The Dynamics of Deposit Flightiness and its Impact on Financial Stability

Kristian Blickle
NY Fed

Jian Li
Columbia

Xu Lu
U. of Washington

Yiming Ma
Columbia

ECB Money Market Conference, 2024

Deposit Flightiness

- Deposits are a key source of funding for the banking system
- Rate-insensitive deposits allow for safe maturity transformation
- Flighty deposits can trigger panic runs and inefficient asset liquidation
- Existing evidence on deposit flightiness in the cross-section
  - E.g., Wholesale versus retail deposits
  - E.g., Insured versus uninsured deposits

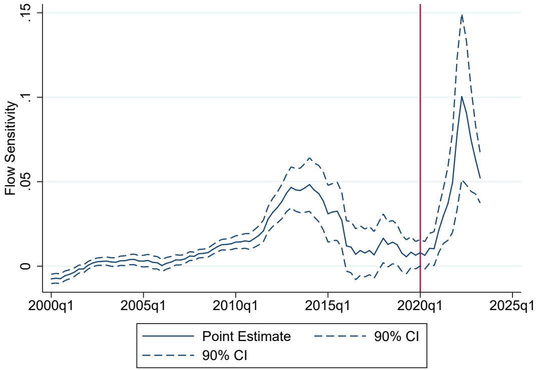
Research Questions

1. What is the aggregate deposit flightiness at a given point in time? How does it evolve over time?
2. What are the determinants of aggregate deposit flightiness?
3. What are the implications for conventional monetary policy, unconventional monetary policy, and their interaction?

1. How Does Deposit Flightiness Evolve over Time?

- Deposit flightiness exhibits pronounced fluctuations over time
- Flow sensitivity: when a bank increases its deposit rates by 1 ppts, what is the change in its deposit flows?

Figure: Deposit Flow Sensitivity



2. What are the Determinants of Deposit Flightiness?

- Heightened deposit flightiness coincides with large inflows
  - Low interest rate environments
  - Expanded central bank balance reserve supply (QE / APP)
  - Potentially from non-banks

2. What are the Determinants of Deposit Flightiness?

- Heightened deposit flightiness coincides with large inflows
  - Low interest rate environments
  - Expanded central bank balance reserve supply (QE / APP)
  - Potentially from non-banks
- Dynamic bank-run model
  - Investors in banks are less rate sensitive/value deposit convenience by more than investors in outside options, i.e., non-banks
  - After influx from outside investors, the marginal depositor in the banking system values deposit convenience less than before the influx
  - $\uparrow$ aggregate deposit flightiness when lower interest rates and reserve expansions draw in more deposits into banks

3. What are the Implications?

- Interaction between conventional and unconventional monetary policy
  - QE attracts flightier deposits into the banking system
  - For a given rate hike, deposit outflows and increase in run risk are larger following QE unless all reserves are cost-less to sell

3. What are the Implications?

- Interaction between conventional and unconventional monetary policy
  - QE attracts flightier deposits into the banking system
  - For a given rate hike, deposit outflows and increase in run risk are larger following QE unless all reserves are cost-less to sell
- Speed of rate hikes matters
  - Depositor run risk larger with a faster speed of rate hikes, compared with a gradual rate hike
  - Gradual rate hike allows depositor base to adjust slowly

3. What are the Implications?

- Interaction between conventional and unconventional monetary policy
  - QE attracts flightier deposits into the banking system
  - For a given rate hike, deposit outflows and increase in run risk are larger following QE unless all reserves are cost-less to sell
- Speed of rate hikes matters
  - Depositor run risk larger with a faster speed of rate hikes, compared with a gradual rate hike
  - Gradual rate hike allows depositor base to adjust slowly
- Rate hike cycle starting in early 2022: more than 450 bps within 1 year + nearly $4 trillion reserves → amplified outflows and run risk

Related Literature

1. **Bank fragility** e.g., Diamond and Dybvig 83, Goldstein and Pauzner 05, He and Xiong 12, Egan, Hortacsu and Matvos 17, Drechsler et al. 23, Granja et al. 24, and Haddad, Hartman-Glaser and Muir 24...

   ⇒ Bank run risk is driven by the convenience value of the marginal depositor, which varies over time with deposit inflows

2. **Rate sensitivity of deposits** e.g., Drechsler, Savov and Schnabl 17, Xiao 20, Wang et al. 22, Erel et al. 23, d'Avernas et al. 23, Koont, Santos and Zingales 23, Zhang, Muir and Kundu 24...

   ⇒ Estimate variation in investors' rate sensitivity over time and its effect on bank fragility

3. **Unintended consequences of QE** e.g., Acharya and Rajan 22, Diamond, Jiang and Ma 23, Acharya et al. 23, Haddad, Moreira and Muir 24, Lopez-Salido and Vissing-Jorgensen 24...

   ⇒ QE can increase the run risk from subsequent rate hikes

Roadmap

1. Empirical Facts
2. Model
3. Counterfactuals

Data

1. Bank-level deposits
   - Quarterly bank-level deposit volumes and rates from Call Reports
2. Deposits by counterparty and account type (FR2052)
   - Bank-level deposits by retail versus corporate depositors
   - Bank-level deposits by deposit account type
   - Monthly for banks larger than $100 billion, daily for 11 SIFIs
3. Depositor-level deposits
   - Transaction-level account data for more than 1,400 fin institutions
   - Includes transactions between different bank accounts
   - Includes transactions between bank accounts and investment accounts

Estimating Deposit Flow Sensitivity

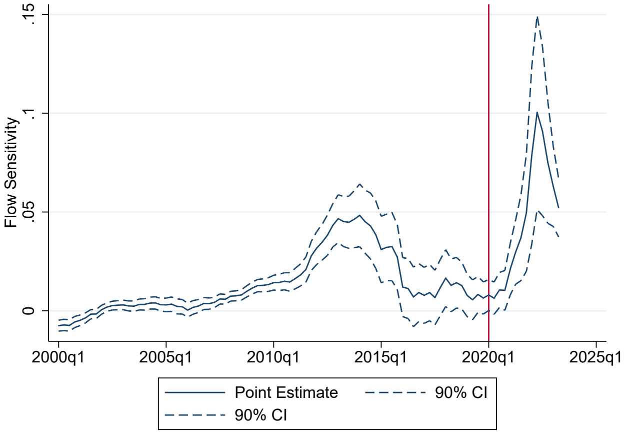
- To estimate flow sensitivity:

$$Flow_{it} = \beta_y \widehat{DepRate}_{it} + TimeFE_t + \epsilon_{it},$$

- $Flow_{it}$: deposit flow of bank i in quarter t
- $DepRate_{it}$: average deposit rate of bank i in quarter t
  - Similar results with only savings deposits
- Standard IO IVs using ratio of fixed costs and salary expense
- β_y: sensitivity of bank-level deposit flows to bank-level deposit rates in 8-quarter rolling window y.

Fact 1a: Deposit Flow Sensitivity over Time

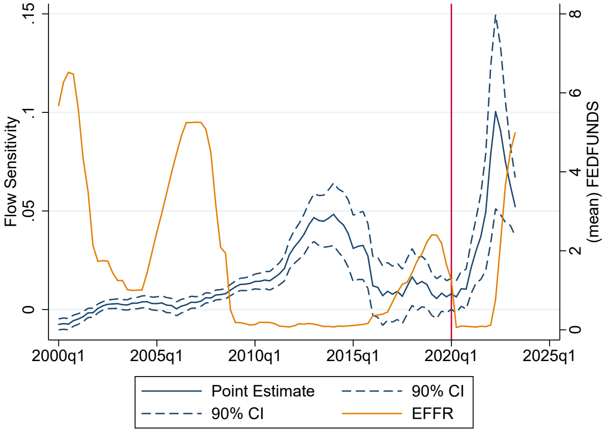
- Deposit flow sensitivity over time



Savings | Dep insurance | Weighted | Asset Size | Expsure | Log deposits

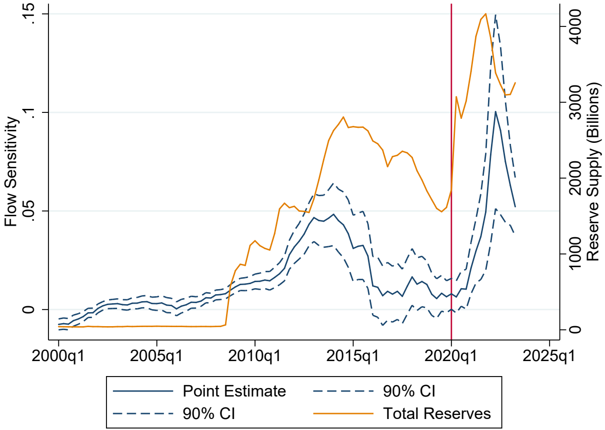
Fact 1b: Deposit Flow Sensitivity and Monetary Policy

- ↑ Deposit flow sensitivity as ↓ monetary policy rate



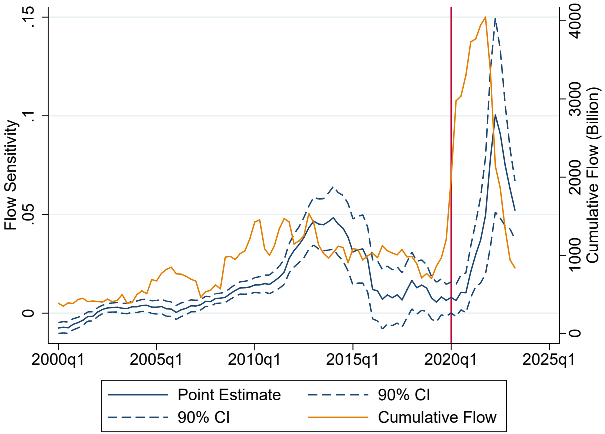
Fact 1c: Deposit Flow Sensitivity and QE

- ↑ Deposit flow sensitivity as ↑ central bank reserve supply



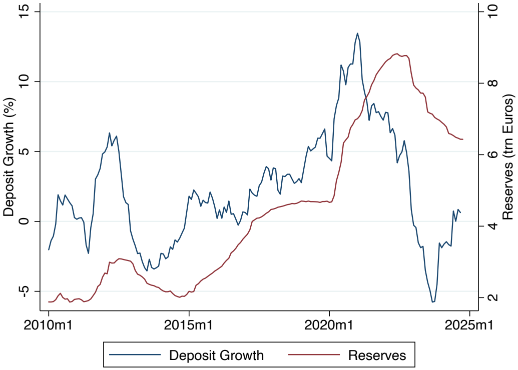
Fact 1d: Deposit Flow Sensitivity and Aggregate Deposits

- ↑ Deposit flow sensitivity as ↑ deposit inflow into banking system



Euro Area Reserve and Deposit Growth

- Reserve and deposit growth positively co-move in the Euro area



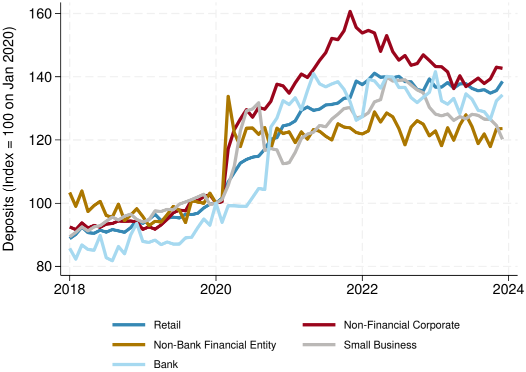
Data

1. Bank-level deposits
   - Quarterly bank-level deposit volumes and rates from Call Reports
2. Deposits by counterparty and account type (FR2052)
   - Bank-level deposits by retail versus corporate depositors
   - Bank-level deposits by deposit account type
   - Monthly for banks larger than $100 billion, daily for 11 SIFIs
3. Depositor-level deposits
   - Transaction-level account data for more than 1,400 fin institutions
   - Includes transactions between different bank accounts
   - Includes transactions between bank accounts and investment accounts

Fact 2a: Deposits by Counterparty Type

- Growth and decline in corporate deposits are most pronounced

Figure: Volume of Deposits (Indexed to January 2020)



Fact 2a: Deposit Volatility by Counterparty Type

- Corporate deposits are more volatile (sd/mean) than retail deposits

⇒ Dynamics of deposit flightiness influenced by counterparty composition

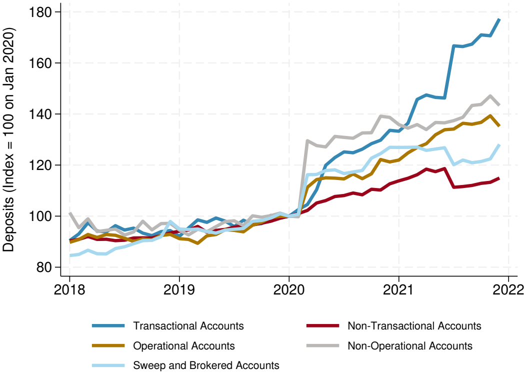
Table: Deposit Volatility by Depositor Type

Counterparty	25 Pctl	Median	75 Pctl
Monthly Bank-Level SD			
Retail	14.10	20.07	29.21
Non-Financial Corporate	22.18	27.57	41.17
Non-Bank Financial Entity	18.79	38.00	56.06
Small Business	14.81	19.87	46.84
Bank	25.33	69.82	121.34

Fact 2b: Deposits by Account Type

- Growth of non-operational and transactional deposits is more pronounced

Figure: Volume of Deposits (Indexed to January 2020)



Fact 2b: Deposit Volatility by Account Type

- Transactional deposits are more volatile than non-transactional deposits

Table: Deposit Volatility by Account Type

Account Type	25 Pctl	Median	75 Pctl
Monthly Bank-Level SD			
Transactional Accounts	14.78	19.76	51.00
Non-Transactional Accounts	9.81	12.66	23.98
Operational Accounts	18.27	24.43	38.60
Non-Operational Accounts	19.40	25.07	41.69
Sweep and Brokered Accounts	19.75	28.79	55.44

Fact 2b: Deposit Volatility by Account Type

- Transactional deposits are more volatile than non-transactional deposits
- Non-operational deposits are more volatile than operational deposits

Table: Deposit Volatility by Account Type

Account Type	25 Pctl	Median	75 Pctl
Monthly Bank-Level SD			
Transactional Accounts	14.78	19.76	51.00
Non-Transactional Accounts	9.81	12.66	23.98
Operational Accounts	18.27	24.43	38.60
Non-Operational Accounts	19.40	25.07	41.69
Sweep and Brokered Accounts	19.75	28.79	55.44

Fact 2b: Deposit Volatility by Account Type

- Transactional deposits are more volatile than non-transactional deposits
- Non-operational deposits are more volatile than operational deposits

⇒ Dynamics of deposit flightiness influenced by account types

Table: Deposit Volatility by Account Type

Account Type	25 Pctl	Median	75 Pctl
Monthly Bank-Level SD			
Transactional Accounts	14.78	19.76	51.00
Non-Transactional Accounts	9.81	12.66	23.98
Operational Accounts	18.27	24.43	38.60
Non-Operational Accounts	19.40	25.07	41.69
Sweep and Brokered Accounts	19.75	28.79	55.44

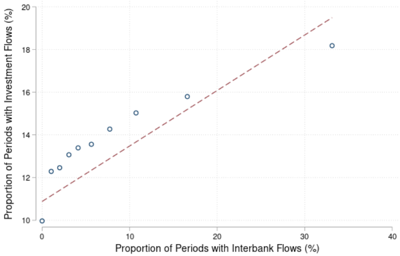
Data

1. Bank-level deposits
   - Quarterly bank-level deposit volumes and rates from Call Reports
2. Deposits by counterparty and account Type (FR2052)
   - Bank-level deposits by retail versus corporate depositors
   - Bank-level deposits by deposit account type
   - Monthly for banks larger than $100 billion, daily for 11 SIFIs
3. Depositor-level deposits
   - Transaction-level account data for more than 1,400 fin institutions
   - Includes transactions between different bank accounts
   - Includes transactions between bank accounts and investment accounts

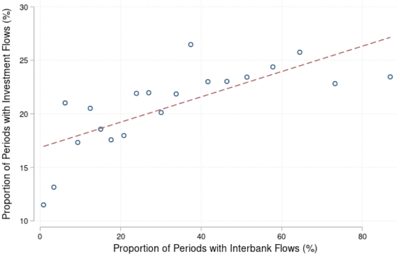
Fact 3a: Depositor-level Flows between Banks and Outside Investments

- Depositors more inclined to move funds between banks are also more inclined to move funds between banks and outside investments

Prop of Months with Flows (Household)



Prop of Months with Flows (Corp)



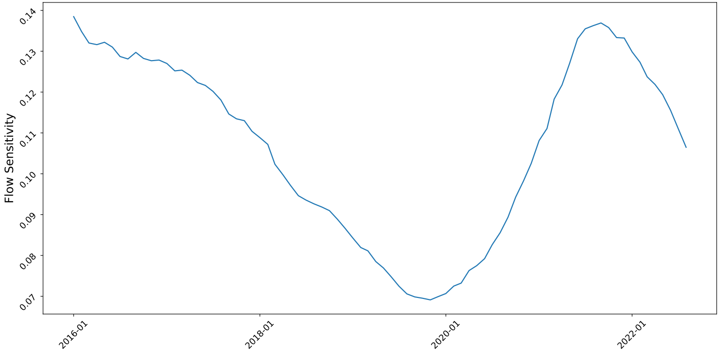
- Also holds for the number of transfers and the sd of transfer amount

Fact 3b: Depositor-level Flow Sensitivity over Time

- Time-series variation in depositor-level bank-to-bank flow sensitivity resembles aggregate flow sensitivity estimates
- For account k of depositor j in month m

$$BankFlow_{jkm} = \gamma_m DepRate_{jkm} + FE_{jm} + Controls_{jkm} + \epsilon_{jkm}$$

Figure: Bank-to-Bank Flow Sensitivity

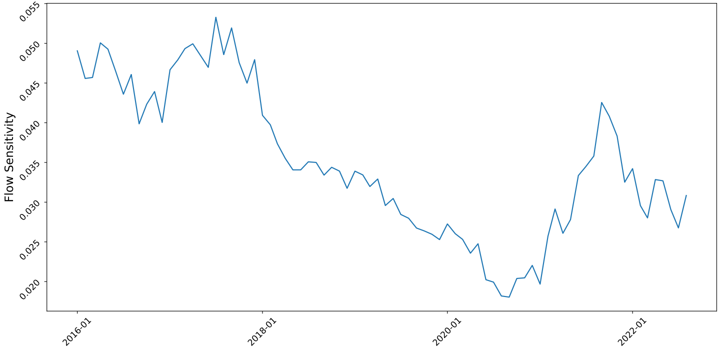


Fact 3b: Depositor-level Flow Sensitivity over Time

- Time-series variation in bank-to-outside-investment flow sensitivity resembles bank-to-bank flow sensitivity
- For account k of depositor j in month m

$$NonBankFlow_{jkm} = \gamma_m DepSpread_{jkm} + FE_{jm} + Controls_{jkm} + \epsilon_{jkm}$$

Figure: Bank-to-Outside-Investment Flow Sensitivity



Roadmap

1. Empirical Facts
2. Model
3. Counterfactuals

Model: Agents

- Continuum of infinitely lived investors
  - Heterogeneous in convenience benefit from deposits θ_i, $\theta_i \sim H(\cdot)$
  - Choose to invest 1 dollar in deposit or outside option with payoff R
  - R increases with the monetary policy rate
  - Switching cost $f > 0$ when moving money in and out of the bank

Model: Agents

- Continuum of infinitely lived investors
  - Heterogeneous in convenience benefit from deposits θ_i, $\theta_i \sim H(\cdot)$
  - Choose to invest 1 dollar in deposit or outside option with payoff R
  - R increases with the monetary policy rate
  - Switching cost $f > 0$ when moving money in and out of the bank
- Bank: issue deposits to fund long-term illiquid projects
  - Asset matures with probability $\lambda \in (0, 1)$ each period
  - Upon maturity, generates cash-flow $y_t \sim F(\cdot)$
  - y_t is the bank's asset fundamentals and is observed at the beginning of each period

Model: Deposit Flows

- Inflow: scale up asset side at per-unit cost 1
- Outflow: sell asset
  - If asset sale $\leq \phi$ of total assets, liquidation price is 1
  - If asset sale $> \phi$ of total assets, liquidation price drops to $L(y) < 1$
- The bank sets deposit rate $r_t \leq y_t$ to maximize equity value, taking into account the effect on flows

Model: Timing

- Each period, given the asset fundamental y_t and existing depositors Θ_{t-1},
  - the bank chooses deposit rate
  - investors decide whether to hold deposits or not
- If the outflow is too large and the bank fails, the bank's asset is liquidated and distributed to existing depositors
  - Bank default probability depends on asset fundamental y_t and existing depositors Θ_{t-1}

Details

Equilibrium

- For a given period t, there exists an endogenous cutoff θ_t, such that investors with convenience value larger than the cutoff, i.e., $\theta_i \geq \theta_t$, hold deposits. Investors with $\theta_i < \theta_t$ invest in the outside option.
  Investor's problem
    - θ_t – marginal depositor in period t
    - Investors in the outside option value deposits' convenience benefit less
    - Inflow of investors implies flightier deposit base

Equilibrium

- For a given period t, there exists an endogenous cutoff θ_t, such that investors with convenience value larger than the cutoff, i.e., $\theta_i \geq \theta_t$, hold deposits. Investors with $\theta_i < \theta_t$ invest in the outside option.
  Investor's problem
  - θ_t – marginal depositor in period t
  - Investors in the outside option value deposits' convenience benefit less
  - Inflow of investors implies flightier deposit base
- Bank runs: there exists an endogenous threshold $y^*(\theta_{t-1})$ such that the bank experiences a run in period t if $y_t < y^*(\theta_{t-1})$
  - Run threshold $y^*(\theta_{t-1})$ and the default probability increase as the marginal depositor at $t-1$ values deposit convenience less, i.e., smaller θ_{t-1}

Bank's problem

Roadmap

1. Empirical Facts
2. Model
3. Counterfactuals

Policy Counterfactuals

- Monetary policy rate hike = higher R
  - $\Rightarrow$ deposit outflow and increase in run risk
- What do outflows and increased run risk from rate hikes depend on?

Policy Counterfactuals

- Monetary policy rate hike = higher R

  $\Rightarrow$ deposit outflow and increase in run risk

- What do outflows and increased run risk from rate hikes depend on?

- Use the calibrated model to investigate

  1. Effect of unconventional monetary policy

     - QE = influx of deposits into banks: marginal depositor becomes flightier ($\theta_{t-1} \downarrow$)

     $\Rightarrow$ run risk due to rate hikes amplified unless all reserves are costless to sell

Policy Counterfactuals

- Monetary policy rate hike = higher R

  $\Rightarrow$ deposit outflow and increase in run risk

- What do outflows and increased run risk from rate hikes depend on?

- Use the calibrated model to investigate

  1. Effect of unconventional monetary policy
     - QE = influx of deposits into banks: marginal depositor becomes flightier ($\theta_{t-1} \downarrow$)

     $\Rightarrow$ run risk due to rate hikes amplified unless all reserves are costless to sell

  2. Effect of the speed of rate hikes
     - Slower rate hikes: marginal investor adjusts gradually + bank sells assets slower

     $\Rightarrow$ run risk due to rate hikes reduced

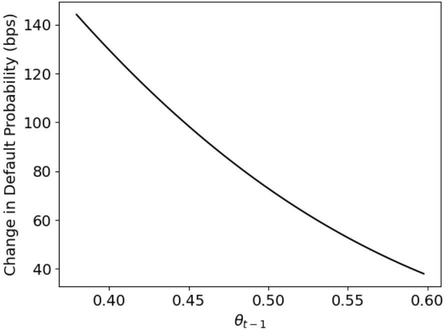
Calibration details

Counterfactual: Interaction between Conventional and Unconventional Monetary Policy

- Consider 2% rate hike (assume persistent coef 0.67)
- Rate hikes are more destabilizing after QE/reserve injections

$\Rightarrow$ **Interdependence between conventional and unconventional monetary policy through the deposit base**

Figure: Effect of Rate Hikes on Bank Default Probability

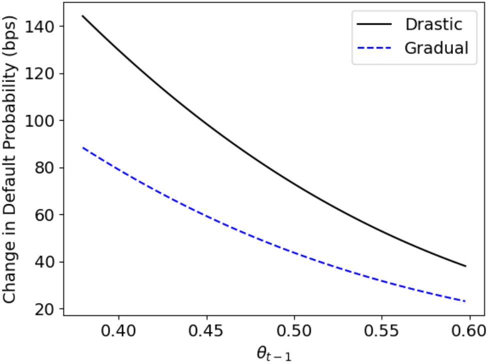


Counterfactual: Speed of Monetary Policy Rate Hike

- Compare a drastic rate hike (2%) with a gradual rate hike (1% + 1%)
- Drastic rate hikes amplify run risk

  ⇒ **Speed of rate hikes matters for financial stability**

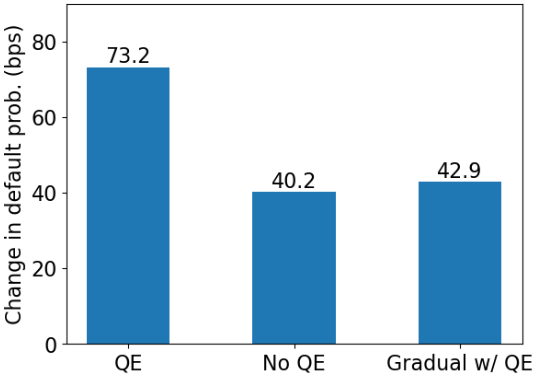
Figure: Speed of Interest Rate Hike and Bank Default Probability



Counterfactual: Magnitudes

- Baseline: effect of a 2% rate hike
- Counterfactual I: effect of a 2% rate hike without QE reserve injection
- Counterfactual II: effect of a 1%+ 1% rate hike

Figure: Effect of Rate Hikes on Bank Default Probability



Conclusion

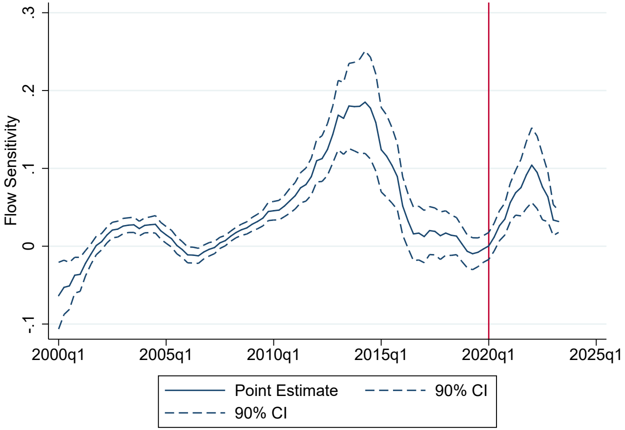
- Deposit flightiness exhibits significant variation over time
- Investors outside of banks have a lower convenience value for deposits than investors in banks

  $\Rightarrow$ Influx of deposits = influx of **flightier** deposits
- Rate hikes are more destabilizing with more reserves/QE

  $\Rightarrow$ Intricate linkage between conventional and unconventional monetary policy
- The expansion of the NBFI sector may amplify the variability in the depositor base

Appendix: Flow Sensitivity, Savings Deposits

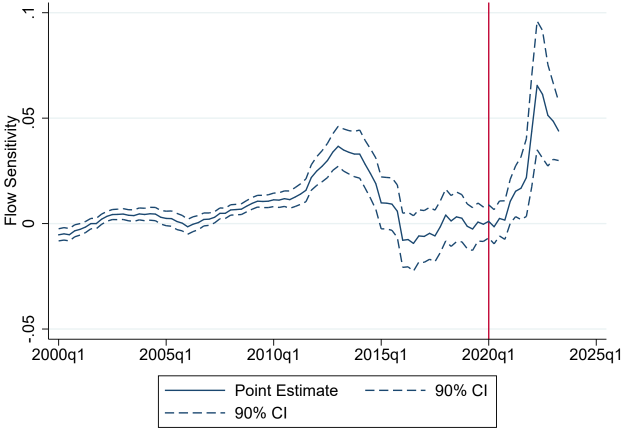
Figure: Deposit Flow Sensitivity (Savings Deposits)



Back to Intro Back to Main

Appendix: Flow Sensitivity, Uninsured Deposits Ratio

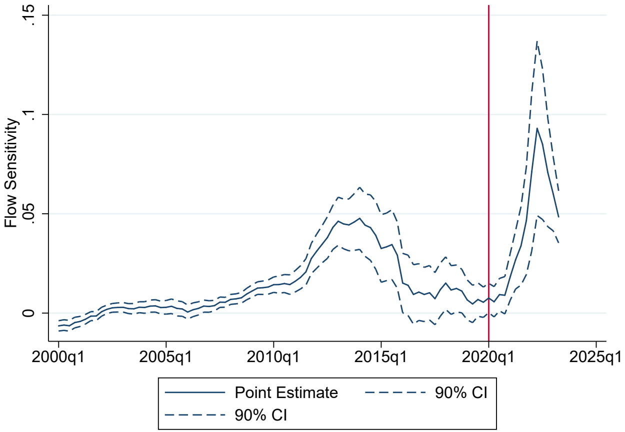
Figure: Deposit Flow Sensitivity (Uninsured Deposit Ratio Control)



Back to Intro
Back to Main

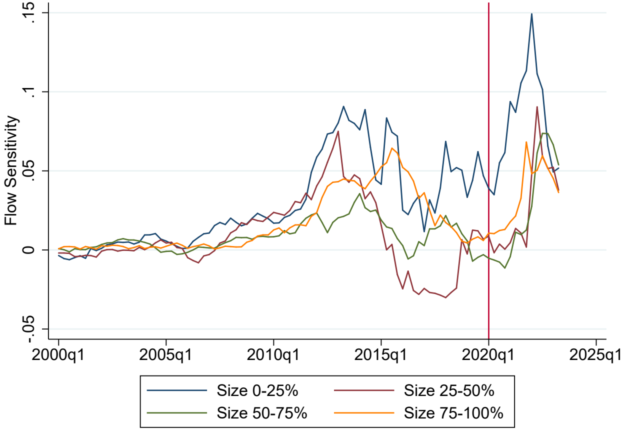
Appendix: Flow Sensitivity (Weighted)

Figure: Deposit Flow Sensitivity (Weighted)



Back to Intro Back to Main

Figure: Deposit Flow Sensitivity (by Asset Size)

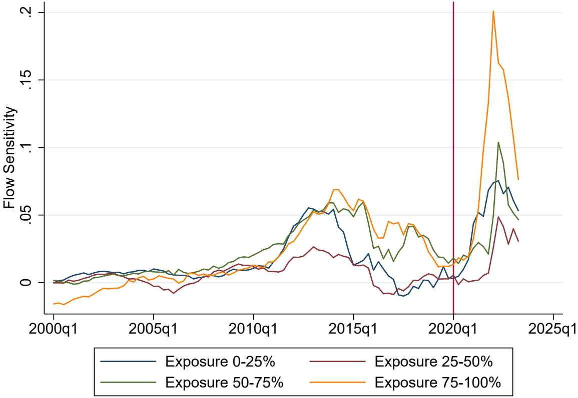


Back to Intro   Back to Main

Appendix: Flow Sensitivity (by Exposure)

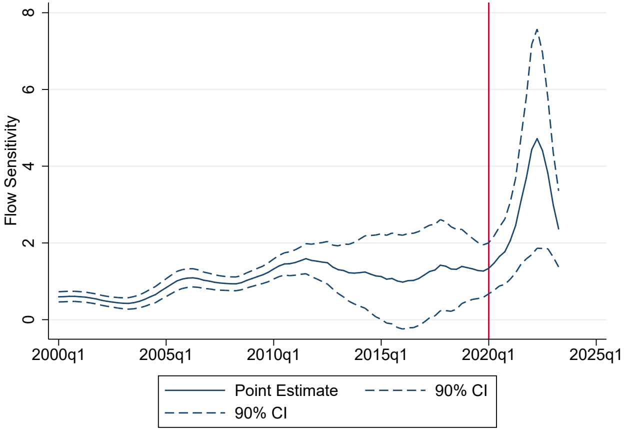
- $Flow_{it} = \gamma_i AggregateFlow_t + \epsilon_{it}$
- Estimate flow sensitivity by quartiles of γ_i

Figure: Deposit Flow Sensitivity (by Exposure)



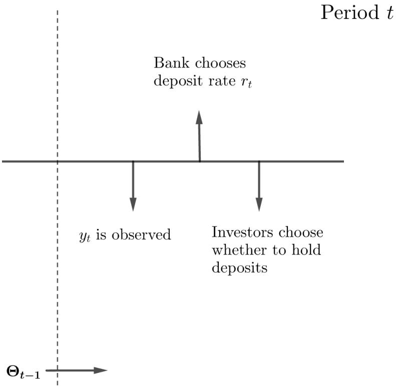
Appendix: Flow Sensitivity (Log Deposits)

Figure: Deposit Flow Sensitivity (Log Deposits)



Back to Intro Back to Main

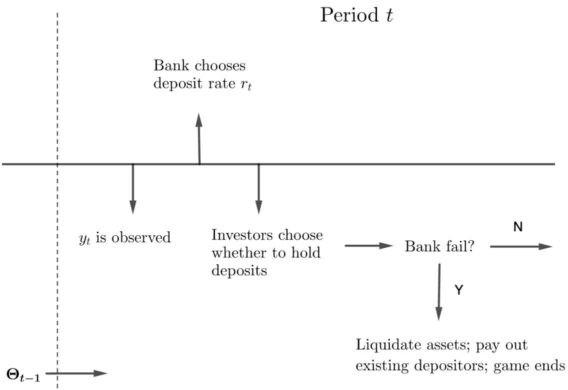
Appendix: Timing Details



- Θ_{t-1} is the set of investors in the banking system entering period t

Back

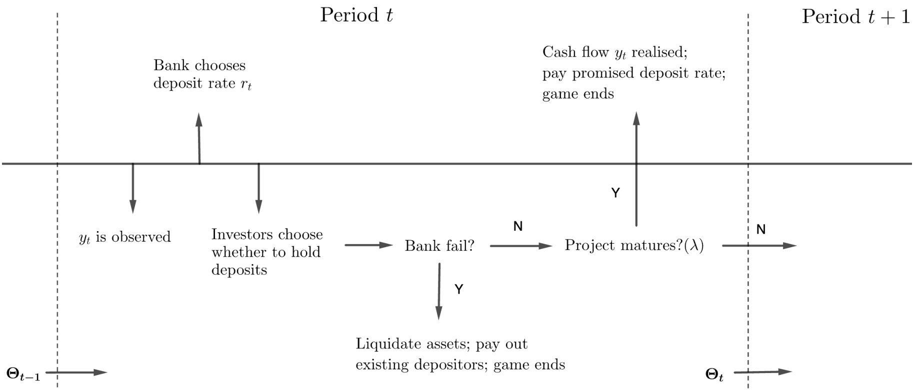
Appendix: Timing Details



- Θ_{t-1} is the set of investors in the banking system entering period t
- Prob of default in period t depends on y_t and Θ_{t-1}

Back

Appendix: Timing Details



- Θ_{t-1} is the set of investors in the banking system entering period t
- Prob of default in period t depends on y_t and Θ_{t-1}

Back

Appendix: Investor's Problem

- Investor i's problem

$$\begin{cases} \max\{D(r_t, \theta_i, \Theta_t), R - f\} & \text{if hold deposits in } t-1 \\ \max\{D(r_t, \theta_i, \Theta_t) - f, R\} & \text{otherwise} \end{cases}$$

$\Rightarrow$ Inter-temporal dependency between Θ_t and Θ_{t-1} due to f.

- Investor i's value from holding bank deposits:

$$D(r_t, \theta_i, \Theta_t) = \underbrace{\theta_i}_{\text{convenience benefit}} + \underbrace{\lambda r_t}_{\text{interest payment}} \tag{1}$$

$$+ (1-\lambda)\beta\mathbb{E}[(1 - \mathbf{1}_{def,t+1}) \underbrace{\max\{D(r_{t+1}, \theta_i, \Theta_{t+1}), R - f\}}_{\text{Continuation value if no bank run}} + \mathbf{1}_{def,t+1} L(y_{t+1})] \tag{2}$$

  - $\mathbf{1}_{def,t+1} = 1$ if default in period $t+1$, depends on y_{t+1} and Θ_t

Back to equilibrium

Appendix: Bank's Problem

- Bank's value function

$$V(y_t, r_t, \theta_t) = \lambda(y_t - r_t)G(\theta_t) + (1-\lambda)\beta\mathbb{E}[(1 - \mathbf{1}_{def,t+1})V^*(y_{t+1}, \theta_t)] \tag{3}$$

where $G(\theta_t) = 1 - H(\theta_t)$ is the amount of deposits

- Bank's problem

$$V^*(y_t, \theta_{t-1}) = \max_{(r_t, \theta_t)} \quad V(y_t, r_t, \theta_t) \tag{4}$$

$$s.t. \quad r_t \leq y_t \tag{5}$$

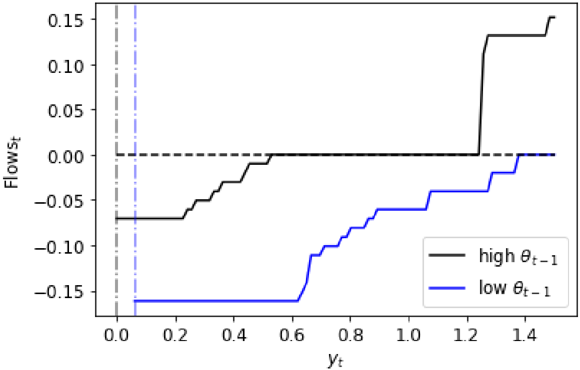
$$\begin{cases} D(r_t, \theta_t, \theta_t) = R - f & \text{if } \theta_t \geq \theta_{t-1} \\ D(r_t, \theta_t, \theta_t) - f = R & \text{if } \theta_t < \theta_{t-1}. \end{cases} \tag{6}$$

Back to equilibrium

Appendix: Equilibrium

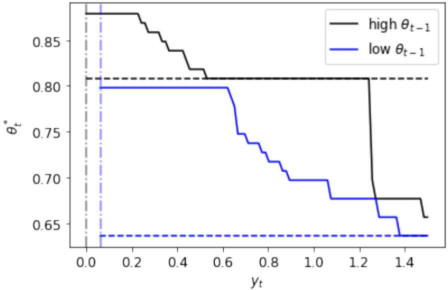
- The marginal depositor type $\theta_t = \theta^*(\theta_{t-1}, y_t)$ is path-dependent
- Deposit flow is weakly increasing in y_t and θ_{t-1} Detail

Figure: Net Deposit Flows



Appendix: Equilibrium θ^*

Figure: Optimal policy θ^*



- For small y_t, the bank is distressed $\Rightarrow$ set rate to retain enough depositors
- When y_t gets larger, the bank allows some outflows or no outflow
- For large y_t, the bank gets inflows

Back

Appendix: Calibration

- Extend the model: y_t follows an AR(1) process

$$y_{t+1} - \mu = \rho(y_t - \mu) + \epsilon \qquad \epsilon \sim N(0, \sigma^2)$$

- Assume θ_i is uniformly distributed in $[0, \bar{\theta}]$

Parameter	Empirical target	Empirical moments
ρ	Persistence of asset returns	0.82
μ	Average asset return	5.43%
λ	Average loan maturity	1.64
α	Average asset discount	21.69%
ϕ	Ample reserve proportion	9.83%
R	Average Fed Fund Rate	1.86%
β	Discount rate	0.98

f	Median deposit rate	0.80%
σ	Median default prob.	0.75%
θ^{max}	Deposit flow sensitivity	0.39

Back to counterfactuals

Appendix: Calibrated parameter values

- to obtain the parameters

Table: Parameter Estimates

Parameter	Description	Value
ρ	Persistence of y_t	0.82
μ	Mean of y_t	1.089
λ	Maturity rate	0.61
α	Liquidity discount	0.78
ϕ	Ample reserve proportion	0.098
R	Value of outside option	0.93
β	Discount rate	0.98

f	Switching cost	0.06
σ	Sd of shock in asset return	0.45
θ^{max}	Upper limit of deposit convenience	1.13

Back to counterfactuals