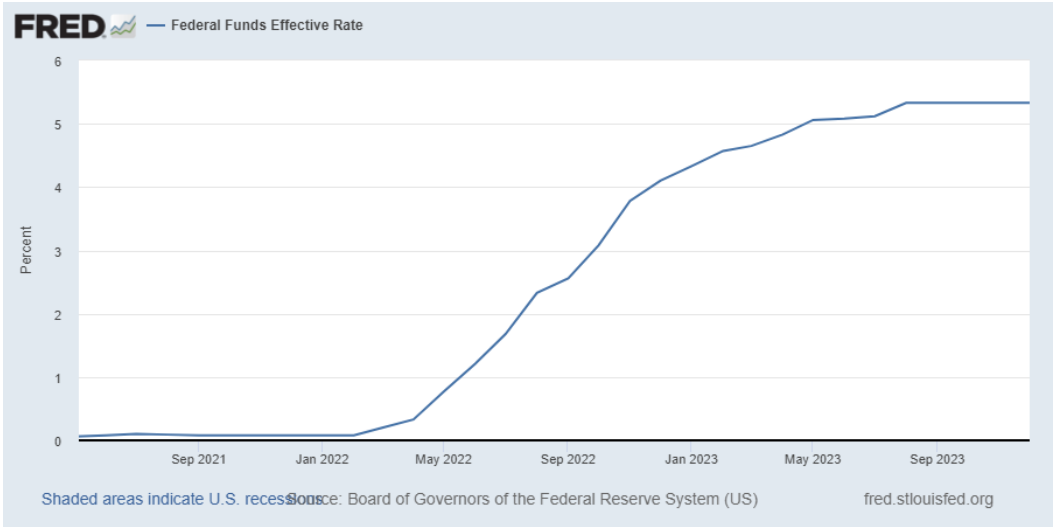
Depositor Characteristics and Deposit Stability

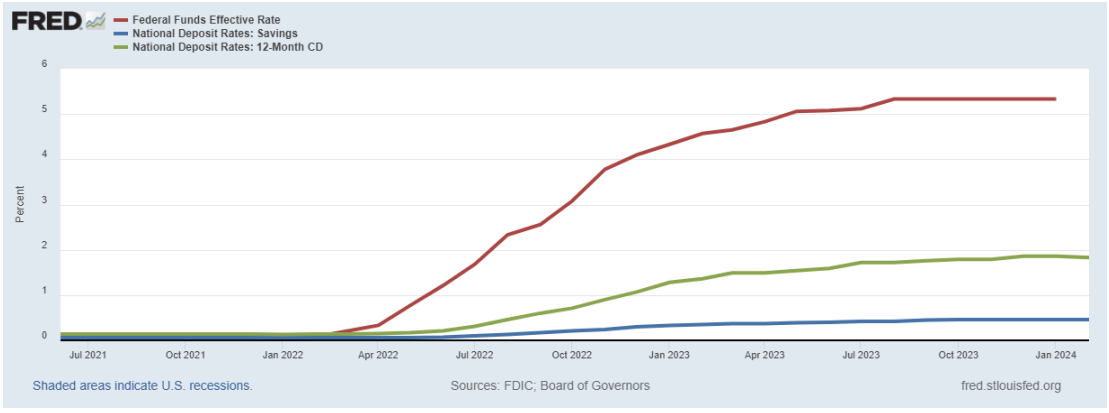
Rajesh Narayanan (LSU) and **Dimuthu Ratnadiwakara (FRB-Richmond)***

FDIC Bank Research Conference | September, 2024

Rapid increase in interest rates in 2022-2023



Banks Raised their Deposit Rates Less Than One-for-One with the Fed Funds Rate



Deposit Instability

- Depositors digitally walked away: Koont, Santos, and Zingales (2023)
- Social media fuelled fast runs in March 2023: Cookson et al. (2023)

Depositor Characteristics and Deposit Stability

- Who left? What are their characteristics?

Depositor Characteristics and Deposit Stability

- Who left? What are their characteristics?

This paper: We use cellphone geolocation data to construct demographic profiles of bank depositors to examine how depositor characteristics impact deposit stability

Findings

- Depositors vary in age, income, education and financial sophistication across banks/branches

Findings

- Depositors vary in age, income, education and financial sophistication across banks/branches
- Depositor characteristics are related to deposit flows and rate-setting behavior during 2022-2023 rate hikes

Findings

- Depositors vary in age, income, education and financial sophistication across banks/branches
- Depositor characteristics are related to deposit flows and rate-setting behavior during 2022-2023 rate hikes
- ....Banks with financially sophisticated depositors suffered greater deposit runoffs despite raising rates

Findings

- Depositors vary in age, income, education and financial sophistication across banks/branches
- Depositor characteristics are related to deposit flows and rate-setting behavior during 2022-2023 rate hikes
- ....Banks with financially sophisticated depositors suffered greater deposit runoffs despite raising rates
- ....which led to losses in deposit franchise value

Findings

- Depositors vary in age, income, education and financial sophistication across banks/branches
- Depositor characteristics are related to deposit flows and rate-setting behavior during 2022-2023 rate hikes
- ....Banks with financially sophisticated depositors suffered greater deposit runoffs despite raising rates
- ....which led to losses in deposit franchise value

Roadmap

Theoretical Background

Data

Identifying Depositor Demographic Characteristics

Depositor Characteristics

Impact on Deposit Beta

Impact on Deposit Flows

Deposit franchise value (Drechsler et al. (2023))

Assume the Fed funds rate at t_0 is 0, and r' at t_1. Then deposit franchise value at t_1 is:

$$DF(r') = D \times (1 - w(r')) \times \left(\frac{r' - \beta r'}{r'} - \frac{c}{r'} \right)$$

Deposit franchise value (Drechsler et al. (2023))

Assume the Fed funds rate at t_0 is 0, and r' at t_1. Then deposit franchise value at t_1 is:

$$DF(r') = D \times (1 - w(r')) \times \left(\frac{r' - \beta r'}{r'} - \frac{c}{r'} \right)$$

Deposits at t_0

Deposit franchise value (Drechsler et al. (2023))

Assume the Fed funds rate at t_0 is 0, and r' at t_1. Then deposit franchise value at t_1 is:

$$DF(r') = D \times (1 - w(r')) \times \left(\frac{r' - \beta r'}{r'} - \frac{c}{r'} \right)$$

Deposit flight from t_0 to t_1

Deposit franchise value (Drechsler et al. (2023))

Assume the Fed funds rate at t_0 is 0, and r' at t_1. Then deposit franchise value at t_1 is:

$$DF(r') = D \times (1 - w(r')) \times \left(\frac{r' - \beta r'}{r'} - \frac{c}{r'} \right)$$

PV of deposit spread

Deposit franchise value (Drechsler et al. (2023))

Assume the Fed funds rate at t_0 is 0, and r' at t_1. Then deposit franchise value at t_1 is:

$$DF(r') = D \times (1 - w(r')) \times \left(\frac{r' - \beta r'}{r'} - \frac{c}{r'} \right)$$

PV of operational expenses

Deposit franchise value (Drechsler et al. (2023))

Assume the Fed funds rate at t_0 is 0, and r' at t_1. Then deposit franchise value at t_1 is:

$$DF(r') = D \times (1 - w^*(r')) \times \left(\frac{r' - \beta^* r'}{r'} - \frac{c}{r'} \right)$$

In equilibrium, banks set β and depositors withdraw w

Deposit franchise value (Drechsler et al. (2023))

Assume the Fed funds rate at t_0 is 0, and r' at t_1. Then deposit franchise value at t_1 is:

$$DF(r') = D \times (1 - w^*(r')) \times \left(\frac{r' - \beta^* r'}{r'} - \frac{c}{r'} \right)$$

We examine how depositor characteristics are related to β and w

Roadmap

Theoretical Background

Data

Identifying Depositor Demographic Characteristics

Depositor Characteristics

Impact on Deposit Beta

Impact on Deposit Flows

Data Sources

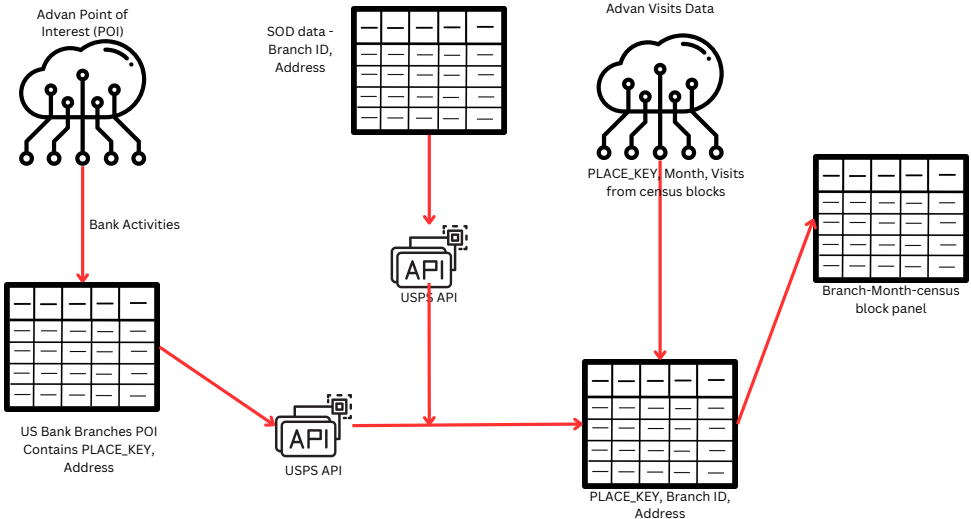
Advan Monthly Patterns: Aggregated mobile device data on monthly POI visits, including visitor frequency, duration, and origin census block group, starting from January 2019.

FDIC SOD Data: Provides branch-level deposit information for U.S. bank branches as of June 30th each year, with identifiers and branch addresses.

US Call Reports Data: Quarterly reports on financial health and performance of U.S. banks, publicly available with details such as assets, equity, and operating expenses.

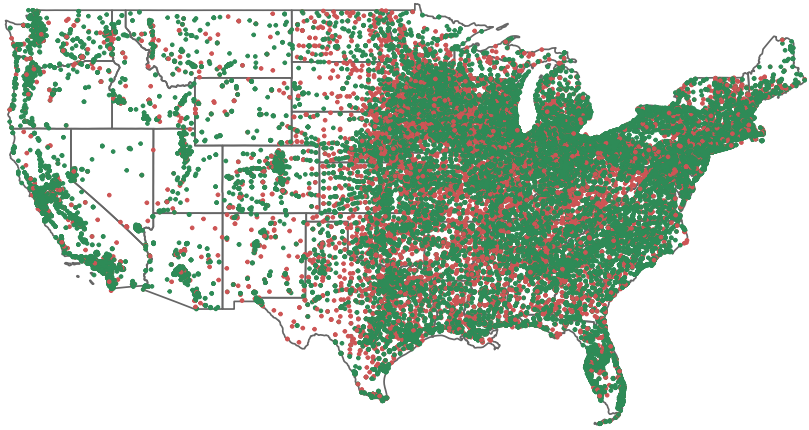
ACS 5-Year Data: Census tract-level demographic and socioeconomic information in the United States, used to proxy characteristics of visitors in Advan Monthly Patterns data.

Identifying Visits to Bank Branches



Bank Branches - SOD-POI Match

76% match



Roadmap

Theoretical Background

Data

Identifying Depositor Demographic Characteristics

Depositor Characteristics

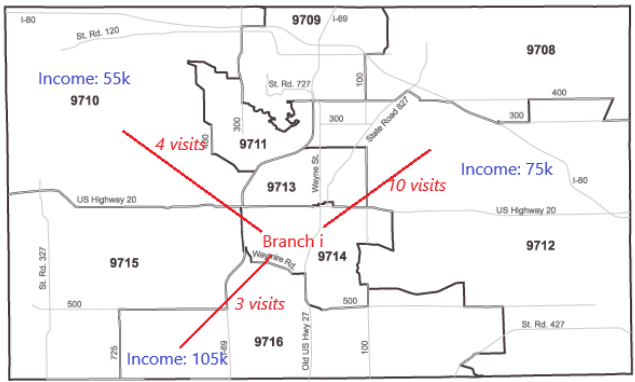
Impact on Deposit Beta

Impact on Deposit Flows

Branch-Level Characteristics

Consider visits to bank branch i from census tract j

in month m



$$Income_{im} = \sum_j \left[\frac{v_{ijm}}{V_{im}} \times Income_j \right]$$

$$Income_{im} = \frac{105 \times 3 + 75 \times 10 + 55 \times 4}{17}$$

$$Income_{im} = 75.59$$

Aggregate to Bank-Level

$$X_{bim} = \sum_j \left[\frac{v_{itm}}{V_{im}} \times X_j \right]$$

$$X_{bm} = \sum_i \left[\frac{v_{im}}{V_{bim}} \times X_{bim} \right] \Rightarrow X_b = \frac{\sum_m X_{bm}}{\sum_m 1}$$

Roadmap

Theoretical Background

Data

Identifying Depositor Demographic Characteristics

Depositor Characteristics

Impact on Deposit Beta

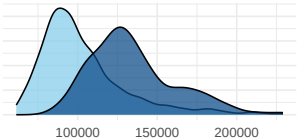
Impact on Deposit Flows

By Bank Size

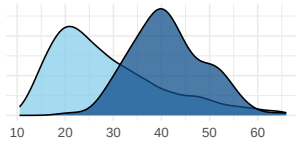
	Less than 1b (1)	1 to 10b (2)	10 to 50b (3)	50 to 250b (4)	More than 250b (5)
Number of banks	3,006	782	102	30	11
Family income ($)	98,557	120,891	132,158	152,363	146,715
College educated (%)	26.900	36.600	40.900	45.800	44.200
Age	41.200	40.300	39.800	39.700	39.100
Tax returns with dividend (%)	17.700	20.500	21.500	23.600	21.900
Tax returns with capital gains (%)	15.900	18.100	19.200	21.400	19.500
Homes refinanced in 2020-2021 (%)	25.600	33.100	36.500	37.600	34.700

Large variations

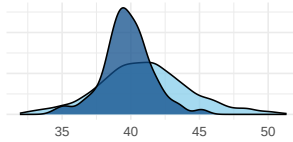
Income ($)



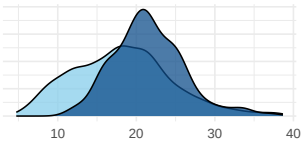
% College Educated



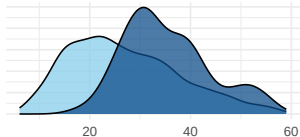
Age



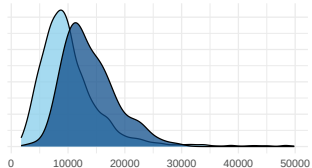
With Dividends %



% Mortgages Refinanced



Distance



"Sophisticated" Depositors

- A bank or a branch is classified as having sophisticated depositors if it exceeds the median for all the following customer characteristics:
  - → Customer income levels
  - → Percentage of customers with a college education
  - → Percentage of customers receiving dividend income
  - → Percentage of customers who refinanced mortgages in 2020-2021

- These thresholds vary based on the bank's size category (small <$10bn and large >$10bn).

Roadmap

Theoretical Background

Data

Identifying Depositor Demographic Characteristics

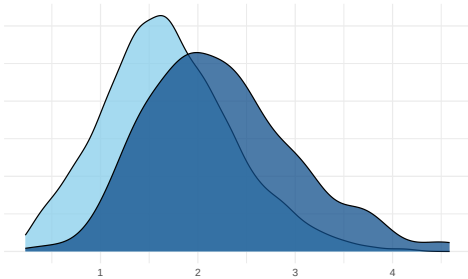
Depositor Characteristics

Impact on Deposit Beta

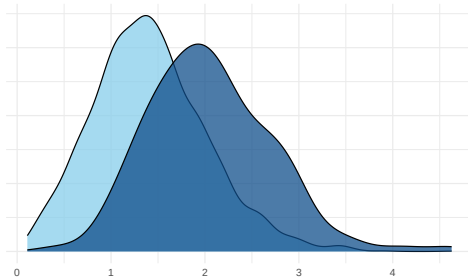
Impact on Deposit Flows

Change in Interest Rate Expense – large variations

Panel A: $IntExp$ in Q4 2023

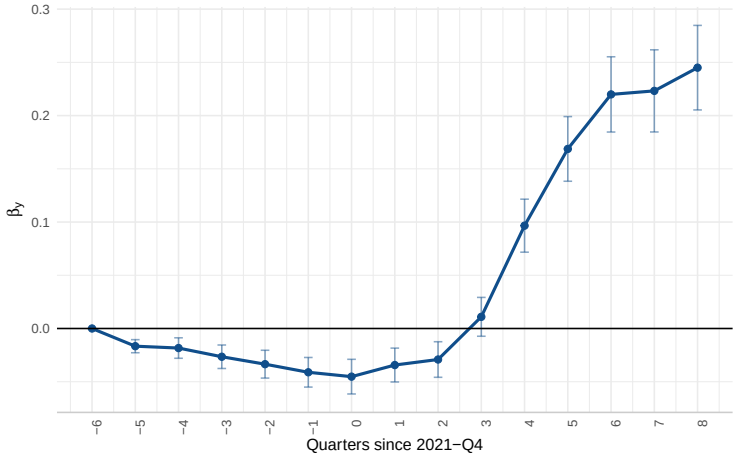


Panel B: $\Delta IntExp$ Dec 2021 - Dec 2023



Banks with sophisticated customers increased rates more

$$IntExp_{b,q} = \alpha + \sum_{q=-6}^{8} \beta_q \times Sophisticated_b + \mathbf{\Gamma X} + \text{Bank FE} + \text{Quarter FE} + \epsilon_{bq}$$



Roadmap

Theoretical Background

Data

Identifying Depositor Demographic Characteristics

Depositor Characteristics

Impact on Deposit Beta

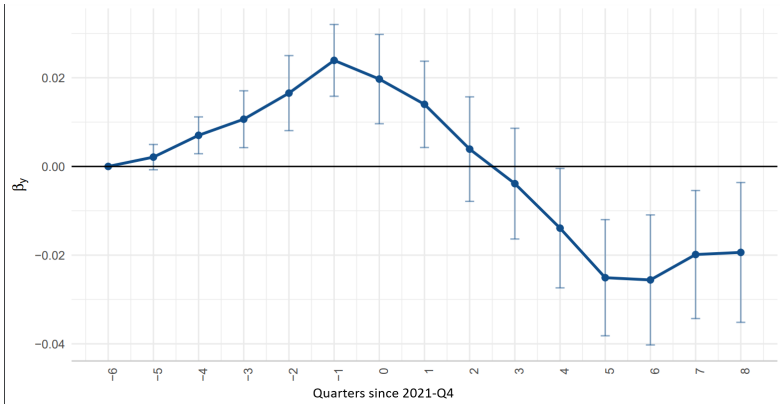
Impact on Deposit Flows

Large variations in deposit flows

Variable	Bank size	p10	p25	p50	p75	p90
Core deposits	Less than 10b	−13.560	−7.760	−1.170	6.240	17.920
	More than 10b	−19.020	−13.360	−5.280	4.920	28.860
Uninsured deposits	Less than 10b	−24.250	−13.660	−0.820	14.170	35.120
	More than 10b	−27.450	−21.500	−8.710	2.710	30.470
Insured deposits	Less than 10b	−5.960	−0.810	6.490	19.070	44.230
	More than 10b	0.790	6.650	20.770	56.080	89.200
Time deposits	Less than 10b	−4.370	15.070	43.150	85.720	148.560
	More than 10b	29.250	61.220	138.060	305.160	472.120

Banks with sophisticated customers had greater deposit runoffs

$$Coredeposits_{b,q} = \alpha + \sum_{q=-6}^{8} \beta_q \times Sophisticated_b + \boldsymbol{\Gamma X} + \text{Bank FE} + \text{Quarter FE} + \epsilon_{bq}$$



Branch-level Data

Bank-level confounding factors?

- Banks of various sizes function in different markets (d'Avernas et al. (2023))
- Cater to customer bases with differing attributes

Branch-level Data

Bank-level confounding factors?

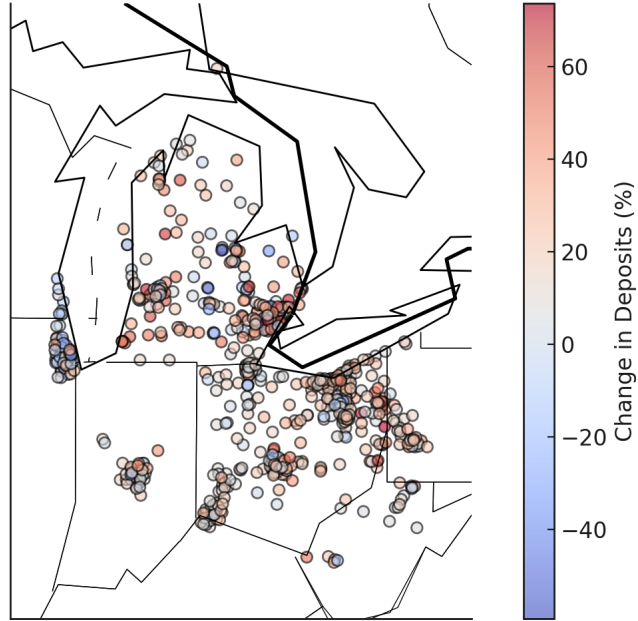
- Banks of various sizes function in different markets (d'Avernas et al. (2023))
- Cater to customer bases with differing attributes

Branch-level deposit changes rule out these alternative explanations

- Branch-level deposit data from FDIC Summary of Deposits (SOD) as of June 30th each year
- Allows us to focus on within-bank (bank fixed effects) variation of deposit changes (June 2021 - June 2023)
- Implement county-fixed effects to rule out local economic shocks

Deposit changes across **Huntington Bank**'s branches during the most recent Fed rate hike cycle

- Large variations
- These variations can be explained by depositor characteristics



Higher deposit outflows when customers are more sophisticated

- Sample: bank branches
- Dependent variable $\Delta deposits$ from June 2021 to June 2023
- Includes bank and county fixed effects

	Assets $<$ 10 bn		Assets 10-250 bn		Assets $>$ 250 bn		KRE Constituents	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
sophisticated	-2.659^{***}	-1.883^{***}	-3.106^{***}	-1.517^{***}	-2.040^{*}	-2.005^{*}	-2.973^{***}	-1.393^{***}
	(0.413)	(0.487)	(0.413)	(0.413)	(1.050)	(0.916)	(0.413)	(0.467)
N	16,541	16,541	15,193	15,193	16,741	16,741	12,433	12,433
Bank FE	Y	Y	Y	Y	Y	Y	Y	Y
County FE	N	Y	N	Y	N	Y	N	Y

Robustness

- Supplementing physical visit data with mobile and web data shows qualitatively unchanged results, but stronger for banks with lower online visit intensity

- Similar results:

  → for the period from the start of Fed rate hikes to the quarter before the SVB collapse

  → when $\frac{\text{Deposit interest}}{\text{Total deposits}}$ is used instead of $\frac{\text{Total interest}}{\text{Total assets}}$
  (Rules out funding composition changes)

  → for both the banks with high and low $\frac{\text{HTM}}{\text{Total assets}}$
  (Independent of unrealized losses on the asset side)

Conclusion

- Banks with more financially sophisticated depositors (higher income, education, financial market participation):
  - → Increased deposit rates more (had higher deposit betas)
  - → Experienced greater deposit outflows
  - → Which reduced their deposit franchise value

Conclusion

- Banks with more financially sophisticated depositors (higher income, education, financial market participation):
  - → Increased deposit rates more (had higher deposit betas)
  - → Experienced greater deposit outflows
  - → Which reduced their deposit franchise value

- Policy Implications:
  - → Granular approach to deposit modeling: Federal Reserve Bank of San Francisco (2021), Kupiec (2023), and Moody's Analytics (2023)
  - → Incorporate characteristics of a bank's depositor base when evaluating interest rate risk and deposit flight vulnerability.