{g \in G}\left(\sum_{k \in g_b^\ell} e^{V_{\ell k}(\beta)/\rho_g}\right)^{\rho_g} + e^{O_\ell(\pi)}} \\
&= d_{\ell b}(\beta, \rho, \pi)
\end{aligned}$$

# Model: Predicted Deposits

We can aggregate tract-branch predictions to the branch level deposit predictions:

- Tract-Branch deposit flow prediction:

$$D_{\ell b}(\beta, \rho, \pi) = d_{\ell b}(\beta, \rho, \pi) \cdot \mathsf{LS}_{\ell}$$

- Branch deposit prediction:

$$\hat{D}_b(\beta, \rho, \pi) = \sum_{\ell \in \mathcal{L}_b} D_{\ell b}(\beta, \rho, \pi)$$

# Estimation

- Use model to predict $\hat{D}_b(\beta, \rho, \pi)$
- Branch Residuals:
  1. Get branch-level model (log) deviations $\eta_b := \ln[D_b] - \ln[\hat{D}_b(\beta, \rho, \pi)]$
  2. Regress $\eta_b$ on measures of business activity near $b$
  3. Calculate branch level model residual: $\delta_b$
- Aggregate Outside Good Residual:
  1. Calculate aggregate outside good prediction: $\hat{\mathsf{d}}_0 = \frac{\sum_\ell \hat{D}_\ell}{\sum_\ell \mathsf{LS}_\ell}$
  2. Calculate deviation from data: $\delta_0 = \mathsf{d}_0 - \hat{\mathsf{d}}_0$

Estimation is then:

$$\min_{\beta,\rho,\pi} \left\{ \delta_0^2 + \sum_{b \in \mathcal{B}} \delta_b^2 \right\}$$

# Identification

The model is identified under the following assumptions (EGK 2020):

1. Taste preferences, $\epsilon$, and model deviations, $\delta$, are both uncorrelated with
   (i) store locations & characteristics and
   (ii) consumer characteristics
2. Branch quality and product pricing are at the bank level

# Data

- Liquid Savings: Survey of Consumer Finances, American Community Survey
- Tract characteristics: American Community Survey, HHUUD10 (Markley et al, 2021)
- Bank characteristics: RIS
  - Drop: Bankers' Banks, Foreign Charter, COREDEP $\leq 0$, DEP/ASSET $\leq 0.1$
- Branch characteristics: SOD, Your Economy Time Series (YETS)

**Note**

Current results are for ID, OR, WA

# Liquid Savings

We estimate tract level liquid savings in multiple steps:

- SCF data
  1. $\text{LS}_i = \text{Checking} + \text{Savings} + \text{MMDA} + \text{MMMF} + \text{CDs} + \text{Call Money}$
  2. Predict LS using GLM (Gamma family, log link), Save parameters: $\hat{\theta}$
     - SCF models for single/partner households by owner/renter status
     - Covariates include demographics, education, employment, income, household size, and home valuation/rent
- ACS data
  1. Fit GLM parameters on ACS data: $\text{LS}_i(\hat{\theta})$
  2. Sum predictions to PUMA level: $\text{LS}_{\text{PUMA}}$
  3. Distribute PUMA-level LS to tracts based on tract/PUMA income share: $\text{LS}_\ell = \text{LS}_{\text{PUMA}} \cdot (\mathcal{I}_\ell / \mathcal{I}_{\text{PUMA}})$

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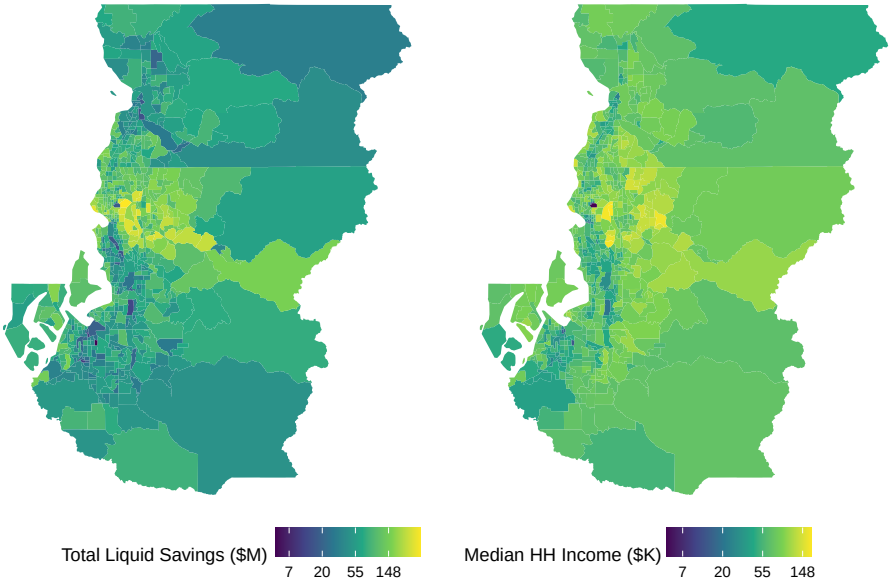
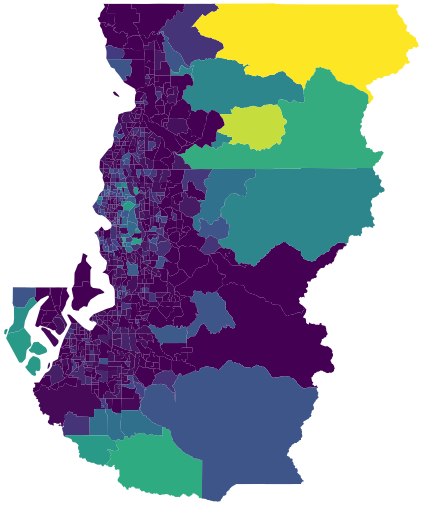
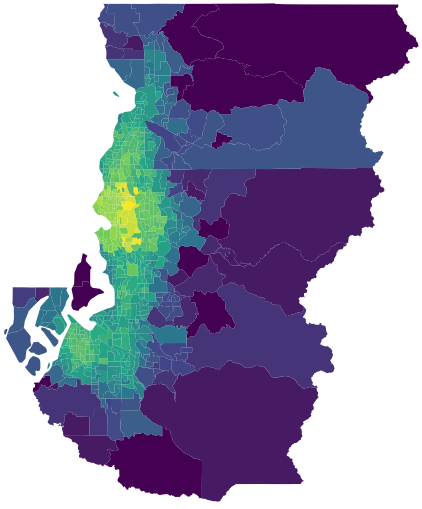
# Liquid Savings vs Median HH Income: Seattle



# Search Distance and Matching: Seattle



# Tract, Branch Characteristics

- Tract-Branch: $x$ distance in miles
- Tract Characteristics
  - Z Median Income, Pct w/ Car, Pct w/ College Degree, Pct 65+, Employment-Population Ratio
  - W Population, Land Area, Developed Land, Number of Branches within 25 miles, 2010-2020 Pct Population Change
- Branch Characteristics
  - Y Main Branch, Full Service, Branch Employment, Branch Age
  - FE Bank FEs:
    - Nationally Large: All banks above $95^{th}$% with 5+ branches
    - Locally Large: Top 5 banks above $85^{th}$% in each state, not already Nationally Large, with 5+ branches
    - All other banks are either 'Small' or 'Midsize'

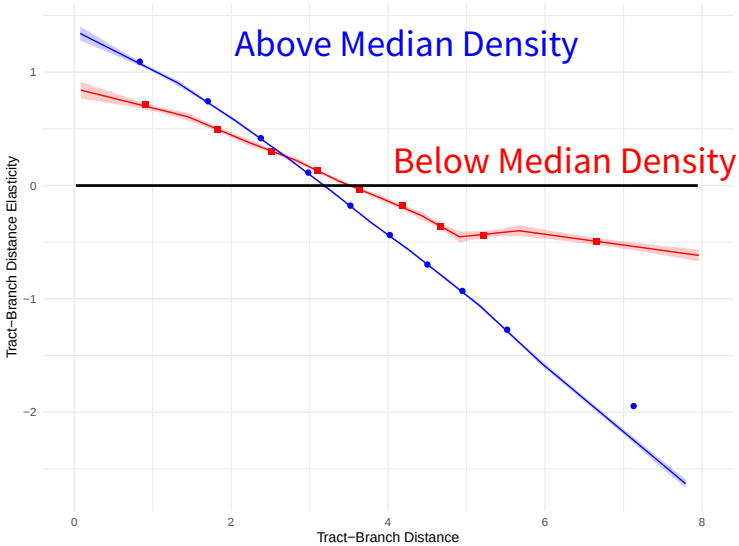
# Nesting Specification

- Local: Assets $< \$1B$, Single State
  $\rightarrow$ 108 Banks
- Regional: Not Local, Assets $< 100^{th}\%$, States $\leq 5$
  $\rightarrow$ 33 Banks
- Nationwide: Not Local and Not Regional
  $\rightarrow$ 16 Banks

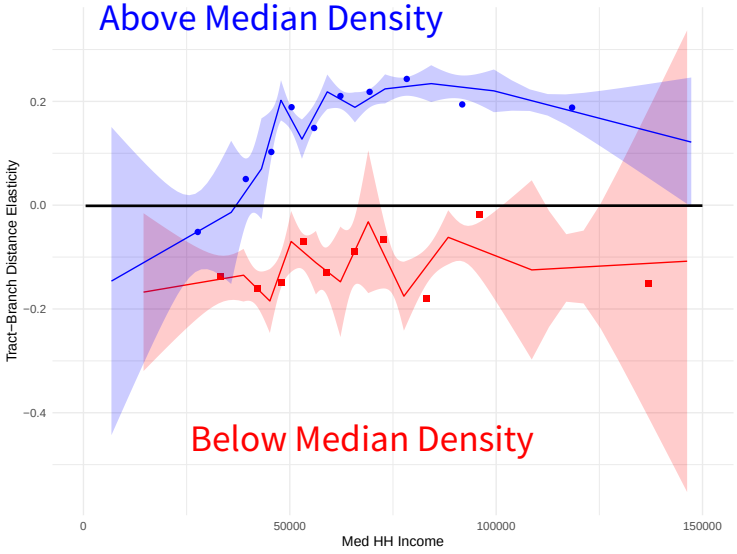
# Results Overview

- Distance, Tract Income, Branch Worker Elasticities
- Tract-HHI Distributions, Maps, Descriptive Regs
- Simulated Merger Pre-Screening Differences

# Distribution of Distance Elasticity by Density



# Distribution of Income Elasticity by Density



# Tract-HHI (or THHI)

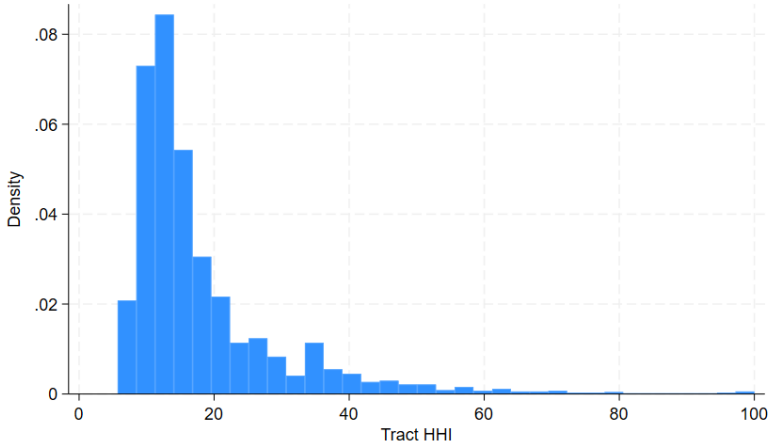
- How to measure deposit market concentration within the neighborhood choice set?
- HHI for representative household in tract $\ell$ with choice set $\mathcal{J}_\ell$:

$$THHI_\ell = 100 \cdot \sum_{j \in \mathcal{J}_\ell} \left( \frac{d_{\ell j}}{\sum_{k \in \mathcal{J}_\ell} d_{\ell k}} \right)^2 . \tag{1}$$

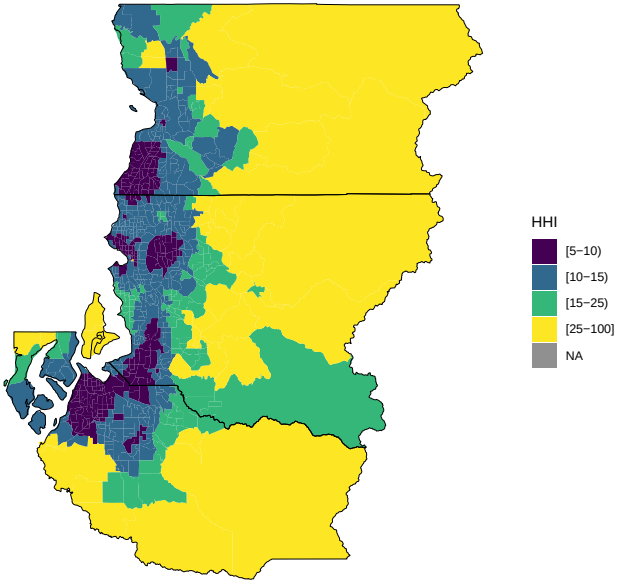
- $d_{\ell j}$ is the share of deposits that go to branches of *bank j* for location $\ell$
- Market area for tract $\ell$ may include branches that are outside of tract $\ell$

# Distribution of THHI

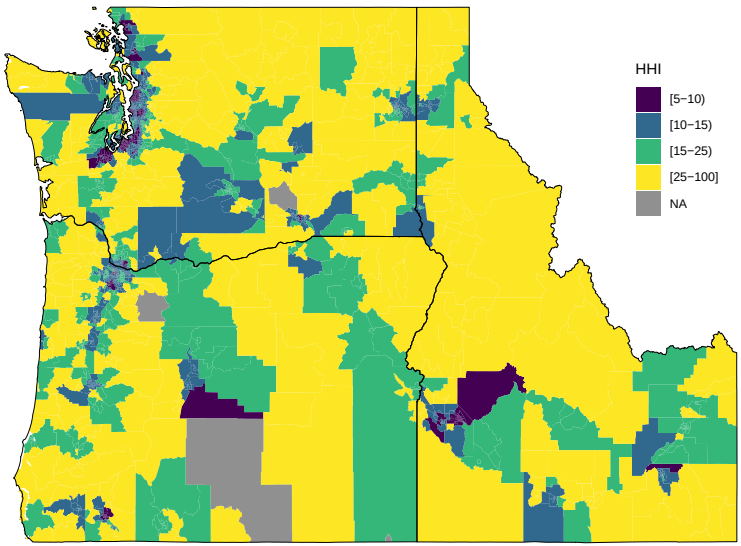
- Mean THHI across tracts is 18.3 with standard deviation of 12.1.
- For reference, 21 is the 2010, branch-based county HHI (deposit weighted average across counties), from Gödl-Hanisch (FDIC CFR WP 2022).



# THHI: Seattle



# THHI: ID, OR, WA



# Geographic variation in THHI

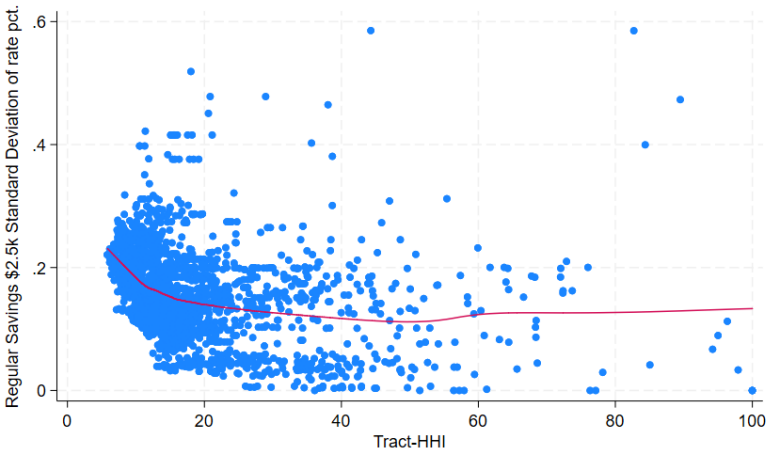
| VARIABLES | (Mean/SD) | (1) | (2) |
|---|---|---|---|
| Pop density, log | 6.7 / 2.3 | -3.030*** | -2.499*** |
| | | (0.150) | (0.182) |
| Savings per pop, $m | 0.015 / 0.008 | -81.42** | -114.3** |
| | | (38.76) | (45.08) |
| College degree, shr. | 0.226 | -2.832 | -4.454 |
| | | (3.480) | (4.012) |
| Age 65, shr. | 0.126 | 8.977** | 0.171 |
| | | (3.962) | (3.607) |
| Vehicle at home, shr. | 0.937 | -5.233 | 1.655 |
| | | (3.999) | (4.465) |
| Constant | 1 | 44.30*** | 39.77*** |
| | | (4.257) | (4.750) |
| Observations | 2,564 | 2,564 | 2,564 |
| County FE | | NO | YES |
| R-squared | | 0.346 | 0.486 |

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

# Associations of THHI and deposit rates

- Standard Deviation of savings rate vs. THHI (scatter and lowess fit)



# Merger Simulation

| | Average of All Possible Shared County Mergers | | | |
|---|---|---|---|---|
| | Ch HHI | Pct Scrutiny | Pct Likely | Pop Share Likely |
| Tract-Markets | 0.22% | 0.22% | 0.05% | 0.05% |
| Fed-Markets | 0.02% | 0.25% | 0.07% | 0.02% |
| F-Mkt Agg Tracts | 0.02% | 0.34% | 0.12% | 0.03% |
| Counties | 0.02% | 0.20% | 0.10% | 0.04% |
| County Agg Tracts | 0.02% | 0.28% | 0.12% | 0.04% |
| | Two Random Top 10 Asset Banks Merge | | | |
| | Ch HHI | Pct Scrutiny | Pct Likely | Pop Share Likely |
| Tract-Markets | 2.9% | 33% | 5.8% | 6.0% |
| Fed-Markets | 1.1% | 16% | 1.6% | 0.12% |
| F-Mkt Agg Tracts | 1.3% | 32% | 6.3% | 1.1% |
| Counties | 0.7% | 14% | 1.7% | 0.77% |
| County Agg Tracts | 1.0% | 24% | 4.3% | 1.5% |

Note: Authors' calculations; 2,564 tracts, 63 Fed-Markets, 117 Counties

# Conclusions

- Our paper approaches spatial bank markets from a model-based perspective of household choice of branches.
- Coefficient estimates reveal that unobserved demand is less correlated for local banks than regional or nationwide banks, which hints that local banks are able to find niche market opportunities.
- Elasticity results reveal differences in bank business strategies, where some banks are geographically positioned to serve households while others may be choosing to target business deposits.
- THHI results display tremendous heterogeneity in concentration levels, from perfectly concentrated to highly competitive even within counties or Fed-markets.