Balance Sheet Policy Above the Effective Lower Bound

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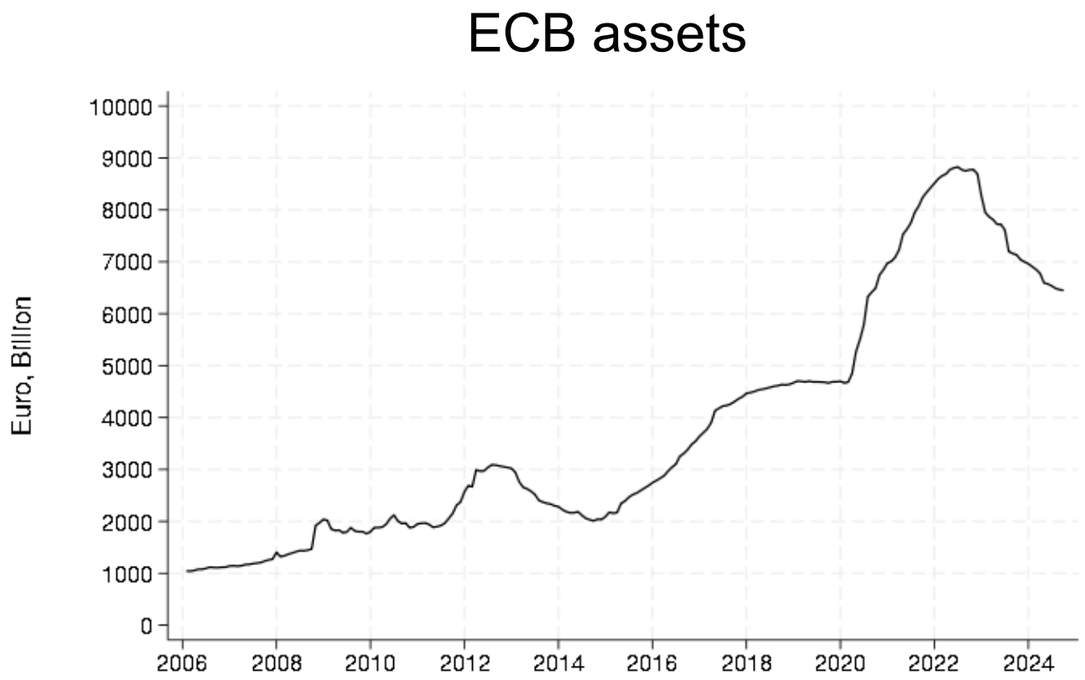
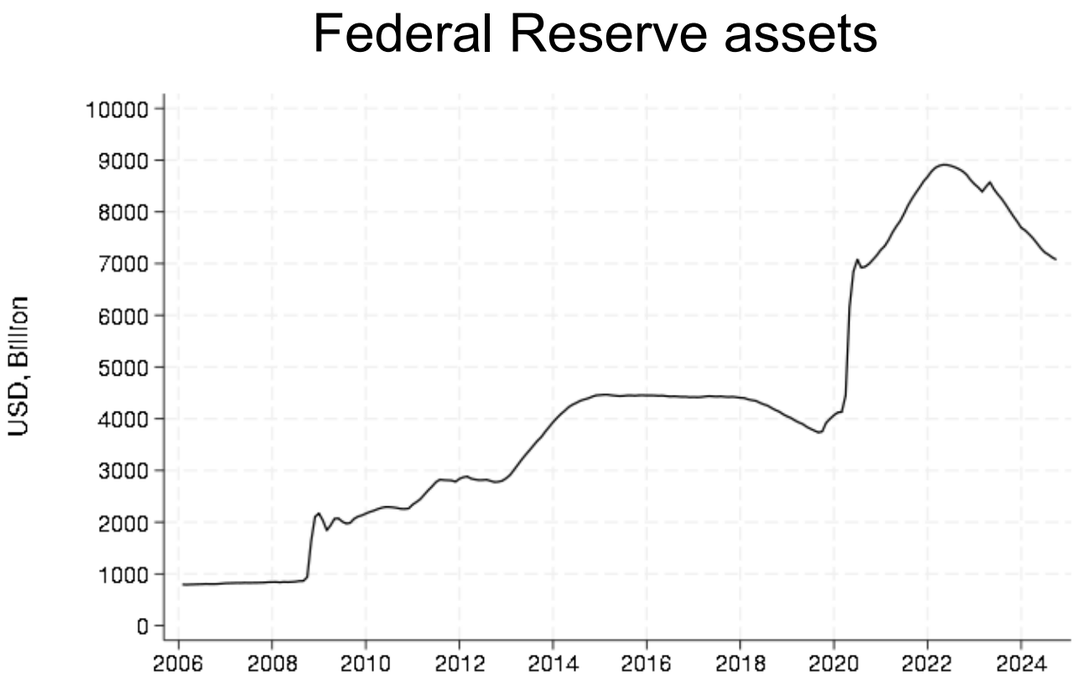
Balance sheet reduction (QT) is well under way: When should it end?





Data to Sept 18, 2024

When the interest rate on reserves (IOR) is not constrained by the effective lower bound:

- Central bank can hit short-rate target for any reserve supply by setting the IOR as needed
- A given balance sheet size is not needed for stimulus/tightening. How large should it be?

Federal Reserve balance sheet

September 11, 2024

H.4 release, $B

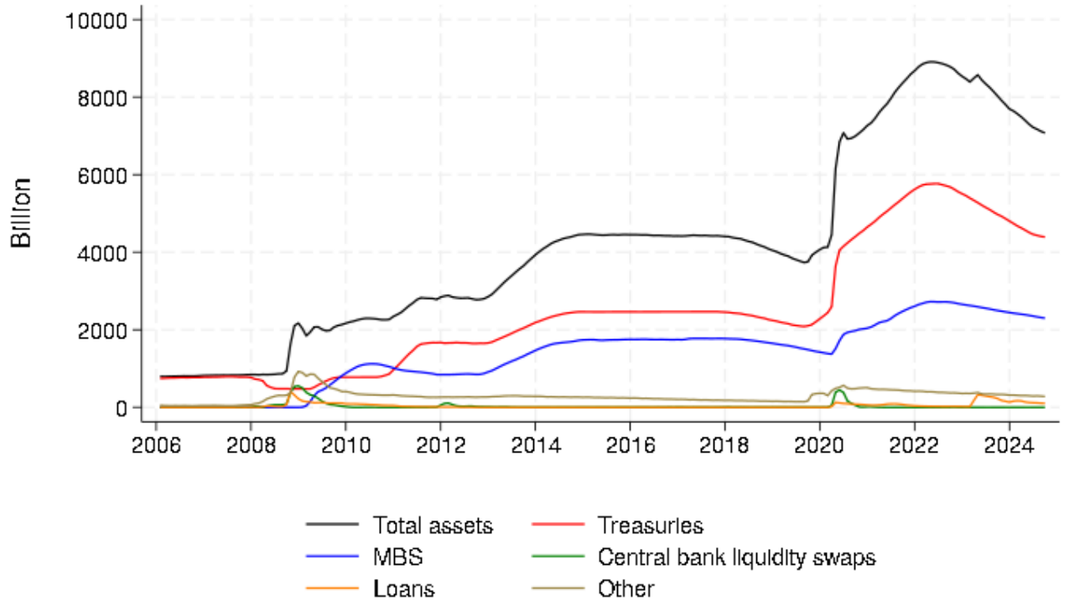
Assets		Liabilities	
Treasuries	4,389	Reserves	3,360
MBS	2,300	Overnight reverse repo agreements	279
Loans	102	Currency	2,353
Other	375	Treasury general account	726
		Other	448
	7,166		7,166

$$\text{Securities} + \text{Lending} = [\text{Reserves} + \text{ON RRP}] + \text{Autonomous factors}$$

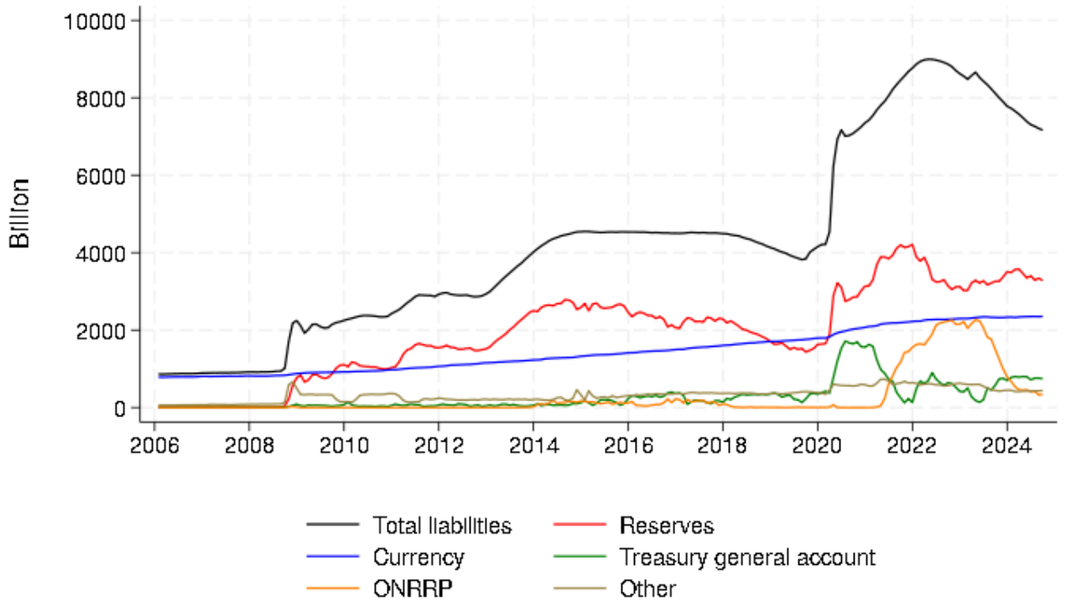
Federal Reserve balance sheet

2006M1-2024M9

Assets



Liabilities



What do the typical central bank mandates say about balance sheet policy above ELB?

1. Monetary policy: Not much

2. Financial stability: A large balance sheet helps
   - Lowers interest rate volatility

3. Facilitate payments, supply money: A large balance sheet can – surprisingly – be harmful
   - Supplying money is not free if CB assets have money-like features, "convenience yields"
   - How does the CB maximize its net convenience supply?

Fed: Estimations → Conflict between 2 and 3. If it puts some weight on 3, would want a smaller balance sheet and would tolerate a bit more interest rate volatility than if focusing on 2

ECB: New operating framework designed partly to diminish conflict between 2 and 3 by creating a lot of the reserves via lending (and within bonds, only some are scarce, Bunds)

References

On my google site: https://sites.google.com/view/annette-vissing-jorgensen

- Vissing-Jorgensen, A., 2023a, "Balance Sheet Policy Above the Effective Lower Bound", *ECB Forum on Central Banking (Sintra)*
- Lopez-Salido, D. and A. Vissing-Jorgensen, 2024, "Reserve Demand, Interest Rate Control, and Quantitative Tightening", working paper
- Vissing-Jorgensen, A., 2023b, "Convenience Yields and Monetary Policy", *Baffi Lecture, Bank of Italy*

1. Reserve demand and monetary policy implementation with IOR, above the ELB (Lopez-Salido and Vissing-Jorgensen, 2024)

Reserve demand

Bank Assets	*Bank Liabilities*
Reserves	Deposits
Securities, loans	Interbank and central bank borrowing
Interbank lending	Equity

1. Interest on reserves: IOR
2. Reserves are needed to satisfy reserve requirements (if any)
3. Reserves have convenience benefits: Liquidity: Don't have to sell illiquid assets/ cut lending/delay payments if deposits drop

   Also useful for supervision & regulation purposes

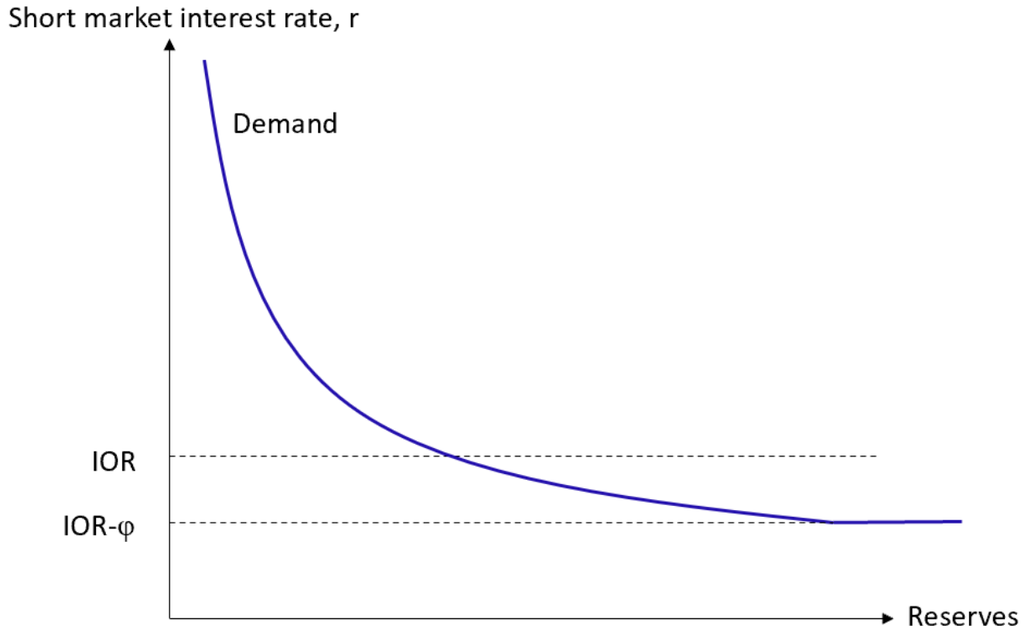
$v(ExcessReserves, Deposits)$	Convenience value: Expected savings on transactions costs/other costs
$v'_R(ExcessReserves, Deposits)$	Convenience yield: Marginal value of more reserves Decreasing in reserves, increasing in deposits

4. Bank balance sheet cost φ per dollar of assets (capital requirements)

Reserve demand

FOC for borrowing to hold more reserves:

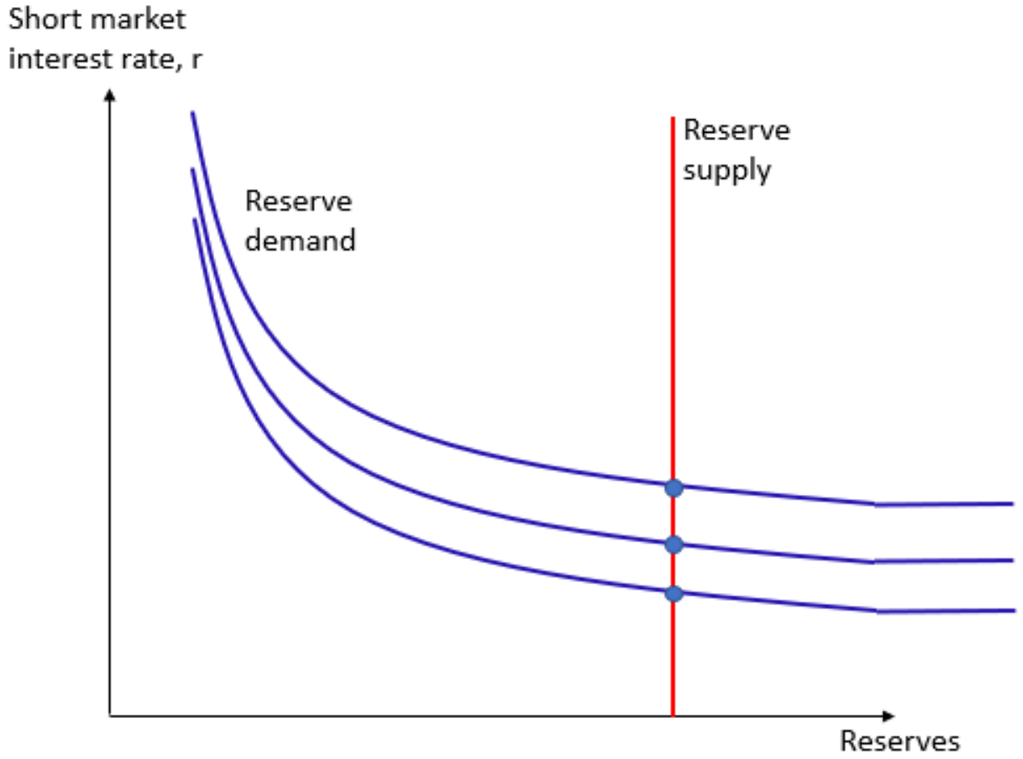
$$\underbrace{r}_{\substack{\text{Highest interest rate bank} \\ \text{is willing to pay to borrow} \\ \text{to invest in additional reserves}}} = \underbrace{IOR + v_R'(ExcessReserves, Deposits) - \varphi}_{\text{Net benefit of additional reserves}}$$



- Demand for reserves:
  - Slope: Comes from $v_R'(.)$
  - Level: Shifts up with IOR, down with φ
  - Location: Shifts right with req. reserves
  - Asymptotes to IOR-φ if $v_R'(.) \rightarrow 0$

- Reserve scarcity is measured by $v_R'(.) - \varphi$ and thus r-IOR:
  - Scarce: $r - IOR = v_R'(.) - \varphi > 0$
  - Abundant: $r - IOR = v_R'(.) - \varphi = -\varphi$
  - Ample: In between

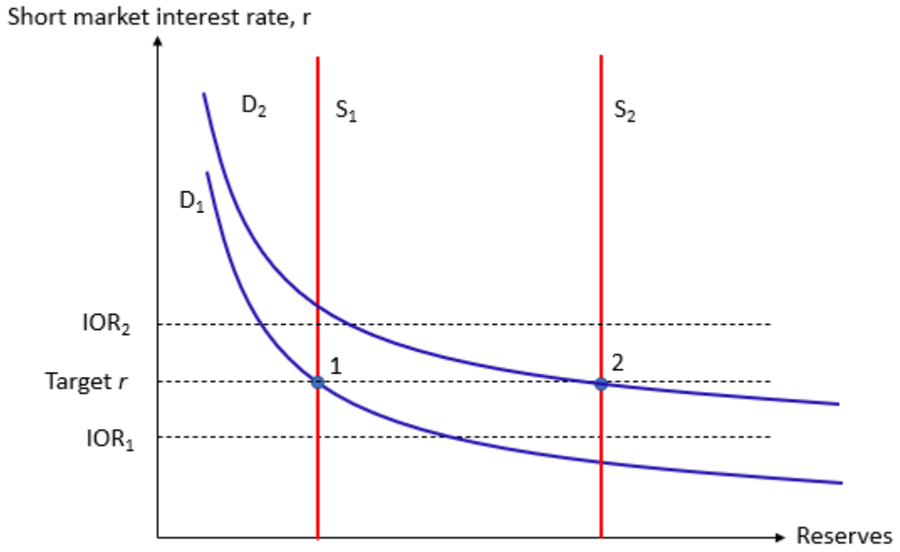
Above ELB: Central bank can hit target for any reserve supply by setting IOR



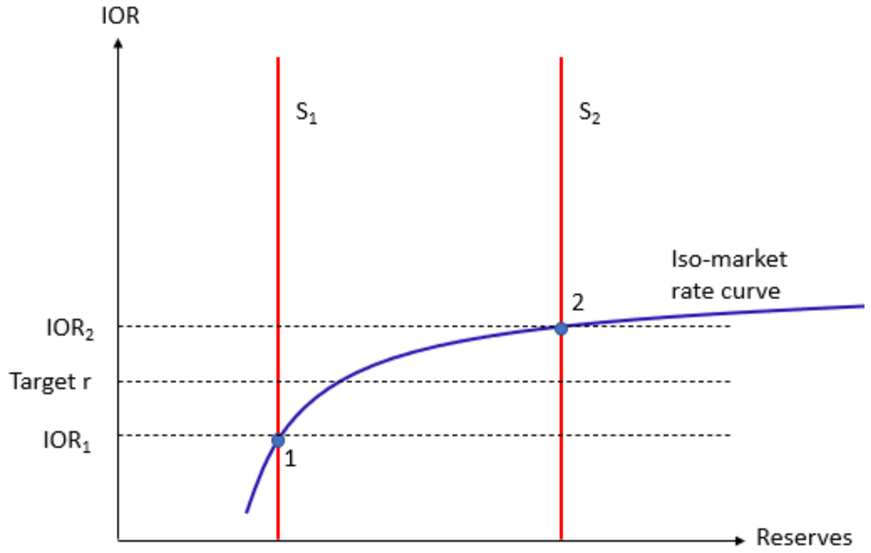
With IOR, the central bank can control both reserve demand and reserve supply!

Iso-market rate curve: $(IOR, Reserves)$ combinations that achieve same market *r*

Reserve market



Iso-market rate curve for short rate



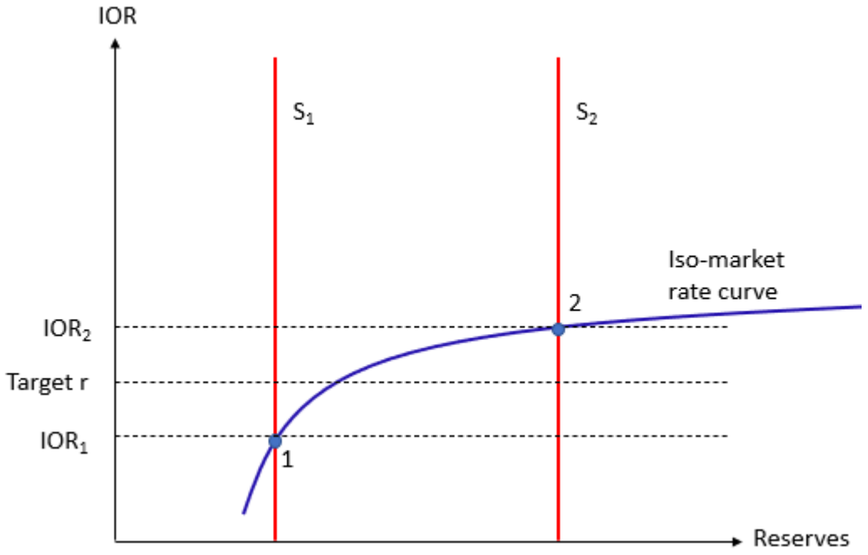
Reserve demand: $r = IOR + v_R'(Reserves, Deposits) - \varphi$

1: Low IOR, high $v_R'(.) - \varphi > 0$. 2: High IOR, low $v_R'(.) - \varphi < 0$

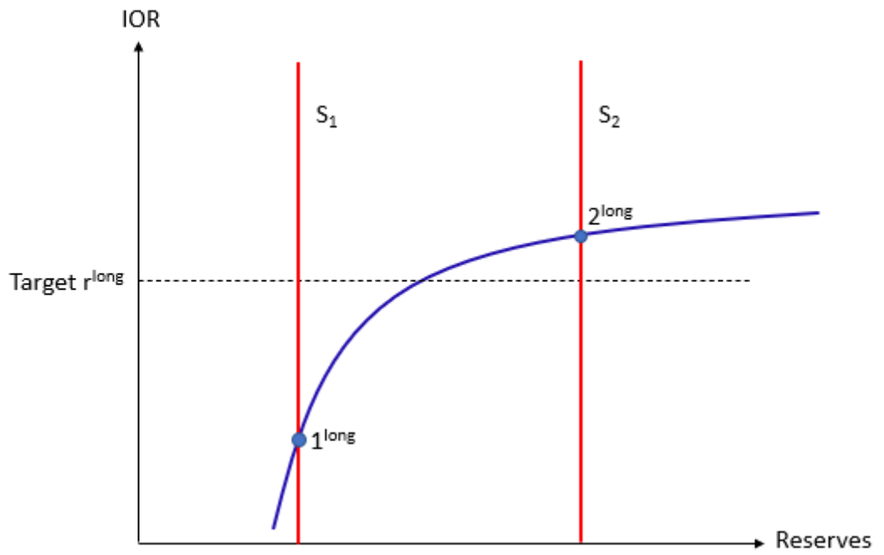
"Iso-market rate" curve: $IOR = r^{Target} - [v_R'(.) - \varphi]$ How to set IOR given reserves

Iso-market rate curve: $(IOR, Reserves)$ combinations that achieve same market *r*

Iso-market rate curve for short rate



Iso-market rate curve for long rate



Steeper iso-market rate curve for long market rate (better measure of policy stance)

$r = IOR + v'_R(Reserves, Deposits) - \varphi + Risk\ Premium$ (for duration/pre-payment/credit risk)

- Reserves up → $v'_R(Reserves, Deposits) - \varphi$ down and $Risk\ Premium$ down
- Same conclusion: Many (IOR,reserves) combinations give similar policy stance

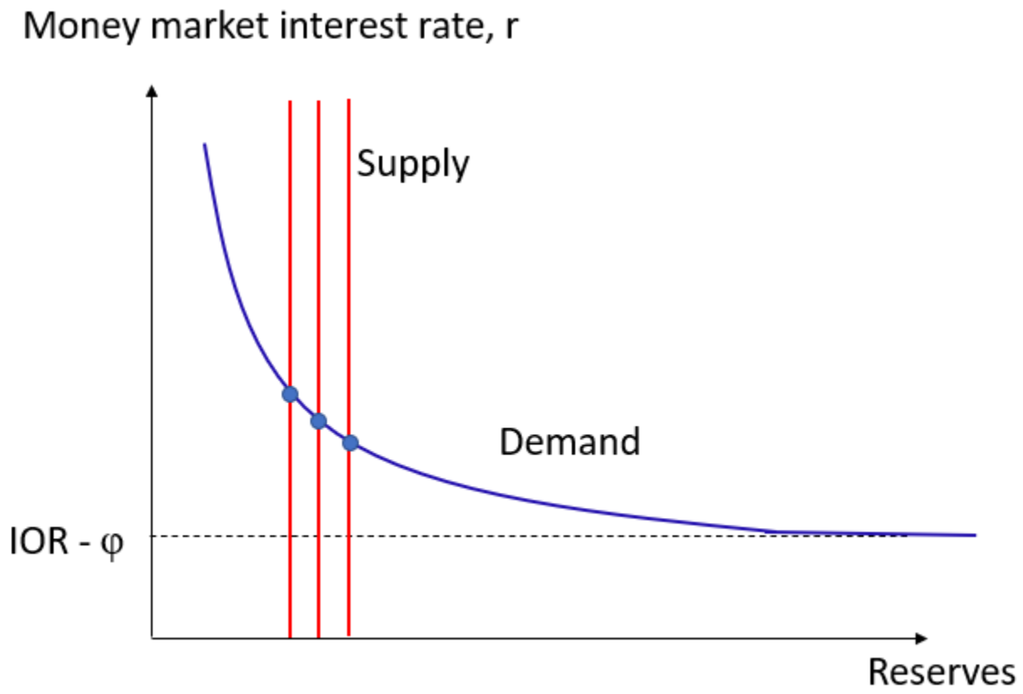
2. Interest rate volatility: Avoid another yield spike like September 2019 (Lopez-Salido and Vissing-Jorgensen, 2024)

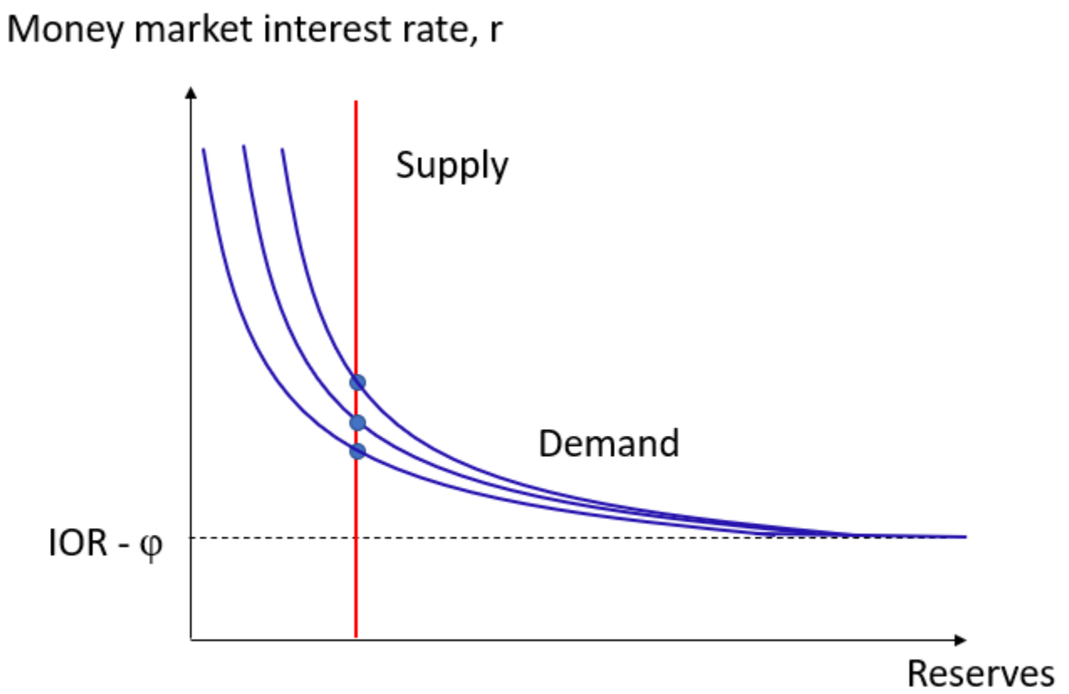
Financial stability: Interest rate volatility

Reserve demand flatter at higher quantities

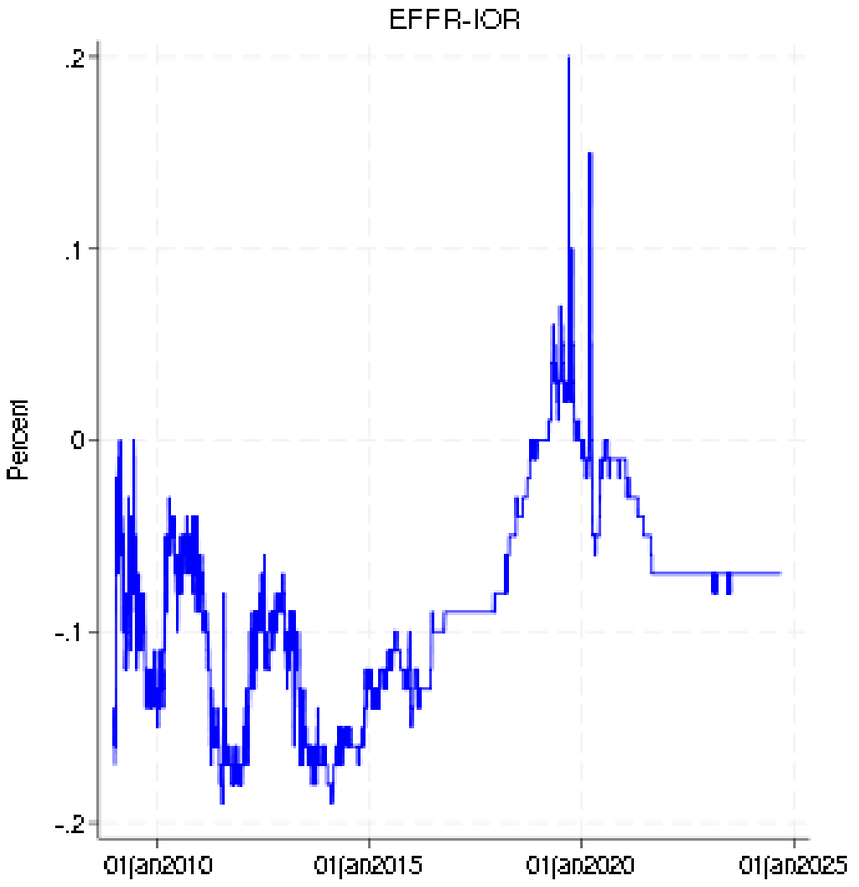
→ Operating with higher reserves reduces interest rate volatility from:

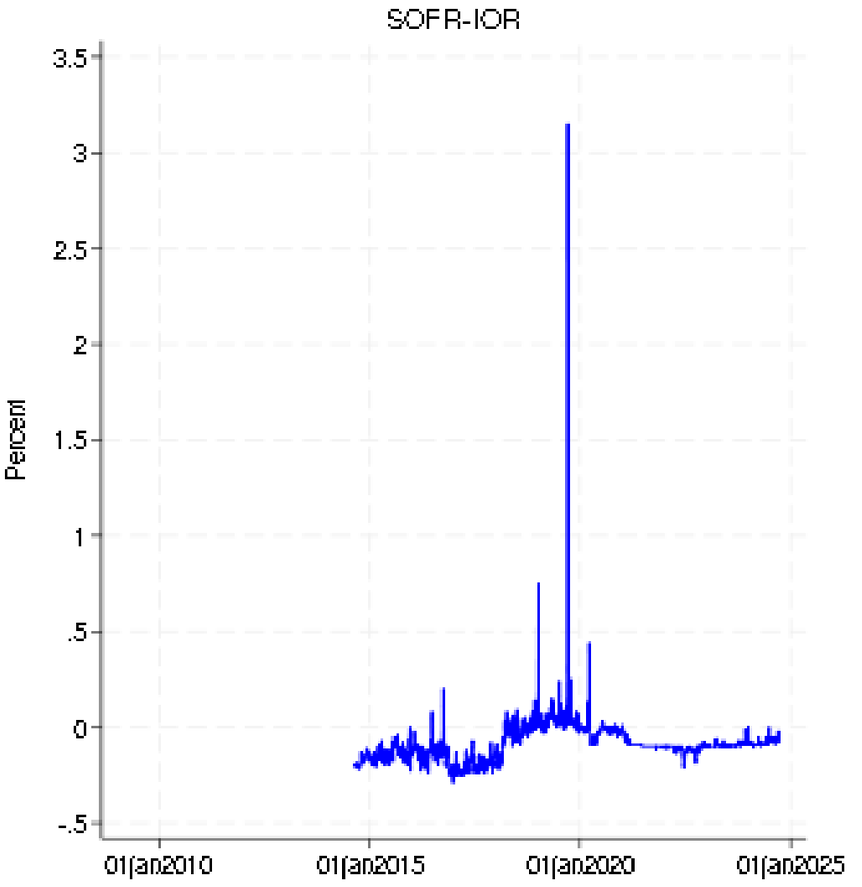
- Supply shocks: Due to fluctuating autonomous factors (currency, government deposits)
- Demand shocks, if horizontal





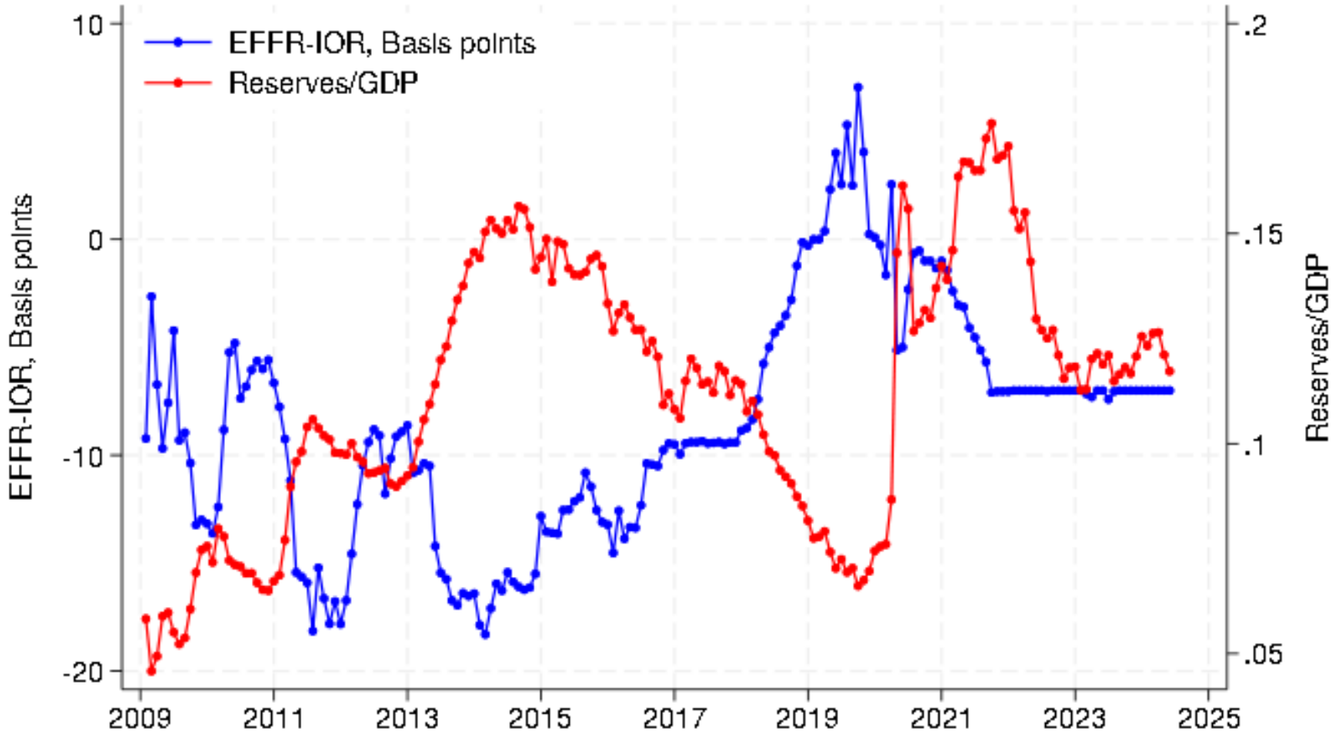
Interest rate volatility: Low reserve supply → Yield spikes, September 17, 2019





Daily data: 2009-Sept 18, 2024. Last day of the month dropped.

Interest rate volatility: September 17, 2019, was unexpected, given level of reserves



Monthly data (averages), 2009M1-2024M5.

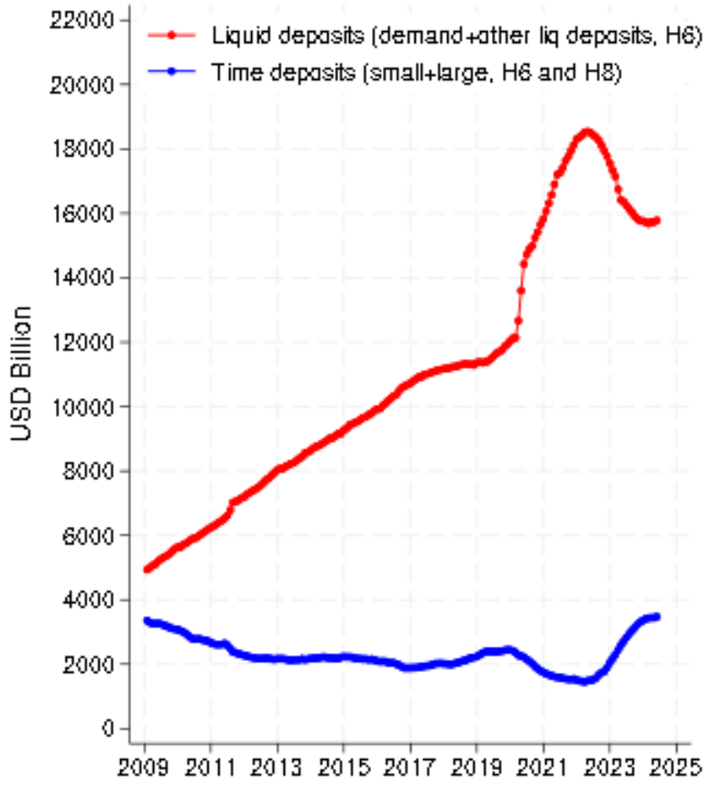
Lopez-Salido and Vissing-Jorg. (2024):

- To understand reserve demand, need to include size of banking sector (liquid deposits)
- Show that then Sept 2019 was not surprising
- At which supply *today* are reserves as scarce as in Sept 2019, given today's deposits?

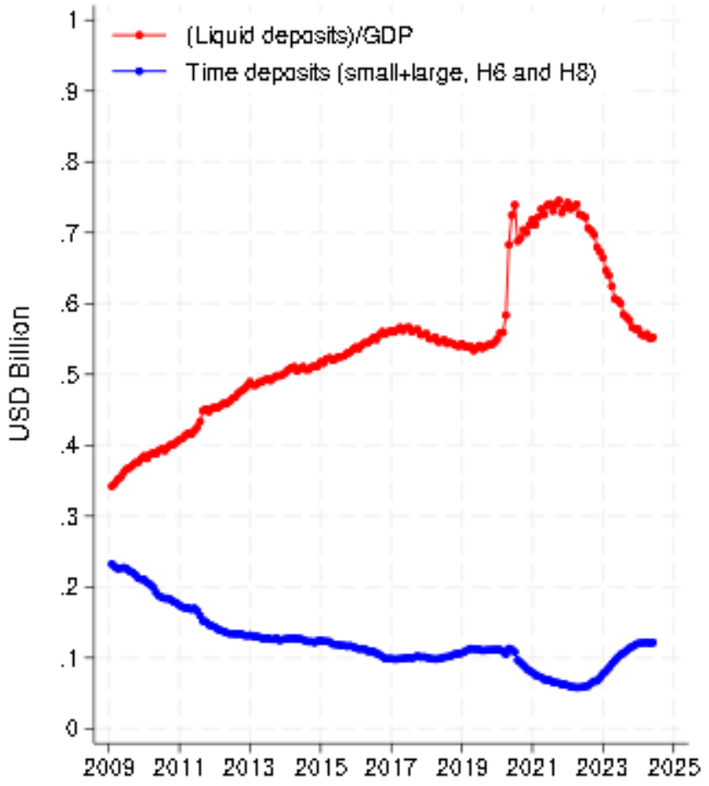
Estimating reserve demand: Deposit growth

Liquid deposits grew a lot over the 2009M1-2024M5 period, even relative to GDP

USD Billion



Ratio to GDP



Estimating the reserve demand function in ample reserves regime

- Assume $v_R'(.) - \varphi$ is log-linear. Allow for a reserve demand shock *U*

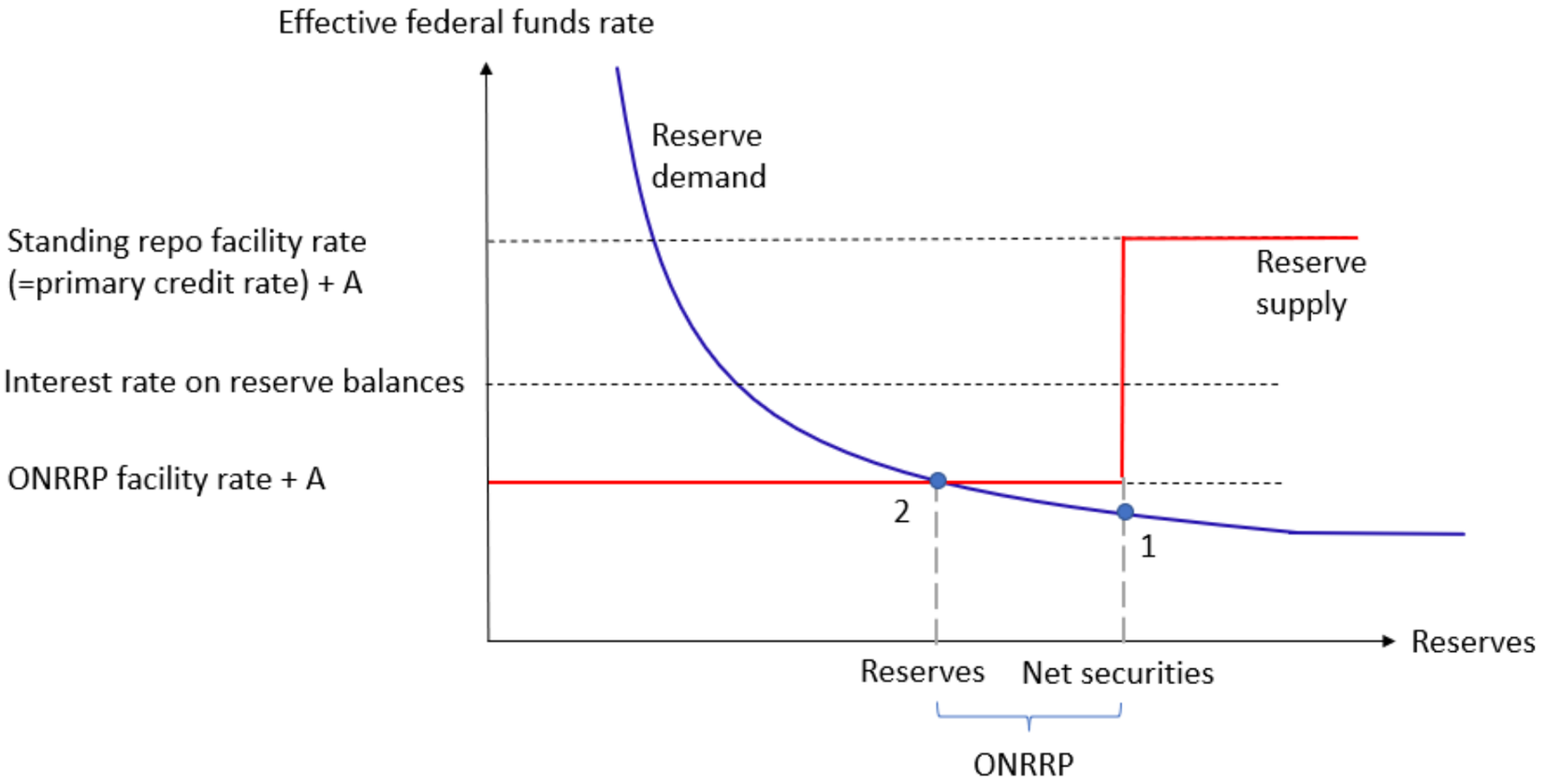
$$v_R'(ExcessReserves, Deposits) - \varphi = B + C * \ln(ExcessReserves) + D * \ln(LiqDep) + U$$

- Reserve demand:

$$r - IOR = B + C * ln(Excess\ Reserves) + D * ln(Liquid\ Deposits) + U$$

- US data, monthly, 2009M1-2024M5
  - r: Effective Federal funds rate (interbank market)
  - Both excess reserves and liquid deposits are nominal so account for prices change
  - Controlling for liquid deposits is important (but instrumenting for liquid deposits is not)
  - Lower bound on *r-IOR* due to the presence of the ON RRP facility
    Binds when the balance sheet is sufficiently large that ON RRP take-up is positive

ON RRP rate implies a lower bound for EFFR



$$\text{Securities} + \text{Lending} = [\text{Res.} + \text{ON RRP}] + \text{AF} \rightarrow [\text{Res.} + \text{ON RRP}] = \underbrace{[\text{Securities} - \text{AF}]}_{Net\ securities} + \text{Lending}$$

For net security supply drawn: Without ON RRP facility: 1. With ON RRP facility: 2

ON RRP rate implies a lower bound for EFFR

EFFR bounded from below by $r^{ON\ RRP} + A$ → EFFR-IOR by $r^{ON\ RRP} - IOR + A$

- A is the marginal value of collateral: Borrowing rate "discount" in repo relative to Fed funds

$$EFFR - IOR = \max\begin{pmatrix} B + C * ln(Reserves + ON\ RRP) + D * ln(Liquid\ Deposits), \\ r^{onrrp} - IOR + A \end{pmatrix} + U$$

When net securities are to the left of point 2:

- ON RRP = 0, Reserves + ON RRP is just Reserves
- 1st term operative: Shifts in supply trace out the reserve demand curve

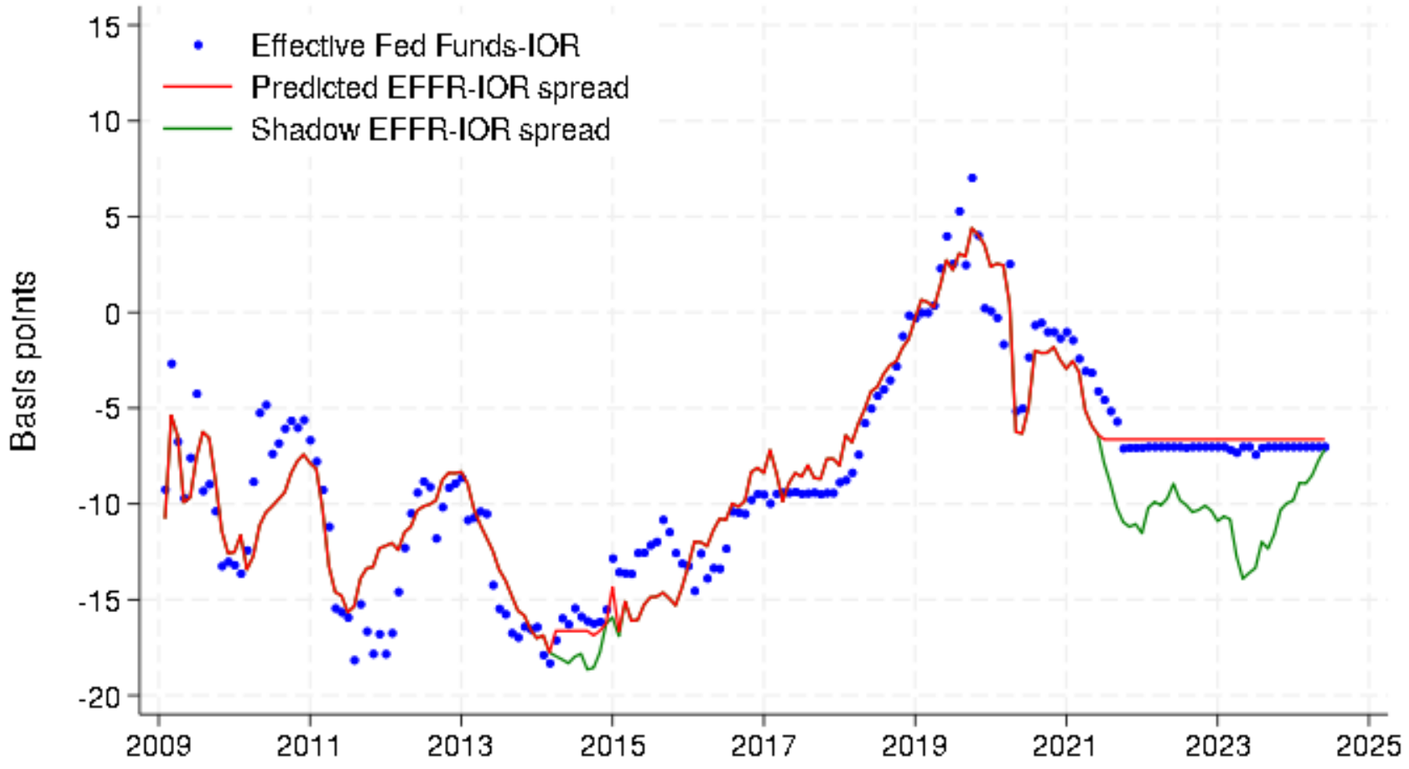
When net securities are to the right of point 2:

- 2nd term operative: Measures avg. EFFR-IOR spread for obs's with binding bound
- 1st term is "shadow" EFFR-IOR spread (spread if there was no ON RRP facility)

Estimating reserve demand: Fitted values from non-linear least squares

$$EFFR - IOR = \max(B + C * ln(Res. + ON\ RRP) + D * ln(Liq\ Deposits), r^{onrrp} - IOR + A) + U$$

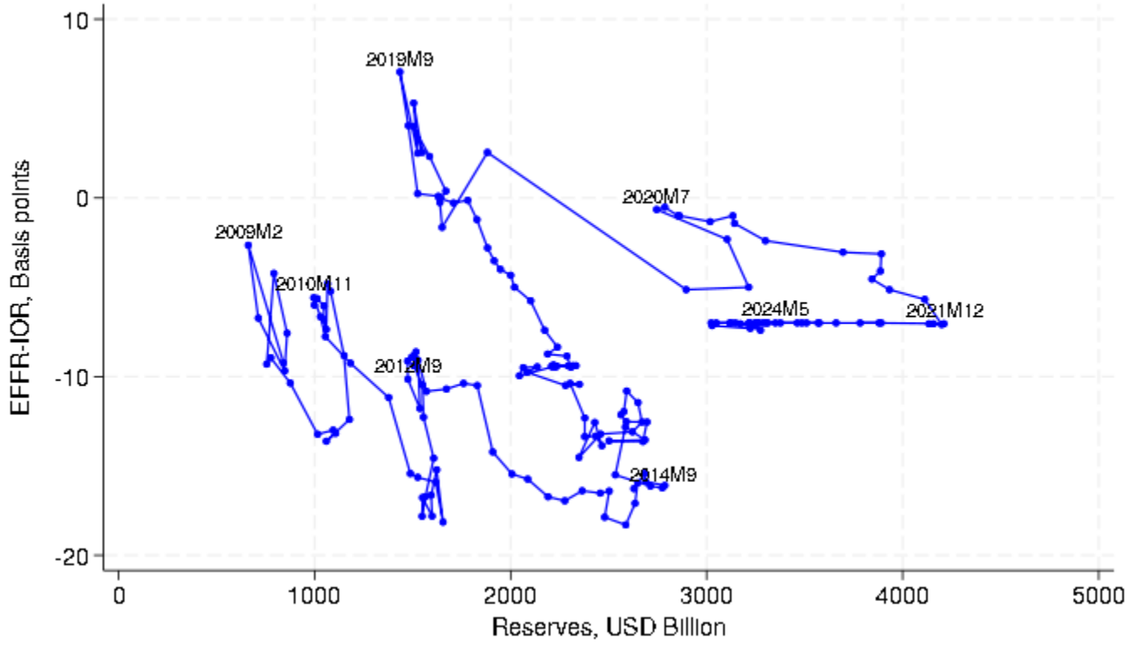
	Dept. var.: (EFFR-IOR)
A	3.37***
	(13.86)
B	-128.58***
	(t=-11.77)
C	-21.11***
	(-14.41)
D	30.57***
	(17.52)
N (months)	185
R^2	0.967

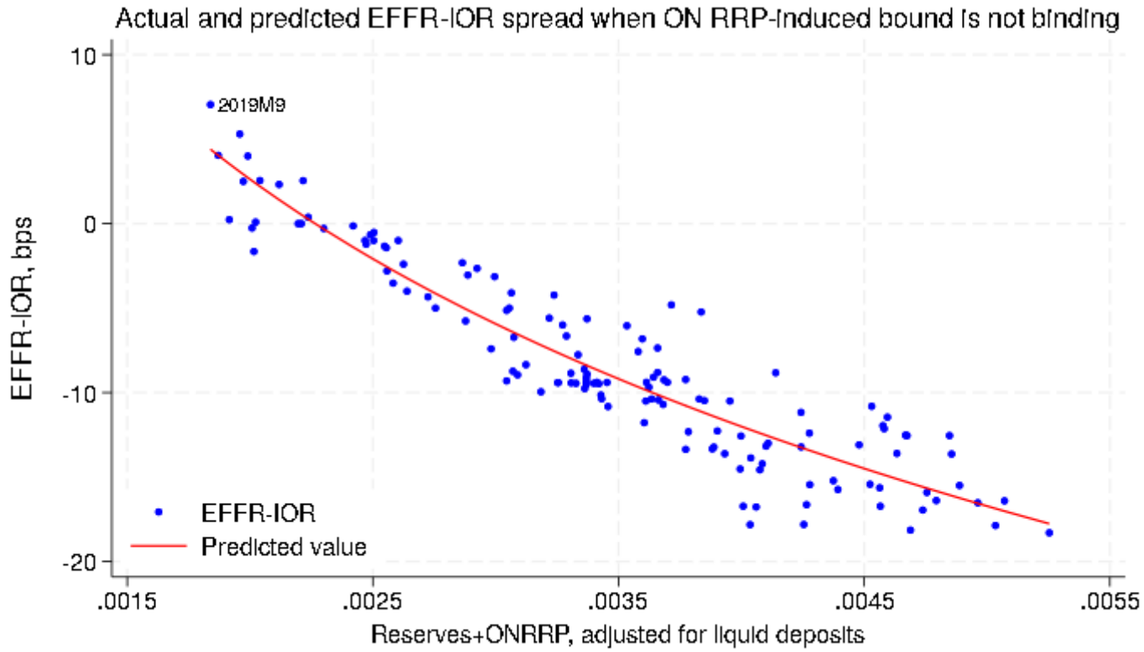


Estimating reserve demand: Fitted values when ON RRP bound is not binding

$$EFFR - IOR = B + C * ln(Reserves + ON\ RRP) + C * ln(Liquid\ Deposits) + U$$

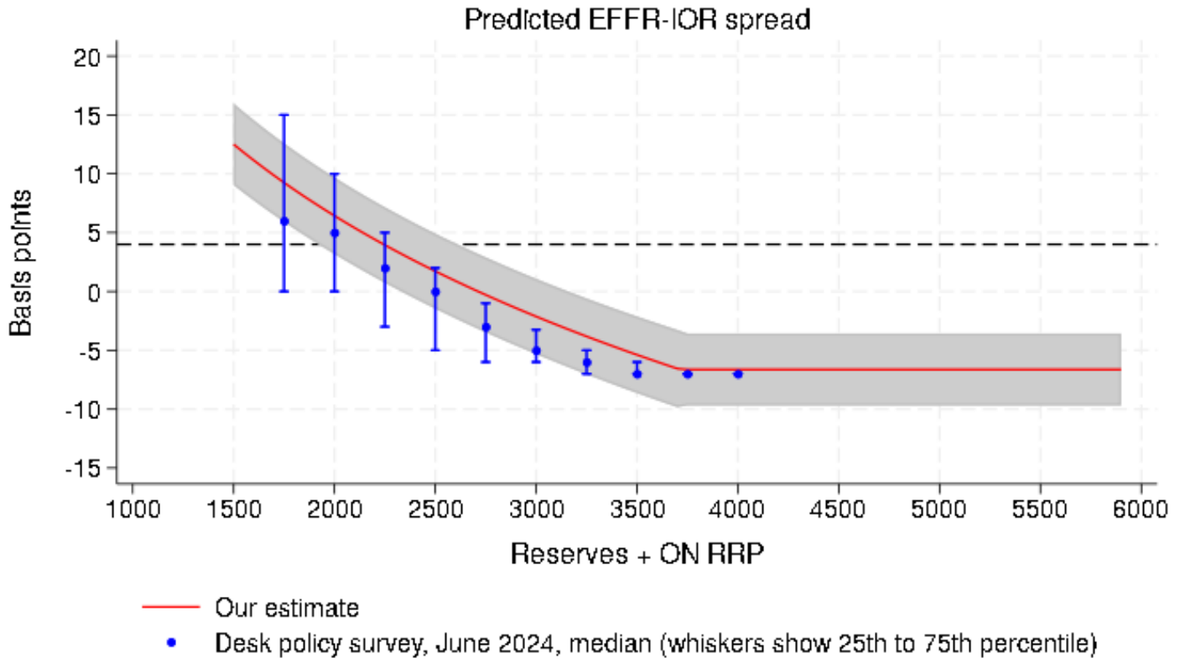
$$= B + C * ln\underbrace{\left[(Reserves + ON\ RRP) * (Liquid\ Deposits)^{\frac{C}{B}}\right]}_{Deposit-adjusted\ Reserves+ONRRP\ supply} + U$$





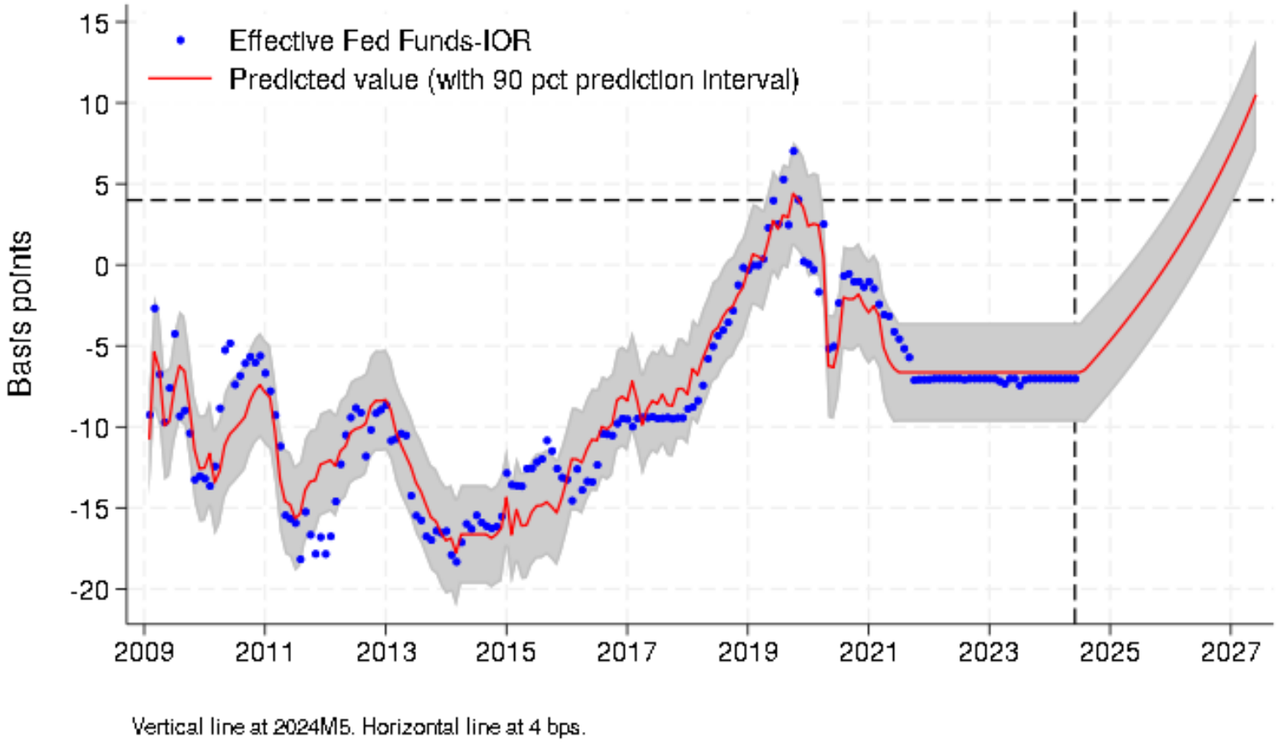
At what Reserves+ONRRP supply are reserves as tight as in September 2019?

$$EFFR - IOR = \max(B + C * ln(Reserves + ON\ RRP) + D * ln(Liq\ Deposits), r^{onrrp} - IOR + A) + U$$



- Calculate predicted spread, given liquid deposits of $15.8T in 2024M5
- Predicted EFFR-IOR=4 bps for Reserves+ON RRP=$2.3T (90% pred int: $1,950B to $2,610B, latest actual=$3.6T)
- Median replies from June 2024 SPD/SMP all fall in 90% prediction interval

At what *time* are reserves as tight as in September 2019?



- Assume liquid deposits will be flat in $B (from level in 2024M5) over next couple of years
- Assume Reserves+ONRRP falls by $60B/month from June
  (this is the cap; runoff is lower but there's growth in the autonomous factors)
- Result: 4 bps pred value in 2026M7 (90% pred. interval: 2026M1 to 2026M12)

3. Payments (convenience maximization): Central bank's net supply of liquidity/safety (Vissing-Jorgensen, 2023a)

Payments: Central bank's convenience (liquidity/safety) supply

Central bank assets	*Central bank liabilities*
Securities	Currency
Loans to banks	Government deposits
	Reserves
	Equity capital

Typical approach: Supply currency and government deposits elastically to facilitate payments

With IOR: Can use reserve supply to supply convenience too
The more special the CBs assets are, the lower the optimal reserve supply

Convenience yield: Benefit on an investment over-and-above interest & principal payments

- Relevant for the central bank's assets too, not just its liabilities
- From liquidity: Saved transactions/payment delay cost
- From safety: Saved information costs due to low default risk
- Both interact with supervision and regulation (can hold liquid and safe assets for LCR)

Convenience-maximizing reserve supply

Depends on *how* the central bank supplies reserves – asset mix

(A) If reserves are supplied via central bank holdings of assets without convenience yields: Convenience-maximizing reserve supply is larger	(B) If reserves are supplied via central bank holdings of assets with convenience yields (Treasuries or Bunds): Convenience-maximizing reserve supply is smaller

Political constraints on asset choices: Federal Reserve versus ECB

Federal Reserve: Has announced plans to primarily hold Treasuries in the longer run "thereby minimizing the effect of Federal Reserve holdings on the allocation of credit across sectors of the economy"

- Federal Reserve Act: Fed can hold assets that are obligations of, or guaranteed by, the US
- Corporate bond purchases during COVID crisis: Emergency program under Section 13
- Discount window priced to be used mainly in crisis

Broaddus and Goodfriend (2001): Express common sentiment that Fed should hold Treas's

- *"…the Fed's asset acquisition policy ought to give priority to preserving public support for the Fed's independence by insulating the central bank as much as possible from potentially damaging disputes regarding credit allocation*
- *"When the Fed purchases Treasury securities, it extends Federal Reserve credit to the Treasury. Doing so, however, leaves all the fiscal decisions to Congress and the Treasury"*

Political constraints on asset choices: Federal Reserve versus ECB

ECB: Could likely hold only assets without convenience yields in the longer run (and without requiring convenient assets as collateral for lending)

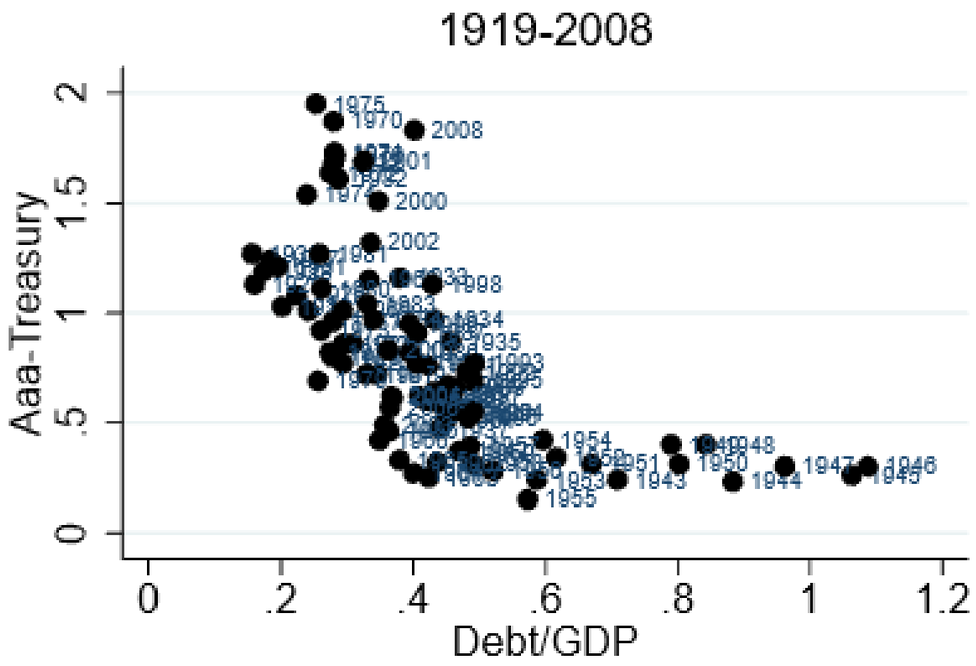
- Historically supplied reserves via collateralized lending to banks
- Government bond purchases: Politically sensitive. Challenged in court
- Schnabel (2023a) states: *"In the euro area, however, there are […] additional considerations relevant for the assessment of whether a large bond portfolio is desirable or not. One is that the lack of a consolidated public sector balance sheet raises more fundamental concerns about monetary and fiscal interactions in a currency union with sovereign member states. These concerns may potentially undermine the credibility and independence of the central bank."*

From the perspective of convenience-supply: ECB is at an advantage

- ECB's new framework exploits this advantage: Large role for supplying reserves via lending – reduces asset scarcity, lowers ECB profit risk, avoids reserves crowding out lending

Evidence for a Treasury convenience yield, Krishnamurthy and V-J (2012)

Prediction: If Treasuries have a convenience yield component,
then $y^{Corp.\ bonds} - y^{Treasury}$ should narrow with Treasury supply

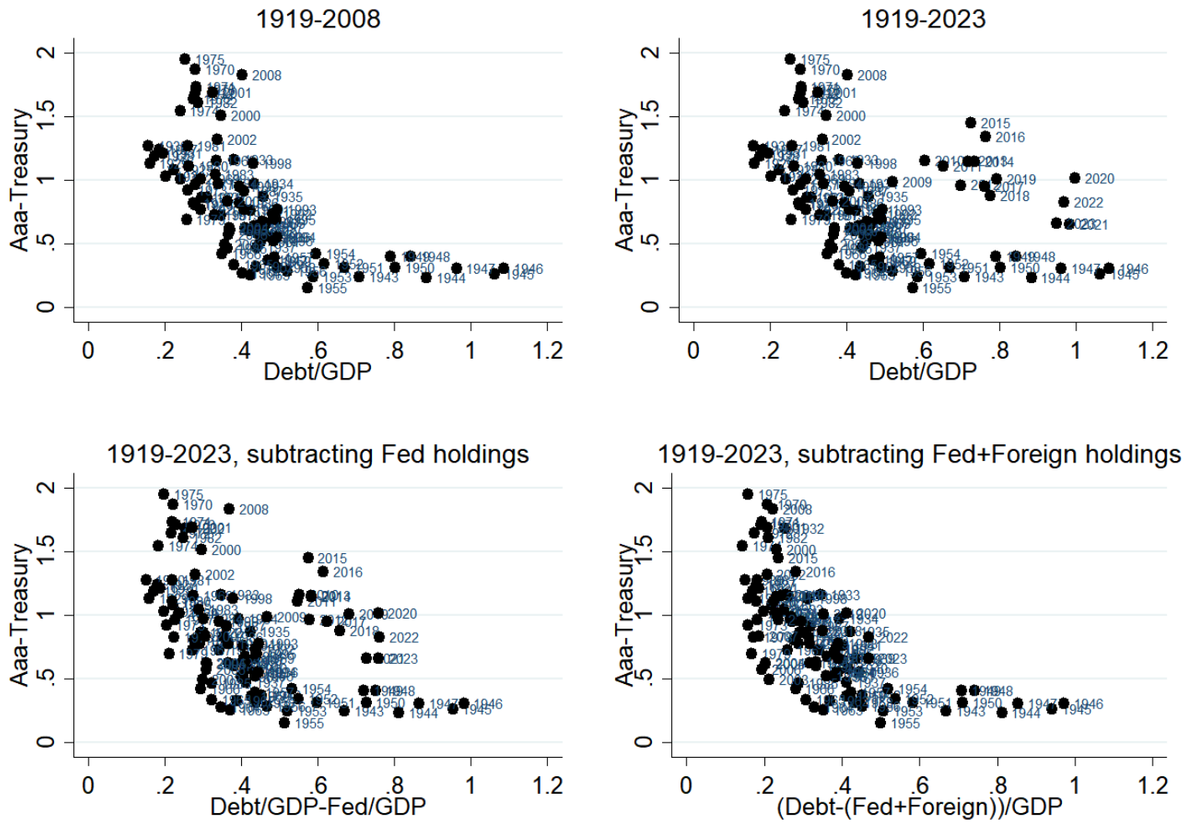


- $y^{Corporate\ bond} - y^{Treasury}$
  $= \underbrace{v'_T(T)}_{\substack{\text{Treasury} \\ \text{conv. yield}}} + \underbrace{\text{Default component}}_{\substack{\text{Spread for large} \\ \text{Treasury supply}}}$

- Default component: Asymptote
  Conv. yield: Distance to asymptote

- Avg. $v'_T(T)$,1919-2008, long maturities:
  46 bps relative to Aaa corp. bonds
  73 bps relative to Baa corp. bonds

There is still a Treasury convenience yield



Top left: 1919-2008
Top right: 1919-2023

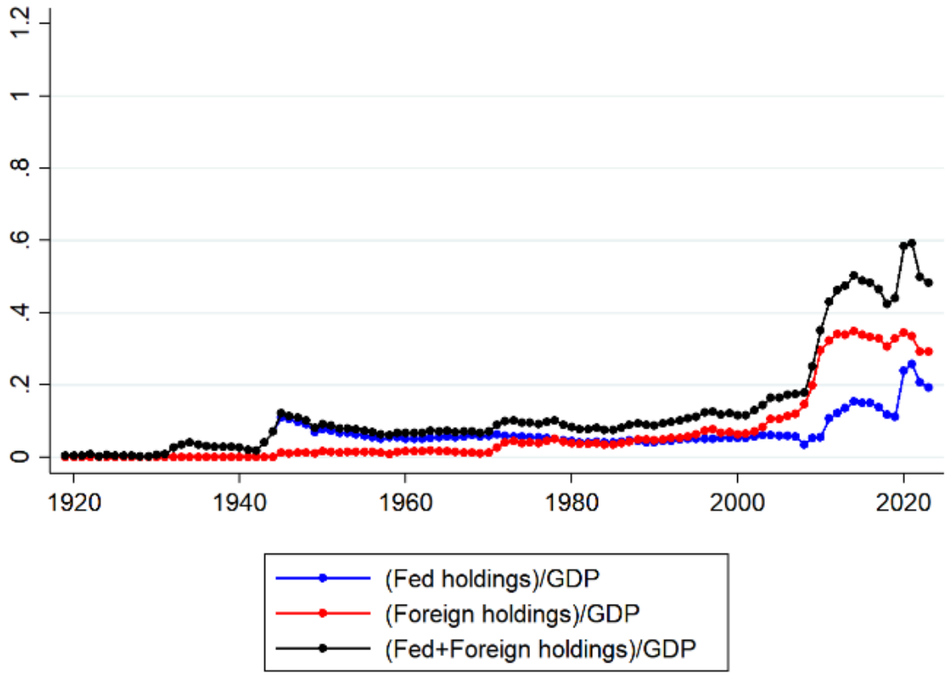
Outward shift post-GFC was due to Fed & foreign demand shocks:

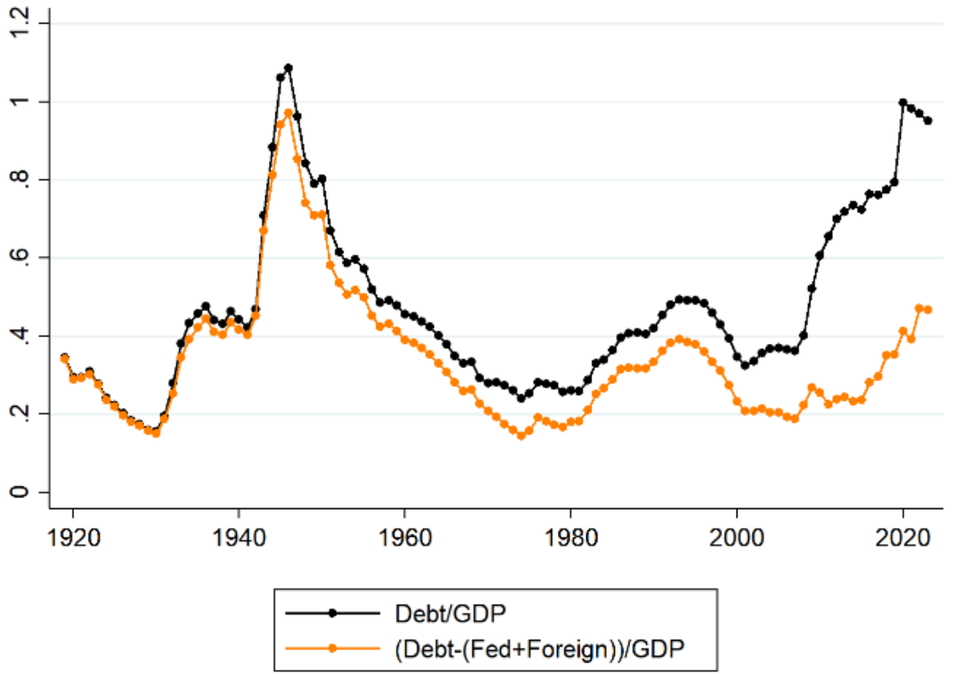
Bottom left: Role of Fed demand shocks
Bottom right: Role of foreign demand shocks

There is still a Treasury convenience yield

Treasury holdings of Federal Reserve and foreigners

Annual data, 2019-2023





A simple framework for convenience-maximization

Private (non-central bank) sector's convenience from reserves and bonds with conv. yield:

$$[v_R(R) - \varphi R] + v_B\left(B - B^{cb}\right)$$

Result (Convenience-maximizing reserve supply)

(A) If a central bank holds assets without convenience yields, $B^{cb} = 0$*:*

$\underset{R}{\text{Max}}\ v_R(R) - \varphi R \quad \rightarrow \mathrm{R}^{\mathrm{A}}$, *solves* $\quad v_R'(R) - \varphi = 0$

(B) If a central bank holds bonds (B) with convenience yields, $B^{cb} = R + AF$*:*

$\underset{R}{\text{Max}}\ [\, v_R(R) - \varphi R\,] + v_B(B - R - AF) \quad \rightarrow \mathrm{R}^{\mathrm{B}}$ *solves:* $\quad v_R'(R) - \varphi = v_B'(B - R - AF)$

(A) is the Friedman rule, applied to reserves:

Supply until the marginal value is zero. Assumes supplying money is free

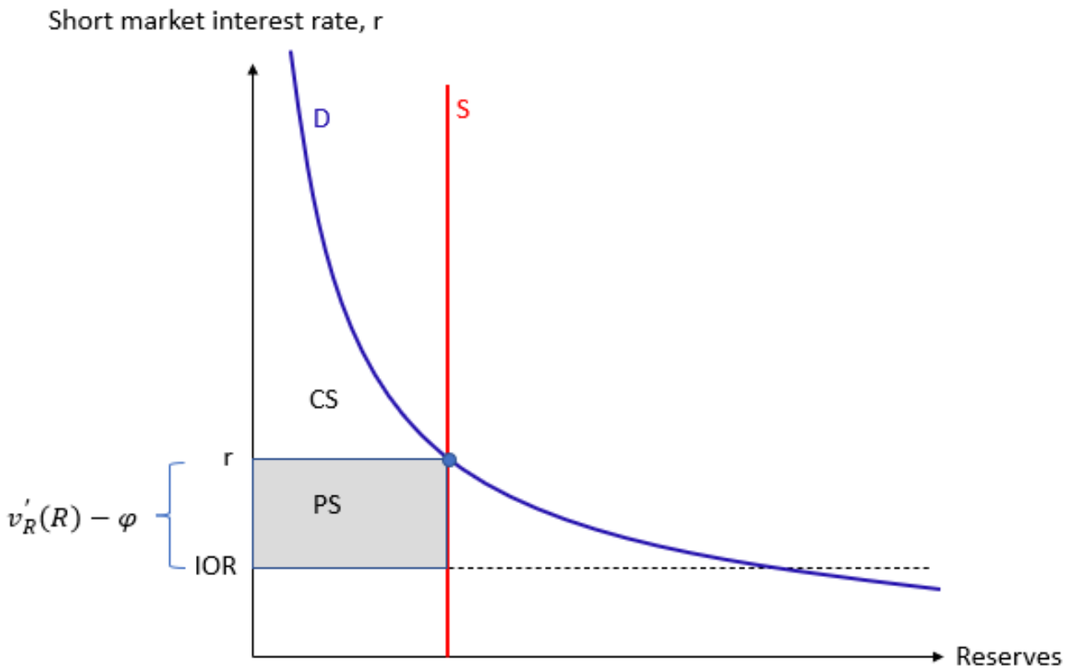
(B) is my suggested rule when the central bank holds convenient assets:

Recognizes that supplying money is not free

Convenience-maximizing reserve supply in *Case A*

Reserve market

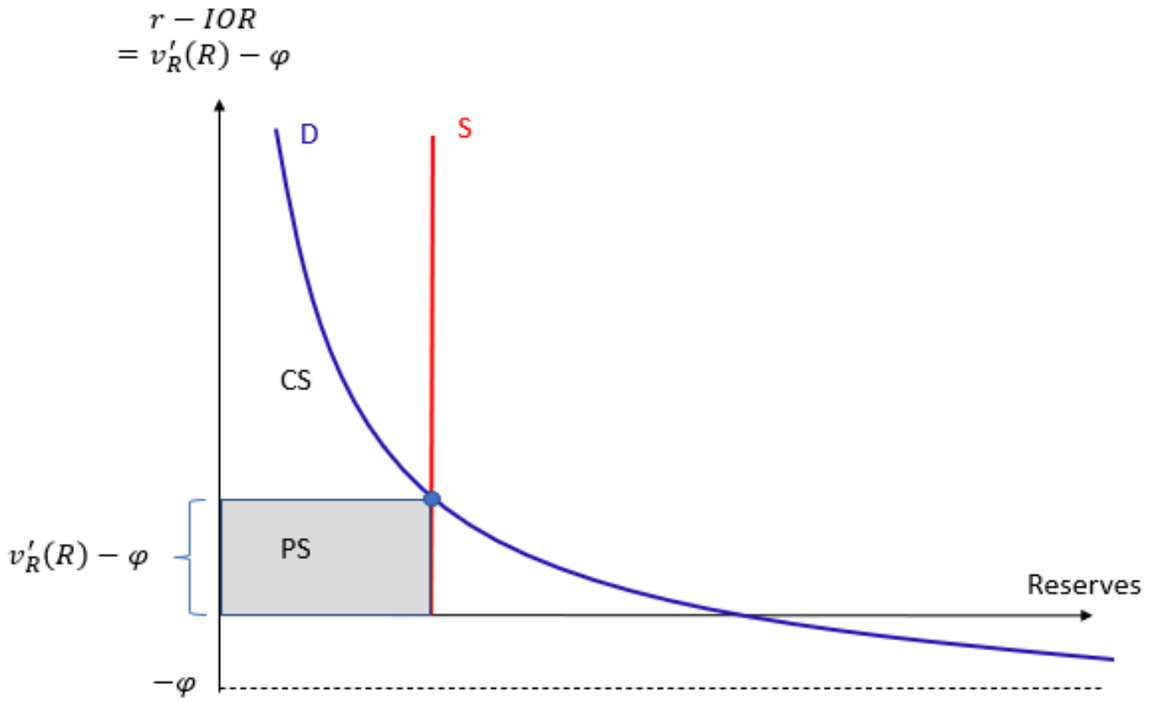
D: $r = IOR + v_R'(R) - \varphi$

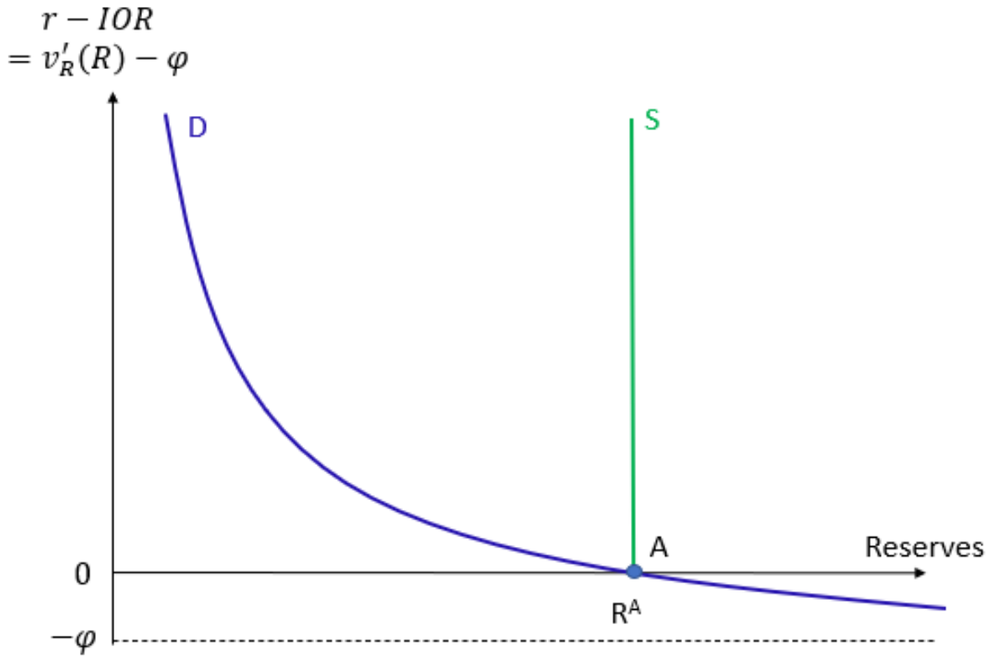


Total convenience value of reserves:

- Area between reserve demand curve and IOR, integral of $v_R'(R) - \varphi$
- For given unit of reserves
  Consumers' surplus (CS): $[IOR + v_R'(R) - \varphi] - r$
  Producers' surplus (PS): $r - IOR$
  Sum: $v_R'(R) - \varphi$

Convenience-maximizing reserve supply in *Case A*



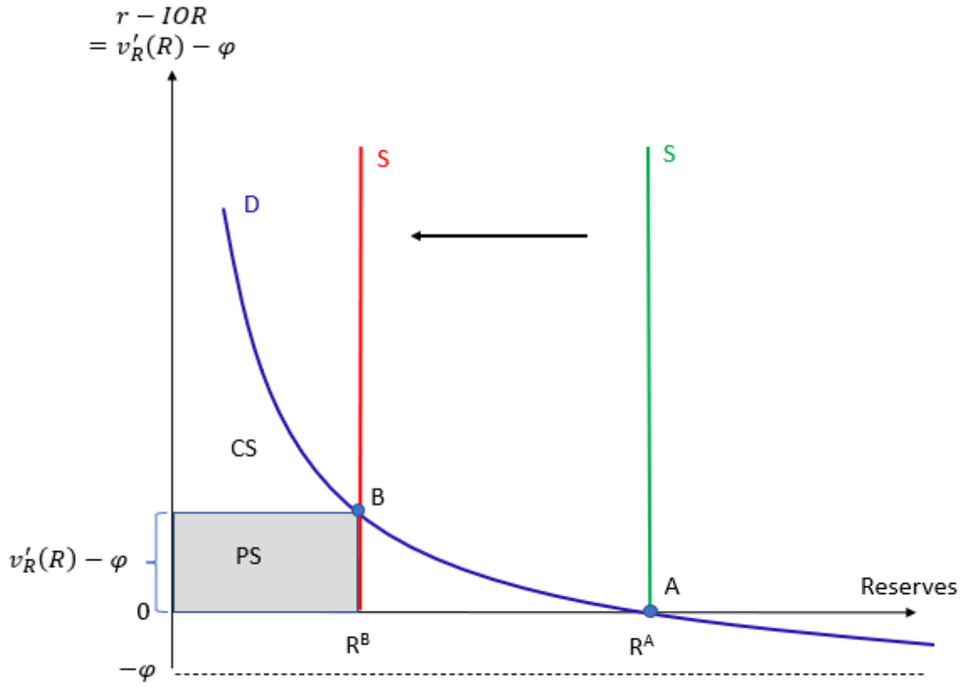


- R^A maximizes CS+PS from reserves by setting $v'_R(R) - \varphi = 0$

Convenience-maximizing reserve supply in *Case B*

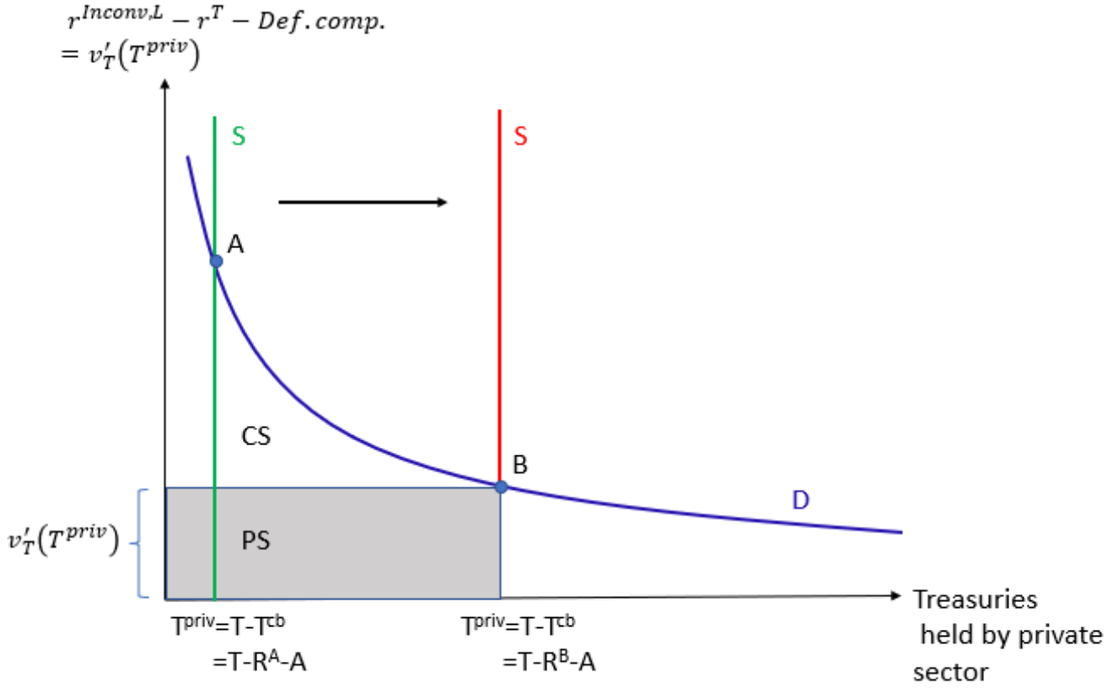
Reserve market

D: $r - IOR = v_R'(R) - \varphi$



Bond market (e.g., Treasuries)

D: $r^{Inconv,L} - r^T - Def.comp. = v_T'(T^{priv})$



- R^B maximizes total conv. value (CS+PS) from both reserves and bonds: Set $v_R'(R) - \varphi = v_T'(T^{priv})$
- R^B is larger if deposits go up (reserves scarcer) or Treasury supply goes up (Treasuries less scarce)

Convenience-maximizing reserve supply, extension

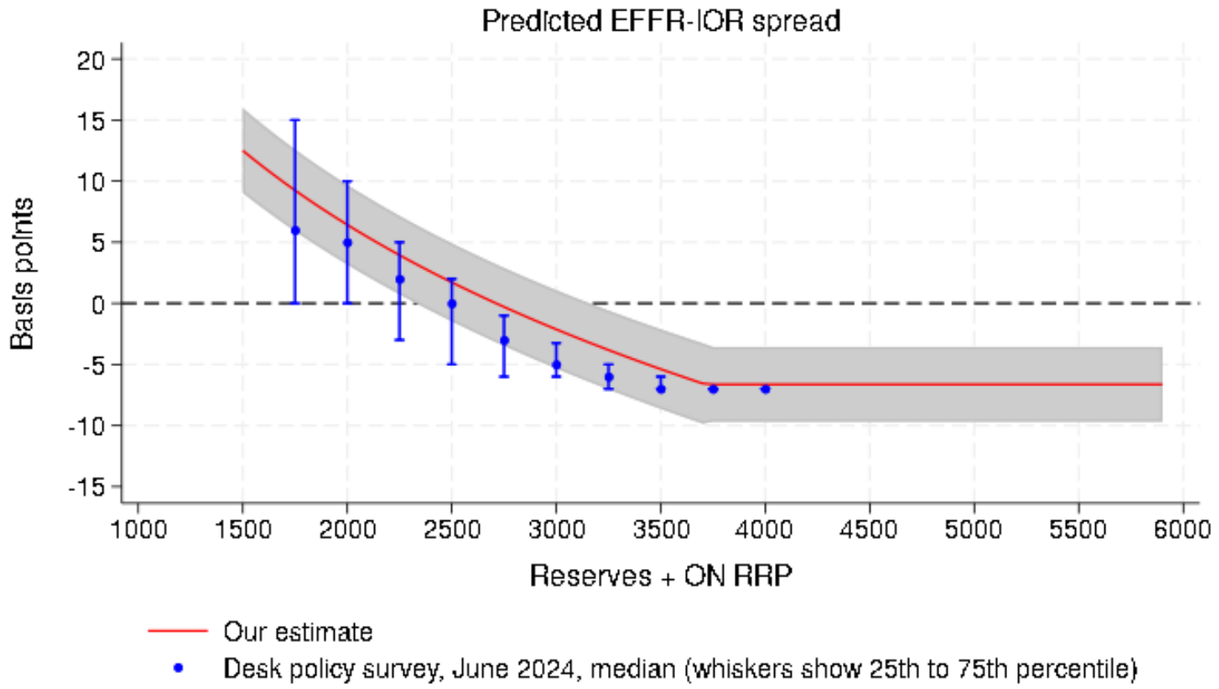
Extension What if the ECB decided to supply reserves with a mix of bank lending (inconvenient) and government bonds (some of which convenient)?

- Set $v_R'(R) - \varphi$ = *Average* convenience yield on ECB assets
- Suppose only German bunds have convenience yield

$$v_R'(R) - \varphi = \underbrace{v_B'\left(B_1^{priv}\right)}_{\text{Convenience yield on bunds}} * \underbrace{\omega}_{\substack{\text{ECB portfolio weight} \\ \text{on bonds}}} * \underbrace{\alpha_1}_{\substack{\text{Weight of bunds} \\ \text{in ECB's government} \\ \text{bond portfolio}}}$$

Implementing the convenience-maximation framework: US, case A

$$EFFR - IOR = \text{Max}(B + C * ln(Res. + ON\ RRP) + D * ln(Liquid\ Deposits), r^{onrrp} - IOR + A) + U$$

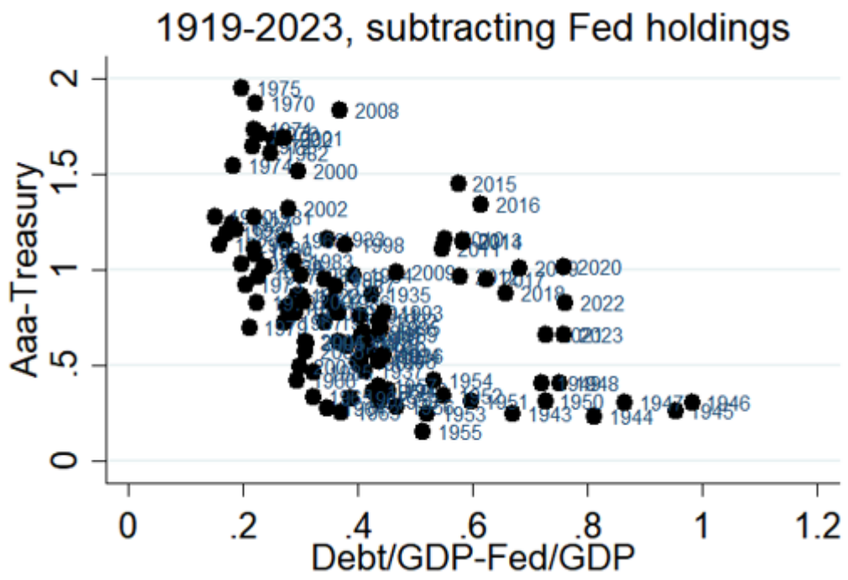


- Calculate predicted spread, given liquid deposits of $15.8T in 2024M5
- Predicted EFFR-IOR=0 bps for Reserves + ON RRP=$2.7T (90% pred int: $2,310B to $3,150B, latest actual=$3.6T)

Implementing the convenience-maximation framework: US, case B

Case B: Also need $v_T'(Treasuries^{Private})$ function. Updating KVJ (2012), annual data

$$y^{Aaa} - y^{Treasury} = \max\left(A_T + B_T * ln\left(\frac{Treasuries^{Private}}{GDP}\right) + \sum_{i=2009}^{2023} \beta_i D(year = i), C_T\right) + U$$



- Max: Accounts for Treasury demand saturation
- C_T: Estimated default component
- $v_T'(Treasuries^{Private})$ is distance to C_T:
- Year dummies for 2009-2023: Capture shift post-GFC (due to foreigners)

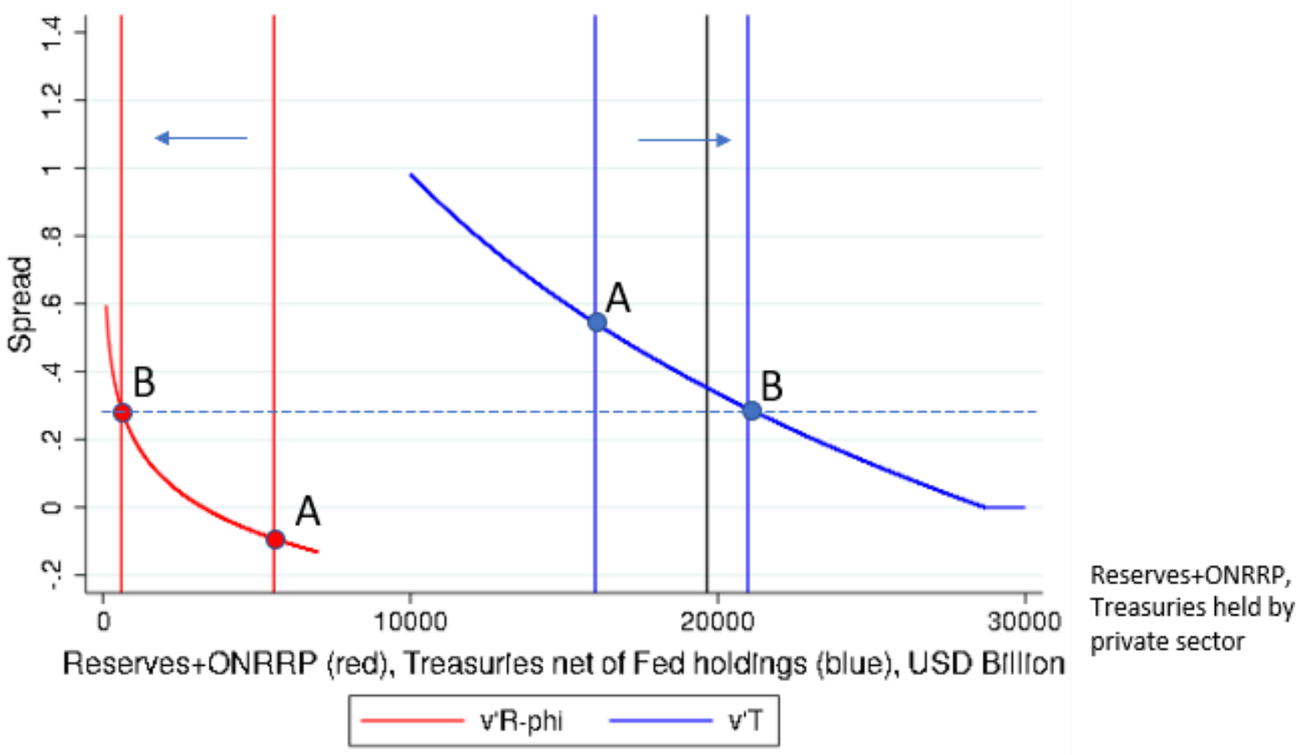
$\widehat{A_T} = -0.219, \widehat{B_T} = -0.933, \hat{\beta}_{2023} = 0.620, \widehat{C_T} = 0.306$

- April 2023: Spread=66 bps.
  Default component: 31 bps
  Convenience yield: $v_T'(.)$ =35 bps

Implementing the convenience-maximation framework: US, case B

$$\widehat{A_R} + \widehat{B_R} * ln(x) + \widehat{C_R} * ln(Deposits) = \max\left(\widehat{A_T} + \widehat{B_T} * ln\left(\frac{Treas - [x + AF]}{GDP}\right) + \hat{\beta}_i - \widehat{C_T}, 0\right)$$

April 2023:



Vertical black line: $Treasuries^{Private}$ given that Fed currently holds Treas. and MBS

NOTE: This slide is based on an earlier version of LS-VJ where we used total deposits.

- Red: $v_R'(.) - \varphi$ given current deposits
- Blue: $v_T'\left(\frac{Treasuries^{Private}}{GDP}\right)$ given current GDP
- A: Locations at current Reserves+ONRRP if Fed only held Treasuries
- B: Locations at convenience-maximizing Reserves+ON RRP if Fed only holds Treasuries

- Convenience yields equalized at 29 bps for Reserves+ONRRP=$600B

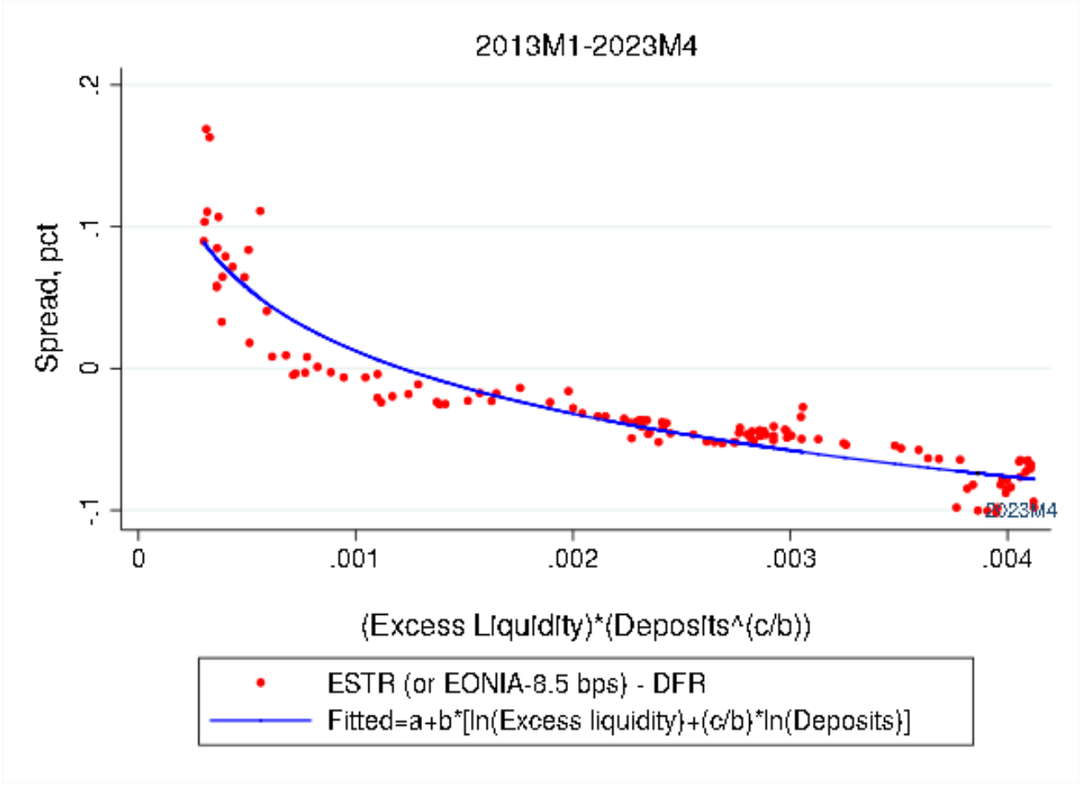
Estimating reserve demand for the euro area

$$ESTR - DFR = a + b * \ln(Excess\ Liquidity) + c * \ln(Liquid\ Deposits) + u$$

$$= a + b * ln \underbrace{\left[(Excess\ Liquidity) * (Liquid\ Deposits)^{\frac{c}{b}}\right]}_{Deposit-adjusted\ excess\ liquidity\ supply} + u$$

- Measure $v_R'(.) - \varphi$ by ESTR (or EONIA-8.5 bps)-DFR. April 2023: -10 bps
- Excess liquidity (excess reserves) = [Current account+Deposit facility] - [Required reserves]
- Liquid deposits measured as overnight deposits
- No ON RRP facility → No max operator
- Estimate euro area reserve demand for 2013M1-2023M4
  Spike in spread around European sovereign debt crisis, likely related to bank default-risk

Estimating reserve demand for the euro area

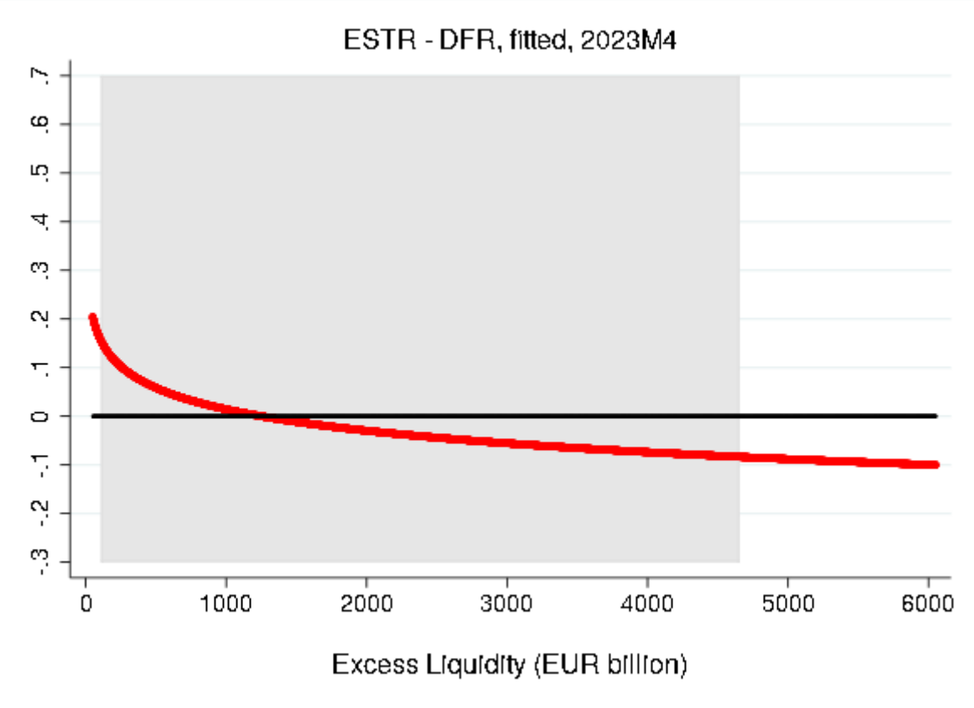


- $R^2 = 0.87$
- $\hat{a} = -0.428$, $\hat{b} = -0.064$, $\hat{c} = 0.097$
- b and c sign. at the 1% level (a at 10% level) accounting for autocorr. up to 12 monthly lags
- Could try other functional forms with more curvature for low deposit-adj. excess liquidity

Estimating the convenience-maximizing reserve supply for the euro area: Case A

Relevant if ECB decided to supply all reserves via bank lending (no structural bond portfolio)

April 2023:



Shaded area: Range of data used in estimation

- $v_R'(.) - \varphi = \hat{a} + \hat{b} * ln(Excess\ Liquidity) + \hat{c} * ln(Deposits)$

  using overnight deposits for April 2023: € 9.4T

- $v_R'(.) - \varphi = 0$: Excess liquidity = € 1.251T
  + Required reserves € 165B
  Liquidity = € 1.416T

- Likely somewhat higher than the true convenience-maximizing value (functional form issue mentioned)

Estimating the convenience-maximizing reserve supply for the euro area: Case B

Relevant given announced framework, with reserves supplied via a mix of a structural bond portfolio and lending to banks (weights ω and 1- ω)

- No specific mix accounced yet
  - Given asset scarcity for Bunds, a low ω seems favorable
  - Use of longer-term lending to banks lowers operational risks from banks managing large rollovers of ECB borrowing

- Whatever mix the ECB decides, it will affect its optimal reserve supply!
  - Back of the envelope calculation
  - Assume structural bond portfolio weights equal ECB capital key (Germany: α_1 =0.214) and assume only German Bunds (B_1) have convenience yields

Estimating the convenience-maximizing reserve supply for the euro area: Case B

- Measure German Bund convenience yield by KfW - Bund spread
  April 2023: Around 40 bps (varies across maturities)
- How much reserve scarcity is optimal from a convenience supply perspective?

]

$$v_R'(R) - \varphi = \underbrace{v_B'\left(B_1^{priv}\right)}_{Around\ 40\ bps} * \omega * \underbrace{\alpha_1}_{=0.214}$$

$= 0\ bps$ if $\omega = 0$ (bank lending only)

$= 4\ bps$ if $\omega = 0.5$ (equal mix)

$= 8\ bps$ if $\omega = 1$ (structural bond portfolio only)

- As of April 2023, 0 bps predicted reserve scarcity at Liquidity around €1.4T
- As of April 2023, 8 bps predicted reserve scarcity at Liquidity around €500B
- This is only approximate, since $v_B'\left(B_1^{priv}\right)$ will change with ECB holdings of Bunds

Conclusions: What do central bank mandates say about balance sheet policy above ELB?

1. Monetary policy: Not much when central bank can pay interest on reserves

2. Financial stability: A large balance sheet helps
   - Interest rate volatility: Avoid another yield spike like September 2019

3. Facilitate payments, supply money: A large balance sheet can – surprisingly – be harmful
   - Depends on asset choice which is affected by political constraints

KEY MESSAGE: Asset mix is a central driver of optimal balance sheet size

If the central bank has to hold convenient assets: 2 and 3 are in conflict and the optimal balance sheet, putting some weight on both 2 and 3, is smaller than if only weighting 2

Conclusions: What do central bank mandates say about balance sheet policy above ELB?

Fed: Conflict between 2 and 3 due to constraint to hold Treasuries. >$2T vs. <$1T

- Suggestion: Push for more reserve creation via lending (e.g., SRF):
  - Avoids conflict between 2 and 3
  - Avoids interest rate risk (SRF is floating rate)
    CB losses may pose a threat to central bank independence → Large current balance sheet may limit headroom for future QE if needed (e.g., Hauser (2022))
  - Avoids reserves crowding out bank lending
    (Diamond, Jiang and Ma (2022) and Chakraborty, Goldstein and MacKinley (2020))
  - Bank of England is moving in this direction (Bailey speech 21 May, 2024)

ECB: Less conflict between 2 and 3 since ECB assets on avg. have lower convenience yields

- Mix of lending to banks and govt bonds of which only some have convenience yields