Hollow Buffers in U.S. Banking: The Hidden Distribution of Deposit Taxation

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Motivation

- Since October 2008, the Federal Reserve has paid interest on reserve balances
  - Explicitly intended to remove the implicit tax on deposits imposed by reserve requirements
  - With reserves earning interest, banks have been willing to hold large balances
- Natural conclusion: the classic Bailey-Friedman reserve-requirement tax has disappeared
- ***This paper cautions against such a strong conclusion***

The Puzzle

- Aggregates suggest ample liquidity:
  - System-wide reserves equal 57% of deposits (2024:Q4)
  - Suggests substantial buffers and tax neutrality
- But bank-level data reveal a different story:
  - 30% of deposits sit at banks with less than 10% reserve ratios
  - These banks would face immediate binding constraints if requirements were reinstated
- ***Disconnect between aggregate abundance and cross-sectional scarcity***

Research Questions

1. When exactly does interest on reserves eliminate the deposit tax?
2. Is aggregate reserve abundance sufficient to conclude tax neutrality?
3. What are the implications for monetary policy implementation and macroprudential design?

Classic Deposit Taxation Literature

- **Bailey (1956), Friedman (1959), Cagan (1956)**
  - Reserve requirements impose implicit tax on deposits
  - Tax equals opportunity cost of non-remunerated reserves
  - Welfare costs of reserve taxation
- **Tolley (1957), Feinman (1993)**
  - History and evolution of reserve requirements
  - Regulatory rationales beyond monetary control
- This paper: ***Tax remains latent even with IOR***

Interest on Reserves Literature

- **Sargent & Wallace (1985), Goodfriend (2002)**
  - Paying market rates on reserves eliminates deposit tax
  - Separates liquidity provision from fiscal transfers
  - Optimal monetary policy design
- **Fama (1983), Hall (1983)**
  - Financial intermediation without reserve taxation
  - Competitive equilibria with interest-bearing reserves
- This paper: ***Rate condition necessary but not sufficient***

Operating Frameworks & Implementation

- **Ennis & Keister (2008), Afonso et al. (2022)**
  - Flat reserve demand with IOR
  - Evolution of Fed's implementation framework
  - Ample reserves regime post-2008
- **Poole (1968), Baltensperger (1980)**
  - Bank reserve management in stochastic models
  - Portfolio choice with reserve constraints
- This paper: ***Flat demand in aggregate masks cross-sectional heterogeneity***

Reserve Distribution & Segmentation

- **Ennis & Wolman (2015), Wong & Zhang (2025)**
  - Cross-section of excess reserves
  - Concentration of reserve holdings
  - Distribution across bank types
- **Copeland, Duffie, & Yang (2024)**
  - Reserves not so ample after all
  - Segmentation and trading frictions
  - System liquidity vs. usable liquidity
- This paper: ***Hollow buffer creates tax incidence even without segmentation***

Bank Portfolio Responses

- **Mitchell (1982), Ahmed (1987)**
  - Reserve requirements and portfolio risk
  - Effects on bank lending and asset allocation
- **Islam & Koch (2024), Zhang, Wang, & Song (2024)**
  - Bank lending responses to reserve policy changes
  - Risk-taking and lending standards
  - Heterogeneous effects across institutions
- This paper: ***Two-condition test provides cross-sectional mechanism***

Main Contributions

1. **Two-condition incidence test:**
   - Reinterprets Bailey-Friedman deposit tax as margin-activated wedge
   - Rate condition: well-known ($i_{RR} \geq i_{MR}$)
   - Quantity condition: ***newly formalized*** ($\Delta\rho \cdot D \leq ER$)
2. **Hollow buffer documentation:**
   - Aggregate buffers overstate tax neutrality for large share of deposits
   - Requirements create discontinuous effects at buffer boundaries
3. **Policy implications:**
   - Challenges “ample reserves” characterizations
   - Implications for implementation and macroprudential design

Model Setup

- Representative bank with deposits D allocated between:
  - Market-earning assets L at return i_{MR}
  - Reserves R remunerated at i_{RR}
- Balance-sheet identity: $D = L + R$
- Statutory requirement: $R \geq \rho D$
- Excess reserves: $ER = R - \rho D$
- Bank maximizes profits:

$$\max_{L,R} \Pi = i_{MR} L + i_{RR} R - i_D D$$

Change in Requirements

- Suppose regulator raises requirement from ρ to $\rho + \Delta\rho$
- Bank must reallocate $\Delta R = \Delta\rho \cdot D$ from L to R
  - But only ***after exhausting*** ER
- Profit change:

$$\Delta\Pi = -(i_{MR} - i_{RR}) \max\{0, \Delta\rho \cdot D - ER\}$$

- Marginal deposit-tax rate per dollar of deposits:

$$\tau = (i_{MR} - i_{RR})\mathbb{I}\{\Delta\rho \cdot D > ER\}$$

Main Result: Two-Condition Test

Proposition (Tax Neutrality Conditions)

An increase in reserve requirements imposes no positive implicit tax if and only if

$$i_{RR} \geq i_{MR} \quad \textit{or} \quad \Delta\rho \cdot D \leq ER$$

- **Rate condition:** If reserves earn market rate, holding reserves is not costly $\implies$ requirement is neutral
- **Quantity condition:** If increase fits within excess reserves, no reallocation needed $\implies$ requirement is neutral
- Tax "turns on" only when ***both conditions fail***

Economic Interpretation

- Two margins govern the result:
  1. **Rate channel:** $i_{RR} \geq i_{MR}$
     - Neutralizes opportunity cost
     - Well-known from Sargent & Wallace (1985), Goodfriend (2002)
  2. **Quantity channel:** $\Delta\rho \cdot D \leq ER$
     - Neutralizes reallocation need
     - Corresponds to flat reserve-demand (Ennis & Keister 2008)
     - ***Newly formalized in this paper***
- Nests prior views:
  - Bailey-Friedman: $i_{RR} < i_{MR}$ and $ER = 0$
  - Post-2008 neutrality: rate condition OR quantity condition holds

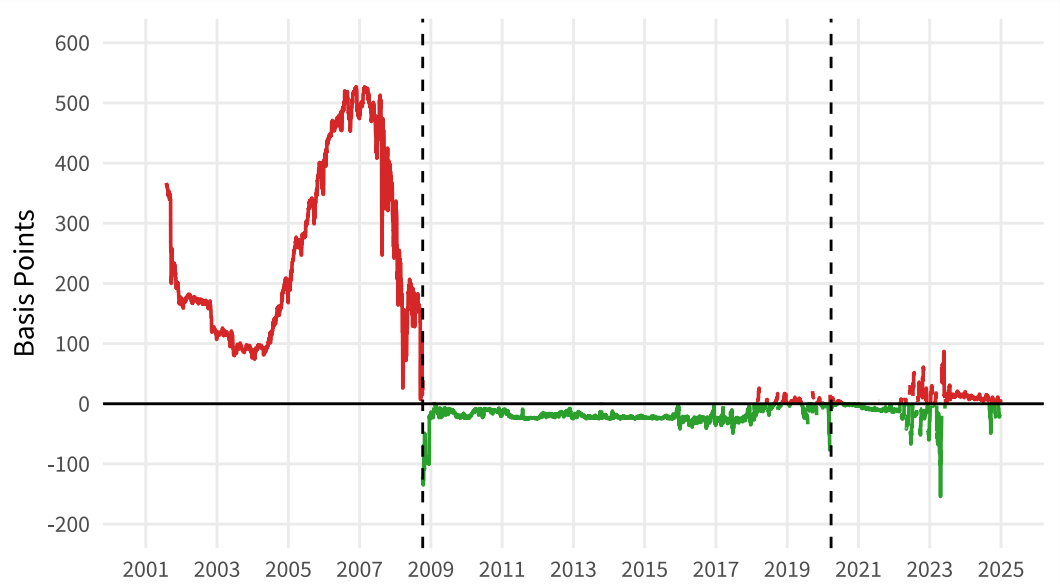
From Aggregates to Banks

- The two-condition test applies at both:
  - System level (aggregate R, ER, D)
  - Individual bank level
- Key insight: Large aggregate buffer can coexist with many banks lacking sufficient buffers
- Incidence is determined at the margin:
  - Banks with $\Delta\rho \cdot D > ER$ face immediate tax
  - Banks with $\Delta\rho \cdot D \leq ER$ remain unaffected
- Creates sharp discontinuity at buffer boundary

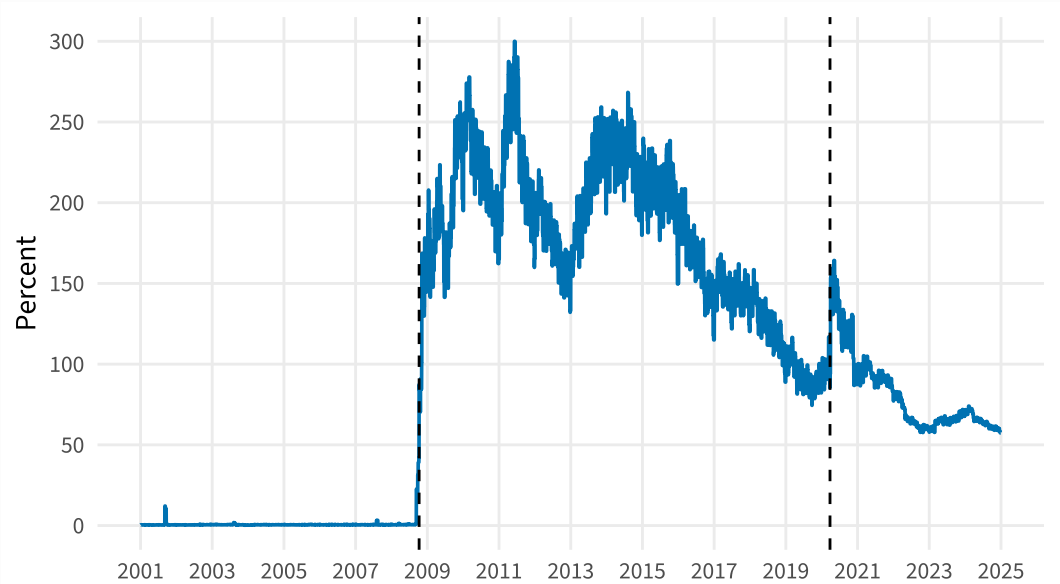
Data

- **Aggregate data:** Federal Reserve Bank of St. Louis (FRED)
  - 1-month Treasury yield, total deposits, reserves
  - Interest on reserves rate
  - 2001:Q1 – 2024:Q4
- **Bank-level data:** FFIEC Call Reports
  - Quarterly panel of U.S. commercial banks
  - Balance sheet and deposit information
  - Conservative retail bank sample selection
  - 115,835 unique bank-quarters

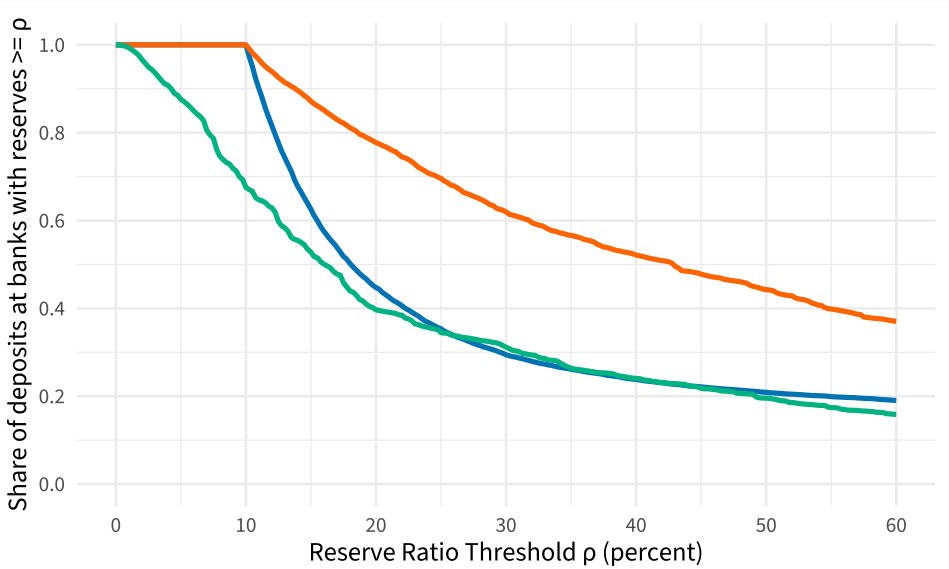
Market Premium: $i_{MR} - i_{RR}$



Aggregate Buffer: ER/D



The Hollow Buffer: Cross-Sectional Reality



The Hollow Buffer: Key Finding

- **IOR with no requirements (2020–2024):**
  - Curve falls below 1.0 almost immediately
  - ***Roughly 30% of deposits at banks with $<$ 10% reserves***
  - Aggregate buffer: 57%
- **Implication:**
  - Reinstating 10% requirement would impose tax on $\sim$30% of deposits
  - Given positive market premium in much of 2023–2024
  - Both conditions fail for these deposits
- This is the “hollow buffer”:
  - Ample in total
  - Scarce for many

Summary of Empirical Findings

Regime	Rate Condition	Quantity Condition
Pre-IOR (2001–2008)	Fails ($i_{RR} < i_{MR}$)	Fails (aggregate) (buffer ≈ 0)
IOR + Req. (2008–2020)	Holds ($i_{RR} \gtrsim i_{MR}$)	Holds (most banks) (buffers built)
IOR, No Req. (2020–2024)	Fails (2023–24) ($i_{RR} < i_{MR}$)	Fails (30% deposits) (thin buffers)

- Current regime: ***Latent fragility*** despite aggregate abundance

The “Ample Reserves” Paradox

- Federal Reserve’s ample reserves framework suggests abundant liquidity
- But: 30% of deposits at banks that would immediately bind
- Current configuration creates stable but brittle equilibrium:
  - Positive market premium
  - Zero requirements
  - Concentrated buffers
- Any policy adjustment triggers cascading effects:
  - Closing rate spread: reduces holding costs, may flatten distribution
  - Reinstating requirements: immediately binds for ~1/3 of deposits
  - Redistributing reserves: requires active intervention

Heterogeneous Policy Transmission

- Concentration of reserves creates discontinuous effects:
  - Banks with $\Delta\rho \cdot D > ER$: immediate portfolio reallocation
  - Banks with $\Delta\rho \cdot D \leq ER$: unaffected entirely
- Amplifies policy transmission through three channels:
  1. Thin-buffer banks must rapidly adjust lending/funding
  2. Small requirement/remuneration changes trigger large responses at margin
  3. Concentrated incidence makes aggregate outcomes less predictable
- Provides microfoundation for documented heterogeneity in bank responses
  - Islam & Koch (2024), Zhang, Wang, & Song (2024)

Design Alternatives

1. **Tiered remuneration:**
   - Pay market rate on required reserves
   - Lower/zero rate on excess
   - Satisfies rate condition for mandatory holdings
   - Eliminates deposit tax even when requirements bind
   - Used by several central banks
2. **Permanent zero requirements:**
   - Acknowledges requirements no longer serve monetary control
   - But: no mechanism to ensure minimum liquidity across system
   - Current voluntary holding produces extreme concentration
   - May undermine financial stability objectives

Macroprudential Perspective

- Current distribution transforms requirements from broad-based tools to targeted interventions
- Whether concentration enhances or diminishes effectiveness depends on objectives:
  - System-wide liquidity provision?
  - Targeted constraints on particular banking models?
- Two-condition framework provides diagnostic:
  - Within buffers or when $i_{RR} \geq i_{MR}$: requirements are merely labels
  - When both fail: requirements become binding taxes
- Policy changes bite first where $\Delta\rho \cdot D > ER$ when $i_{MR} > i_{RR}$

Main Takeaways

1. **Theoretical:** Reserve requirements neutral only under two conditions:
   - Rate: $i_{RR} \geq i_{MR}$
   - Quantity: $\Delta\rho \cdot D \leq ER$
2. **Empirical:** Hollow buffer documented:
   - Aggregate: 57% buffer suggests wide neutrality
   - Cross-section: 30% of deposits would face new tax
3. **Policy:** Challenges “ample reserves” characterizations
   - Incidence falls first on thin-buffer banks
   - Discontinuous effects at buffer boundaries
   - Implications for implementation and macroprudential design

The Bailey-Friedman Tax Redux

- Bailey-Friedman deposit tax reinterpreted as ***margin-activated wedge***
- Appeared to vanish after 2008 due to:
  - IOR satisfying rate condition
  - QE satisfying quantity condition
- But remains latent in the cross-section:
  - Dormant at well-buffered banks
  - Active at thin-buffer banks when $i_{MR} > i_{RR}$
- Simple incidence logic with profound implications for:
  - Bank portfolio management
  - Monetary policy implementation
  - Financial stability

Thank you!

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Paper available at:
https://nicpusateri.com/hollow

Formal Derivation: Portfolio Problem

- Bank's optimization:

$$\mathcal{L} = i_{MR}L + i_{RR}R - i_D D + \lambda_1(D - L - R) + \lambda_2(R - \rho D)$$

- First-order conditions:

$$\frac{\partial \mathcal{L}}{\partial L} = i_{MR} - \lambda_1 = 0 \implies \lambda_1 = i_{MR}$$
$$\frac{\partial \mathcal{L}}{\partial R} = i_{RR} - \lambda_1 + \lambda_2 = 0 \implies \lambda_2 = i_{MR} - i_{RR}$$

- If $i_{RR} < i_{MR}$: $\lambda_2 > 0 \implies R = \rho D$ (constraint binds)
- If $i_{RR} > i_{MR}$: $\lambda_2 = 0 \implies R > \rho D$ (constraint slack)

Data: Retail Bank Sample Selection

- Multi-step filter to focus on genuine retail deposit-takers:
  1. Retail footprint: $\geq$ 1,000 small accounts or $\geq$ 30% small deposits
  2. Drop trust/custodial markers
  3. Drop persistent non-retail profiles
  4. Rescue borderline cases with transaction accounts
  5. Extra custody drop
  6. Name-based exclusions (Ally, Toyota Financial, etc.)
- Final sample: 115,835 unique bank-quarters
- Conservative approach excludes custodial giants and monolines

Reserve Requirement Construction

- **Actual reserves:** Balances at Fed + vault cash
- **Required reserves:** Estimated from transaction accounts using Fed's tiered formula:
  - Net of balances due from other institutions
  - Net of cash in process of collection
- **Excess reserves:** $ER = R - \rho D$
- Post-March 2020: $\rho = 0 \implies ER = R$