How the Financing of Balance-Sheet Policy Shapes Its Effects

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What this paper does

THE QUESTION

- Does balance-sheet policy move output and the price level?
  quantitative easing (QE) and quantitative tightening (QT), one policy in two directions

THEORY

- Yes, through the term premium (Chen et al., 2012; Adrian et al., 2025)
- Buying long-term bonds takes duration out of private hands and lowers long-term yields

EMPIRICAL EVIDENCE

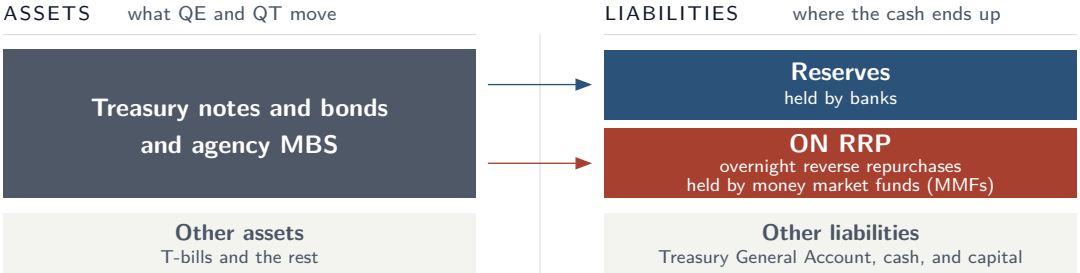
- Not clear. Most papers focus on the financial-market effects, in event studies around announcements (Krishnamurthy and Vissing-Jorgensen, 2012; Swanson, 2021)

THIS PAPER

- **I show empirically that the answer depends on which liability finances the policy**

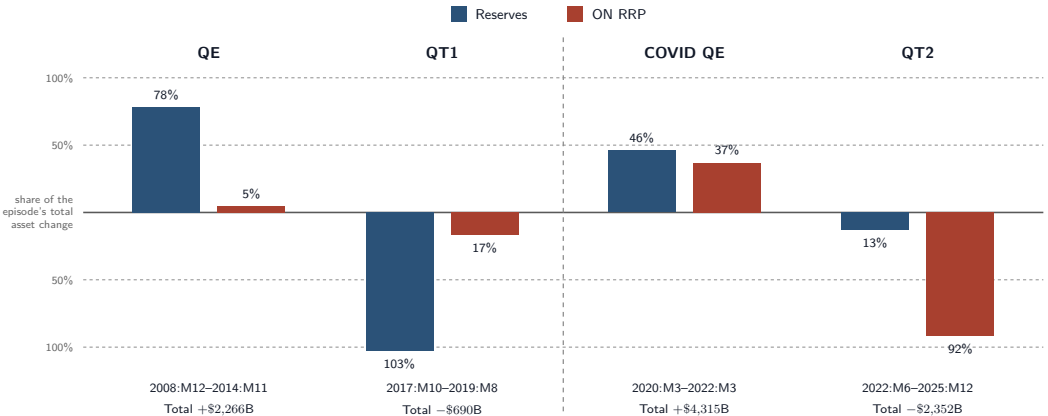
Which liability finances QE and QT?

A liability finances an operation when the cash the Fed creates ends up in it.



- QE and QT move the asset side
- Which liability finances the change is left open
- The cash stays in the banking system as reserves, or MMFs lend it back in ON RRP

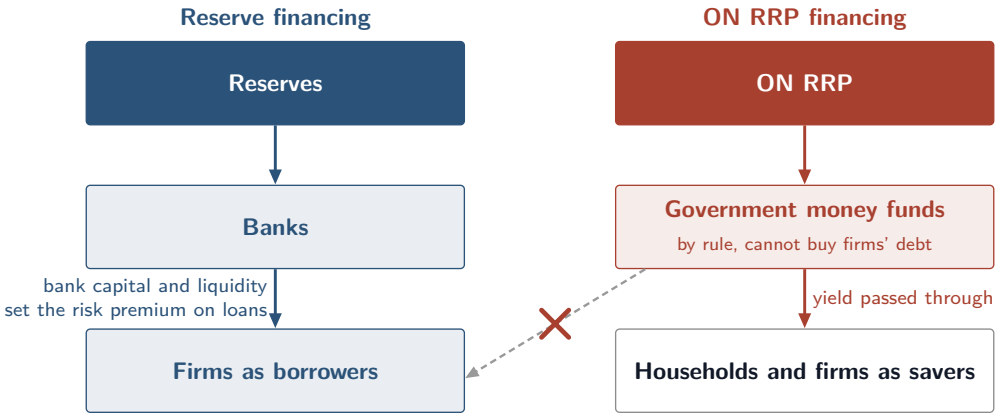
Financing by episode



- Reserves financed QE, and QT1 drained them
- Both liabilities financed the COVID purchases, and QT2 drained ON RRP instead

Why the financing should matter

Full diagram →



- **Reserve financing should affect borrowing costs for firms**
- **ON RRP financing should not**

What I do and find

WHAT I DO

- I identify two balance-sheet shocks, one financed by reserves and one by ON RRP, in a monthly U.S. SVAR

WHAT I FIND

- A reserve-financed contraction lowers output and the price level
- An ON RRP-financed contraction does not move the price level, and its effect on output is less certain and shorter-lived
- A reserve-financed operation moves the cost of credit for firms, and an ON RRP-financed operation does not

1 Data and identification

Data

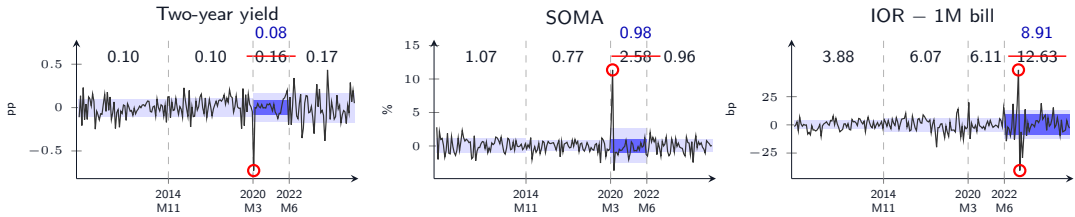
Without the bill-yield control →

Monthly U.S. data, 2008:M11–2026:M6, nine variables, six lags.

Variable	Note
Two-year Treasury yield	the policy rate (Gertler and Karadi, 2015)
SOMA holdings	log; Treasury notes and bonds plus agency MBS, no bills
Reserves + ON RRP	log; the size of the two liabilities
ON RRP/(Reserves + ON RRP)	the ON RRP ratio
Real GDP	log after Chow–Lin interpolation of the quarterly series
GDP deflator	log after Chow–Lin interpolation of the quarterly series
Term spread	the 10-year yield less the 3-month bill rate
Excess bond premium (EBP)	risk premium beyond expected default (Gilchrist and Zakrajšek, 2012)
IOR − 1M bill	interest on reserves less the one-month bill rate, the return MMFs compare

Heteroskedastic SVAR

The variances of the structural shocks shift across regimes, set at the balance-sheet episodes



- The residual variances shift across episodes, and not in the same proportion
- A few months stand far outside their regime

$$y_t' A_0 = x_t' A_+ + \eta_t', \qquad \eta_{i,t} \mid \nu_{i,t},\, s_t = k \;\sim\; \mathcal{N}\big(0,\; \lambda_{i,k}\,\nu_{i,t}\big)$$

- $\lambda_{i,k}$ captures the shifts in shock volatility across regimes
- $\nu_{i,t}$ captures the extreme months (Brunnermeier et al., 2021)
- The structural shocks are non-Gaussian: Student-t with heavy tails

Identification

SIGN RESTRICTIONS

	SOMA	$\log(\text{R} + \text{RRP})$	Term spread	RRP ratio	GDP	Deflator	2Y yield	EBP	IOR − bill
RFBS (expansion)	+	+	−	−	Z	Z			
OFBS (expansion)	+	+	−	+	Z	Z			

RFBS = reserve-financed, OFBS = ON RRP-financed. Z is a zero at impact.

ZERO RESTRICTIONS (ASSUMPTION 1)

- Balance-sheet shocks do not reach GDP or prices on impact (Leeper et al., 1996; Christiano et al., 2005)

NARRATIVE RESTRICTIONS

- The RFBS shock is positive and dominant over 2020:M4–2021:M2, the first phase of the COVID purchases
- The OFBS shock is negative and dominant over 2023:M9–2024:M7, the ON RRP drain

2 HARS-Z: zero restrictions on a heteroskedastic model

Four identifying restrictions, one sampler

The two closest samplers deliver three of the four.

	Kim and Zha (2026)	Carriero et al. (2024)
Shock volatility	✓	✓
Sign restrictions	✓	✓
Narrative restrictions	✓	✓
Zero restrictions	×	×

I extend the sampler from Kim and Zha (2026) to carry the zeros.

HARS: heteroskedastic absorb-and-rotate sampler

Why? →

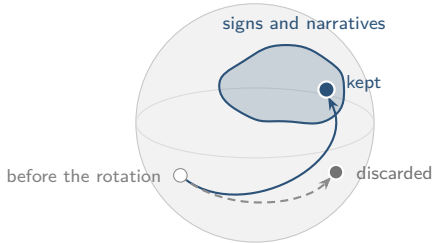
THE CHAIN HAS TWO BLOCKS

- The model block is any MCMC sampler for the model with shock volatility this paper puts Brunnermeier et al. (2021) in that slot
- The rotation block draws the labeling Q Kim and Zha (2026) add it, and the restrictions act only here
- Rotating the first block by that Q does not change the model fit

Changing a sign or narrative restriction changes the labeling, not the fit. A rotation that changed the fit could not be drawn at random.

HARS: draw rotations, keep the admissible ones

With a zero →

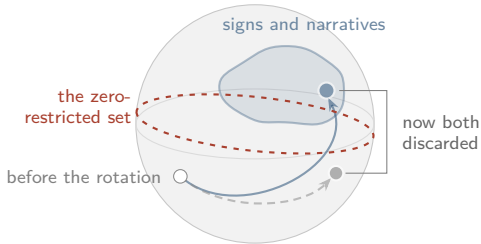


- The signs and narratives are inequalities — they truncate the rotation to a subset of positive measure, the shaded set
- A rotation lands in that subset with positive probability — the sampler draws rotations and keeps the admissible ones, and the model parameters stay fixed

HARS reaches the admissible set by drawing.

Zero restrictions break the existing sampler

Formal failure →

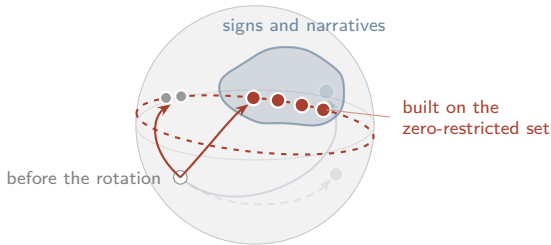


- A zero is a linear equality on a column $Z_j(\theta)\, q_j = 0$ lowers the dimension of the admissible set instead of truncating it
- Neither rotation is on the curve, and no rotation ever will be. A random rotation reaches a set of measure zero with probability zero

Every step of HARS fails with probability one, including its initialization.

HARS-Z: build the rotation on the curve

The target →



- The zeros hold by construction, not by testing — every rotation the sampler draws is already on the curve (Arias et al., 2018)
- The signs and narratives still select among the rotations — the shaded area picks the part it keeps

Every step of HARS-Z stays on the zero-restricted set.

What HARS-Z contributes

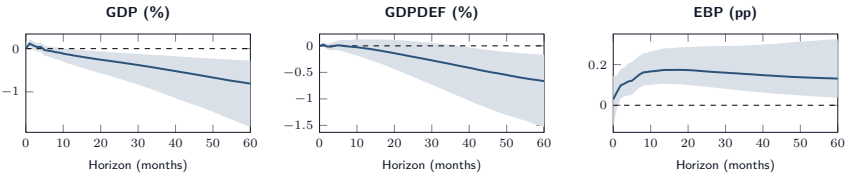
- HARS-Z imposes all four in one sampler — shock volatility, sign restrictions, narrative restrictions, and zero restrictions
- With no zeros, HARS-Z is exactly HARS — the set becomes the whole sphere and every weight is one

The zeros hold at every step of the chain.

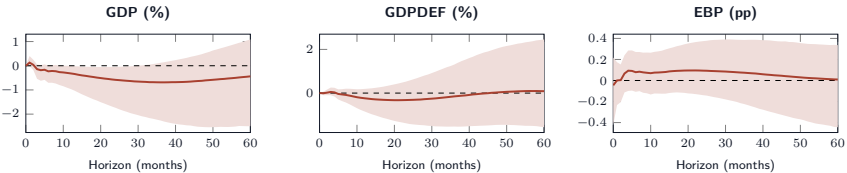
3 Impulse responses and decompositions

Two balance-sheet contractions

RESERVE-FINANCED CONTRACTION



ON RRP-FINANCED CONTRACTION



Only reserve financing affects the economy.

Robustness

	Reserve-financed			ON RRP-financed		
	GDP	Deflator	EBP	GDP	Deflator	EBP
Baseline	falls	falls	rises	falls 11–29	·	·
No zero restrictions	falls	rises 0–8	rises	·	·	·
IP and the CPI	falls	·	rises	·	·	·
Breaks at the zero lower bound	falls	falls	rises	·	·	·
One variance regime	falls	falls	rises	·	·	·
Ten lags	falls	falls	rises	falls	falls 10–22	rises 3–33

Responses to a contraction. "Falls" or "rises" where the 68% band excludes zero, with months where the response is short-lived; a dot where the band includes zero at every horizon. With IP and the CPI the first two columns read IP and the CPI.

In every specification a reserve-financed contraction raises the EBP and lowers output. An ON RRP-financed contraction moves none of output, the price level, and the EBP in four of the five.

Takeaway

Other shocks →

	Reserve-financed	ON RRP-financed
GDP	falls from 11 months	falls over 11–29 months
GDP deflator	falls from 38 months	does not move
EBP	rises from 2 months	does not move

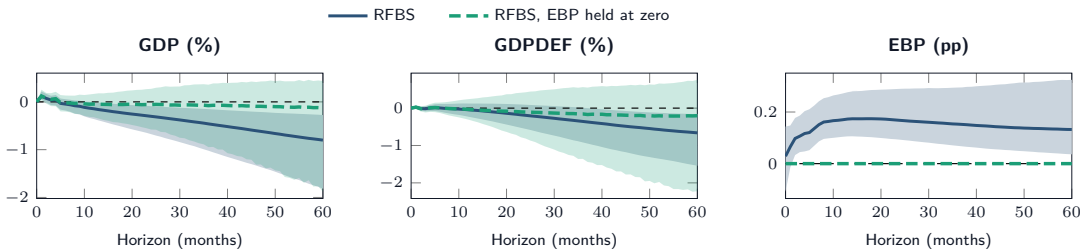
Responses to a contraction, with the months in which the 68% band excludes zero.

A reserve-financed operation moves GDP and the GDP deflator, and an ON RRP-financed operation does not.

WHY

- As predicted, only reserve financing moves the EBP
- The counterfactual that follows confirms it

Holding the EBP at zero

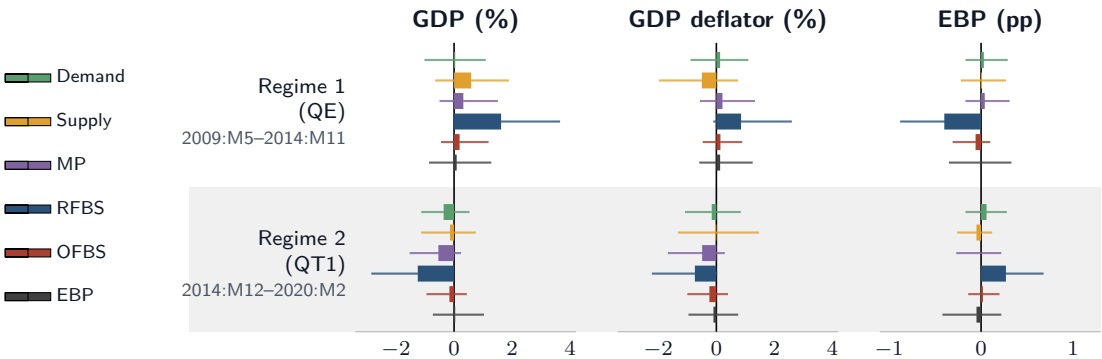


- I add EBP shocks that shut down the EBP response to the RFBS shock (Brunnermeier et al., 2021)
- With the EBP held at zero, the declines in GDP and the deflator disappear
  consistent with Gilchrist and Zakrajšek (2012): a rise in the EBP lowers output and prices

As predicted, reserve financing moves output and prices through the risk premium borrowers pay.

Historical decomposition: QE and QT1

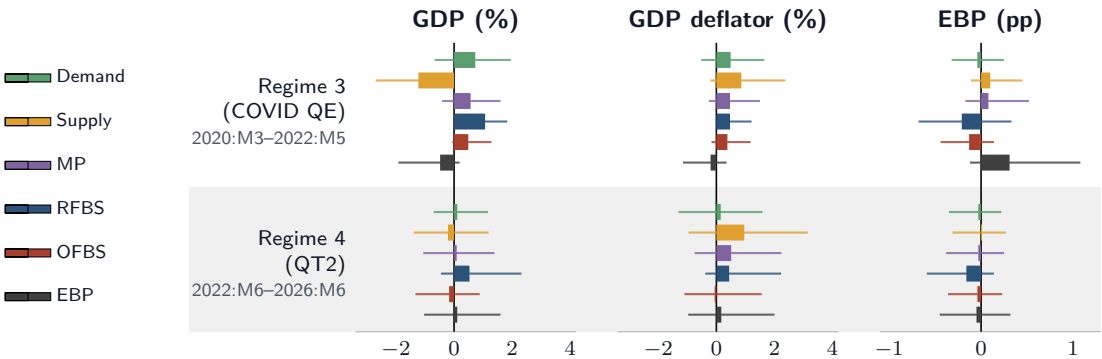
Other variables →



The RFBS shock is the largest contributor to the GDP and deflator forecast errors over QE and QT1. It pushes both above their forecasts over QE and below over QT1.

Historical decomposition: COVID and QT2

Variance shares →



Over COVID the RFBS shock pushes GDP and the deflator above their forecasts, and the OFBS shock contributes little. Over QT2 the OFBS contributions have bands that include zero.

What this means for policy

The Committee on the drain →

WHAT THE COMMITTEE WANTED

- In the recent tightening it kept the policy rate as its main tool (Federal Open Market Committee, 2022b)
- Its 2022 statements set out to shrink the balance sheet while keeping reserves ample (Federal Open Market Committee, 2022a)
- In short, a quiet runoff: the policy rate moves the economy, and the balance sheet shrinks in the background

My results show that the second runoff, which ON RRP mainly financed, was the quiet runoff the Committee wanted.

Conclusion

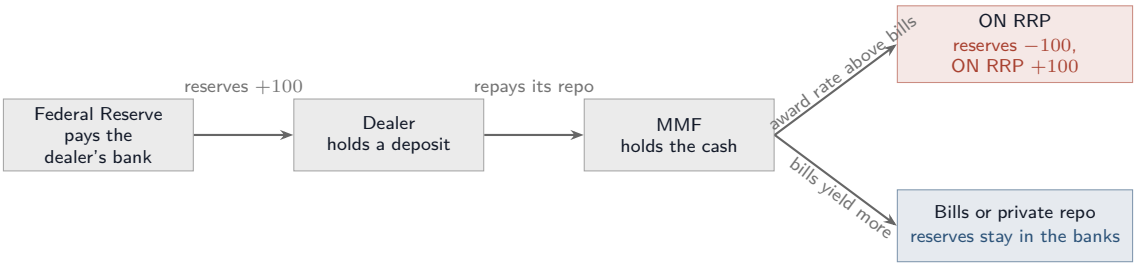
- A reserve-financed contraction raises the EBP and lowers GDP and the deflator. With the EBP held at zero, both declines disappear
- An ON RRP-financed contraction moves neither the EBP nor the deflator, and its effect on GDP is less certain and shorter-lived
- The RFBS shock is the largest contributor to the GDP and deflator forecast errors over QE and QT1
- I develop a new sampler that imposes zero restrictions in a heteroskedastic SVAR

Which liability finances an operation shapes what the operation does to output and the price level.

Appendix

How a purchase reaches ON RRP

← Back



- Every purchase settles in reserves. The dealer's bank receives reserves and the dealer receives a deposit
- Moving the deposit to an MMF moves reserves between banks, not out of them
- Only ON RRP sits outside the banking system, and the MMF chooses, within the Fed's terms

A purchase is ON RRP-financed only if the MMF chooses ON RRP.

Two claims on the Fed, different terms

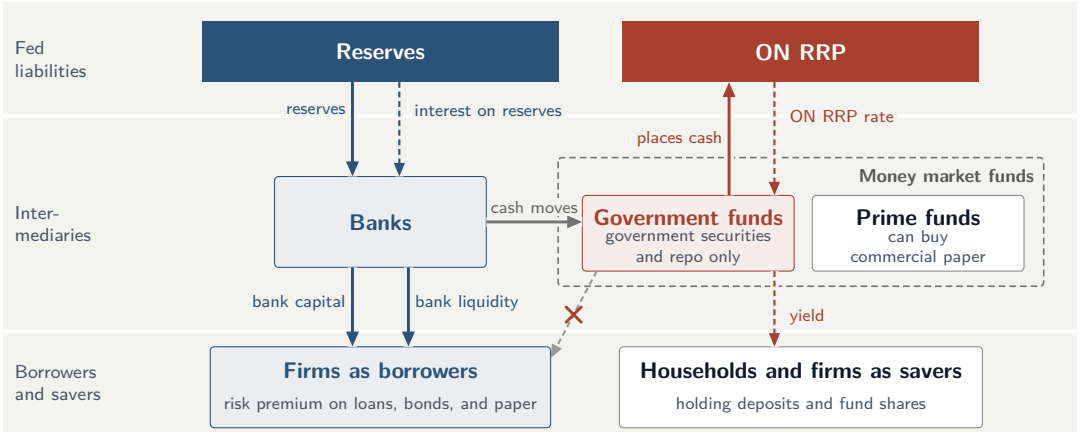
← Back

	Reserves	ON RRP
What it is	a deposit at the Federal Reserve	an overnight reverse repurchase with the Federal Reserve
Who holds it	banks	mostly money market funds
Rate	interest on reserves	the ON RRP award rate
Quantity limit	none	a per-counterparty cap

- Both are overnight central-bank money, held by different sectors
- The Fed sets the rate on each and the cap on ON RRP

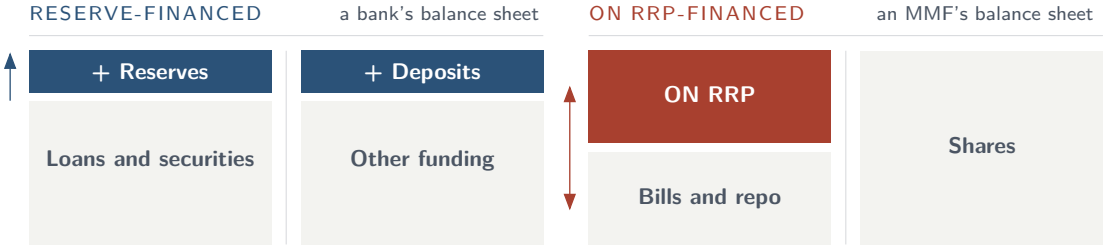
Two different claims on the same balance sheet, and the Fed sets the terms of each.

The full diagram



Two ways of financing

← Back



- Reserve financing changes the size of bank balance sheets, by a quantity the Fed sets
- ON RRP financing changes what MMFs hold, not how much, and MMFs choose where it sits
- Interest on reserves goes to banks, and interest on ON RRP goes to MMFs

Size for banks, composition for MMFs, and a different recipient of the interest.

The channels behind the two chains

← Back

BANK CAPITAL

- Banks earn the margin over their funding cost as income, which adds to capital (Fricke et al., 2026)
- Banks with more capital require a smaller risk premium for credit risk (He and Krishnamurthy, 2013)

BANK LIQUIDITY

- Banks with more reserves are more liquid and lend at a smaller premium (Copeland et al., 2021)

ON RRP

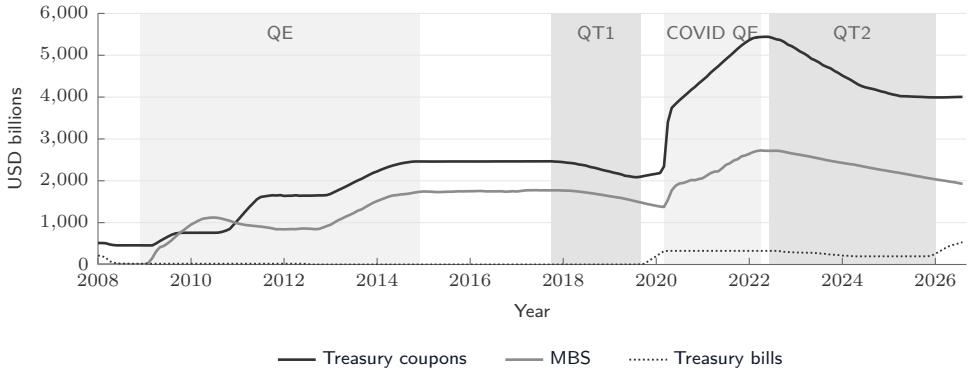
- MMFs pass the ON RRP rate to their shareholders as yield and keep none of it as capital

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The estimates are consistent with both bank channels and do not separate them.

Fed asset holdings

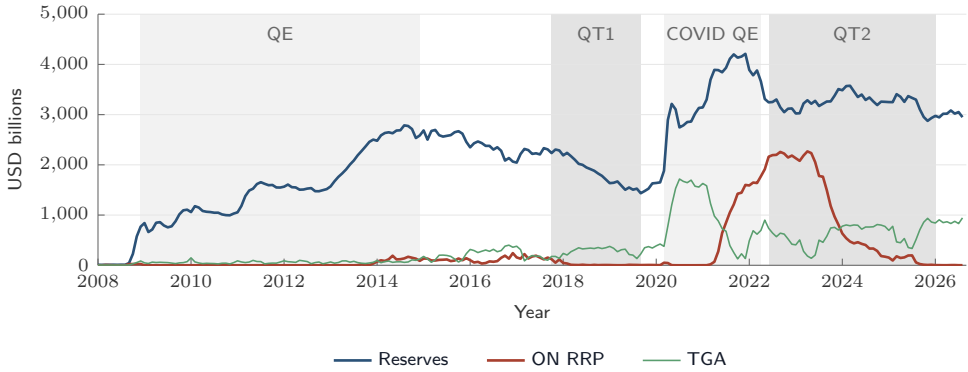
← Back



The four episodes differ in size and not in composition. QT2 ran longer and larger than QT1.

Fed liabilities

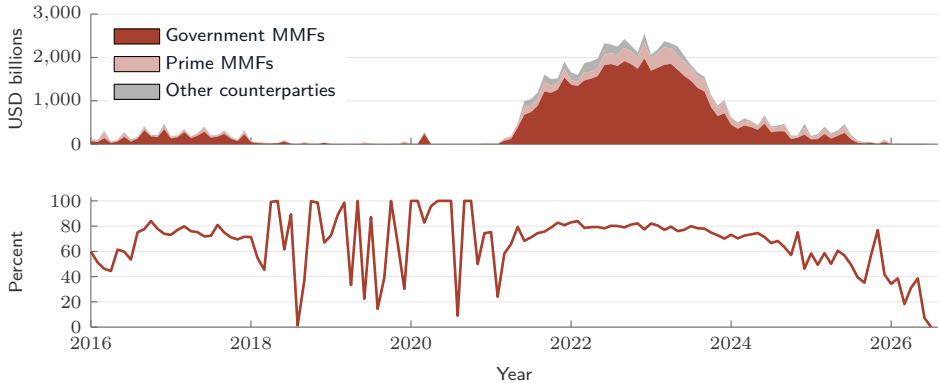
← Back Why it built up →



The ON RRP balance was $154 billion when QT1 began and near $2 trillion when QT2 began.

Who held the ON RRP balance

← Back



Government funds left first. Their share fell from 80 percent in 2023:M7 to 35 percent in 2025:M9.

What built the ON RRP balance

← Back

CASH MOVED TO MMFS, WHICH HAD FEW OUTLETS OTHER THAN ON RRP

- Treasury cut bill issuance and drew down the TGA, the largest of the five channels evaluated (Wong, 2021)
- The temporary SLR relief expired, banks discouraged large deposits, and the cash went to MMFs
- The per-counterparty caps rose from $30B to $160B, so the Fed accommodated the buildup

Both financings move duration

← Back

THE RESERVE-FINANCED CASE THE LITERATURE DOCUMENTS

- When reserves finance a purchase, the Fed takes duration out of private hands and long-term yields fall (Krishnamurthy and Vissing-Jorgensen, 2012; Chen et al., 2012)
- When it lets those securities run off, private investors take the duration back (Crawley et al., 2022; Wei, 2022)

DURATION MOVED IN BOTH ON RRP EPISODES

- The COVID purchases took coupons and MBS out of private hands whether the balance settled in reserves or moved into ON RRP
- Over QT2 the Fed let $1.45 trillion of Treasury coupons run off
- MMFs added short-term Treasury securities and private repo lending, and hedge funds borrowed in private repo to hold more Treasuries

Both financings move duration the same way, so both balance-sheet shocks carry the same term-spread restriction.

What I take as given

THE FED SET THE TERMS OF THE FINANCING

- The terms, the ON RRP award rate, the per-counterparty caps, and the runoff caps (Federal Open Market Committee, 2022b,a)
- The forces inside those terms, the composition of Treasury issuance, bank regulation, and the portfolio choices of MMFs

I TAKE THE OUTCOME AS GIVEN

- I do not model why the financing fell where it did
- I take the realized financing of each episode as it was

Whatever decided the financing, I take it as given and identify one shock for each.

How the Committee saw the ON RRP drain

← Back

THE 2022 PRINCIPLES SET WHERE THE RUNOFF ENDS

- The runoff ends when reserves reach the level the Committee judges consistent with an ample reserves regime (Federal Open Market Committee, 2022b)

TWO MEMBERS TIED THE PACE TO THE LEVEL OF ON RRP

- Governor Waller read the cash remaining in ON RRP as excess liquidity and as room to reduce securities holdings further (Waller, 2024)
- Dallas Fed President Logan argued for slowing the runoff as ON RRP approaches a low level, when further runoff would fall on reserves (Logan, 2024)

I read this as follows. The Committee did not target the ON RRP drain. It watched the drain, and what it protected was reserves.

Regimes and residuals

Regime	Start	End	Description
1	2008:M11	2014:M11	QE1 through QE3
2	2014:M12	2020:M2	Between the QE and the COVID purchases, and QT1
3	2020:M3	2022:M5	COVID-19 QE
4	2022:M6	2026:M6	QT2 and the months after it ended

End dates are inclusive. Each break is a date on the balance sheet, and each regime contains one balance-sheet episode. The QT2 runoff ended in 2025:M12, and the six months that follow are too few for a regime of their own.

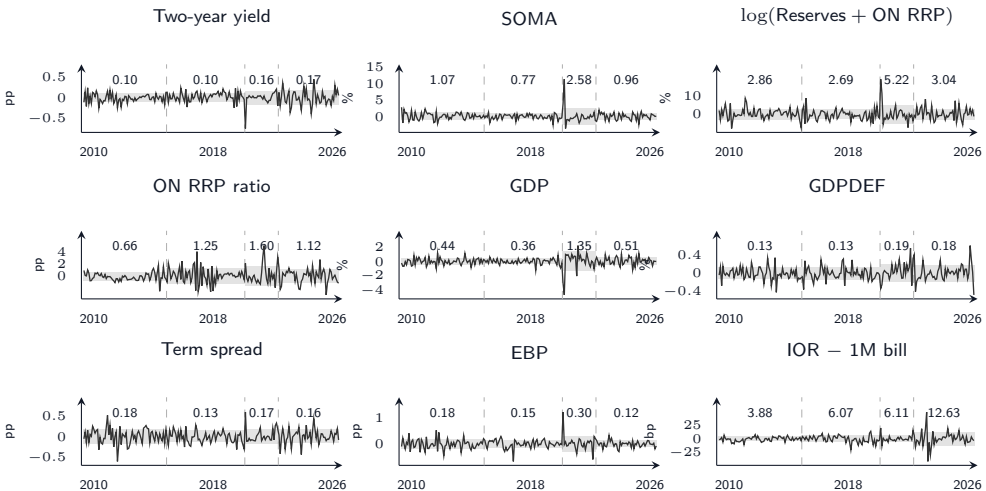
RESIDUAL DIAGNOSTICS, GAUSSIAN ERRORS AND NO IDENTIFICATION RESTRICTIONS

- Under a single regime the residual SDs vary across subsamples and do not move together across equations
- Under four regimes the standardized residuals keep excess kurtosis 4.7 pooled over the nine equations, and 20.3 for SOMA

Four regimes absorb the shifts in volatility and not the heavy-tailed shocks.

Residuals under a single variance regime

← Back



Estimated variance ratios

← Back

Equation	Regime 2	Regime 3	Regime 4
Two-year yield	1.97 [1.96, 1.99]	3.33 [3.29, 3.38]	6.58 [6.51, 6.62]
SOMA	0.08 [0.06, 0.12]	15.09 [14.87, 15.37]	0.08 [0.05, 0.13]
log(R + RRP)	0.85 [0.84, 0.86]	1.02 [1.00, 1.03]	0.73 [0.73, 0.74]
ON RRP ratio	4.55 [4.36, 4.70]	7.57 [7.28, 7.84]	5.19 [4.89, 5.38]
GDP	0.36 [0.35, 0.36]	1.82 [1.81, 1.83]	0.30 [0.29, 0.35]
GDPDEF	0.93 [0.93, 0.94]	1.66 [1.64, 1.68]	1.93 [1.91, 1.95]
Term spread	0.54 [0.53, 0.54]	2.45 [2.43, 2.48]	0.81 [0.80, 0.83]
EBP	0.73 [0.73, 0.73]	1.46 [1.46, 1.48]	0.29 [0.28, 0.31]
IOR − 1M bill	2.89 [2.28, 3.22]	0.33 [0.22, 0.47]	24.50 [16.95, 28.73]

Posterior medians with 68% bands over the retained draws. Rows are the structural equations, labeled by the variable each is normalized on. Regime 1 equals one.

- The ratios are far from mutually proportional, the condition under which the regime covariances identify the columns of A_0, and the SOMA variance rises fifteenfold in Regime 3

The tail fit

← Back

WHAT THE TWO-STEP FITS

- The joint log likelihood of the $1{,}854$ standardized residuals, where a lower δ gains density at the extremes and loses it at the center

THE FIT MATCHES TAIL MASS TWICE

- As a moment, $t_{5.46}$ implies excess kurtosis $6/(\delta - 4) = 4.1$ against pooled 4.7
- As a frequency, 0.8 residual beyond 6σ and 2.0 beyond 5σ predicted against 1 and 3 in the sample

Without the latent scales, the variance of a regime that holds an extreme month would reflect that month rather than the regime.

The identification problem

WHAT THE QUESTION NEEDS

$$\underset{1\times n}{y_t'}\ \underset{n\times n}{A_0} \;=\; \underset{1\times m}{x_t'}\ \underset{m\times n}{A_+} \;+\; \underset{1\times n}{\eta_t'}$$

- The causal responses to the shocks in η_t
- The η_t are model shocks, not yet economic ones

WHAT THE DATA DELIVER

$$\underset{1\times n}{y_t'} \;=\; \underset{1\times m}{x_t'}\ \underset{m\times n}{B} \;+\; \underset{1\times n}{u_t'}, \qquad B = A_+ A_0^{-1}, \qquad u_t' = \eta_t' A_0^{-1}$$

$$\underbrace{\mathrm{Cov}(u_t)}_{\text{the data give this}} \;= \underbrace{(A_0^{-1})'\,\mathrm{Cov}(\eta_t)\,A_0^{-1}}_{\text{two unknowns}}$$

- Identification has to pin down both A_0 and $\mathrm{Cov}(\eta_t)$
- The usual answer assumes homoskedasticity, $\mathrm{Cov}(\eta_t) = I_n$, one covariance for one unknown
- Identifying A_0 still takes additional restrictions

Shock volatility identifies A_0

EACH REGIME HAS ITS OWN COVARIANCE

$$\Sigma_k \;=\; (A_0^{-1})'\,\Lambda_k\,A_0^{-1}, \qquad k = 1, \ldots, 4$$

- The same A_0 in all four, a different Λ_k in each, where Σ_k is the forecast-error covariance of regime k and Λ_k its shock variances

THE VARIANCE RATIOS DECOMPOSE A_0

$$\Sigma_1^{-1}\Sigma_2 \;=\; A_0\left(\Lambda_1^{-1}\Lambda_2\right)A_0^{-1}$$

- An eigendecomposition, whose eigenvectors are the columns of A_0
- Distinct ratios make the columns unique up to signed permutation (Rigobon, 2003; Lanne et al., 2010)

Covariances that differ across regimes identify (A_0, Λ) and do not label the shocks. The labels come from the restrictions.

Why rotating leaves the fit alone

← Back

ROTATING THE COEFFICIENTS ALONE WOULD REFIT THE MODEL

- Under homoskedasticity every rotation is observationally equivalent, and the restrictions pick among equivalent models
- Under shock volatility it is not, since rotating the coefficients at fixed regime variances mixes shocks whose relative variances differ across regimes

THE ABSORBED FORM REMOVES THE PROBLEM

- The regime scale is absorbed into the coefficient block, so the shocks have unit variance in every regime
- Rotating the whole absorbed block preserves that unit variance, and the likelihood depends on the coefficients and the variances, not on Q

Q selects an economic interpretation of a posterior draw. It does not refit the draw.

Why HARS fails with probability one under zeros

← Back

- HARS's restricted posterior conditions on $\mu(R(\theta)) > 0$, where $R(\theta) = \{Q \in \mathcal{O}(n) : SR(\theta, Q) > 0\}$ and μ is Haar measure.
- With one or more zeros, $R(\theta) \subseteq \mathcal{Q}(\theta)$ and $\mu(\mathcal{Q}(\theta)) = 0$ at *every* θ, so the condition fails everywhere, not at isolated draws.
- The Gaussian coordinatization (QR of a Gaussian matrix) reaches the zero set with probability zero, so initialization, repair, and slice updates all fail.
- The rows $Z_j(\theta)$ depend on θ through A_0 and the moving-average coefficients, so the constraint set moves with every structural update, so a fixed parameterization cannot work either.

The failure originates in the measure, not the algorithm.

Volume weighting and inference

← Back

The target of HARS-Z, the analogue of the HARS target on the zero-restricted set, with the conditional-Haar measure on $\mathcal{Q}(\theta)$ in place of Haar measure on $\mathcal{O}(n)$,

$$\pi_v(d\theta, dQ \mid y, SR) \;= \pi(\theta \mid y)\, \frac{\mathbf{1}\{Q \in R(\theta)\}\; \mu\big(dQ \mid \mathcal{Q}(\theta)\big)}{\mu\big(R(\theta) \mid \mathcal{Q}(\theta)\big)}\, d\theta,$$

where $R(\theta)$ is the set of rotations on $\mathcal{Q}(\theta)$ that satisfy the sign and narrative restrictions.

- Generating rotations through γ_z induces the null-space construction measure $\mu_z(\cdot\,; \theta)$ on $\mathcal{Q}(\theta)$, not μ; weighting each retained rotation by the volume element $v(Q; \theta)$ recovers π_v.
- Weights are normalized *within* each retained draw of θ. Summaries are weighted medians and bands.
- Retaining N_{ess} rotations per structural draw divides the cost of the structural update; the slice updates evaluate only the admissibility indicator, not the likelihood.

The HARS-Z algorithm

← Back

1. Rotation update. m column-wise elliptical slice updates of the Gaussian coordinates X at fixed θ
2. Structural update by multiple-try Metropolis (Liu et al., 2000). Draw K random-walk candidates of (A_0, Λ), each completed by a draw of A_+ and its rebuilt rotation $\gamma_z(X; \theta^{(k)})$. Weight each by its collapsed density times the admissibility indicator, select one, and accept it with the probability that keeps the target invariant
3. Latent scales. Draw the Student-t scales from their Gibbs conditional
4. Rotation draw. N_{ess} column-wise slice updates of X at fixed θ, retaining every rotation
5. Advance. Return to step 1

The structural update never redraws A_+ alone to rescue a candidate that fails the restrictions. A rejected step keeps (A_0, Λ) and A_+ together.

Sampler settings and diagnostics

← Back

SETTINGS

- One chain of $10{,}000$ retained draws after $1{,}000$ burn-in sweeps. Three further chains give the same signs
- Multiple-try Metropolis with $K = 300$ candidates from a random walk with covariance $0.05H$, where H is the inverse Hessian of the log posterior at its mode
- $m = 5$ slice updates before each structural update, $N_{\text{ess}} = 1$ rotation kept, and $M = 500$ unrestricted rotations at each θ for the weights

DIAGNOSTICS

- The structural update moves θ in $1{,}436$ of the $10{,}000$ sampling sweeps, and no candidate evaluation fails
- The volume weights stay near uniform, with an effective sample size share of 0.970

Restrictions on the other four labeled shocks

← Back

SIGN RESTRICTIONS

	SOMA	$\log(\text{R} + \text{RRP})$	Term spread	RRP ratio	GDP	Deflator	2Y yield	EBP	IOR − bill
Demand	Z				$+$	$+$	$+$		
Supply	Z				$+$	$-$			
MP	Z				$-$	$-$	$+$		
EBP	Z				Z	Z		$+$	

Same conventions as the main restriction table. The three unlabeled shocks carry no restriction.

ZERO RESTRICTIONS ON SOMA (ASSUMPTION 2)

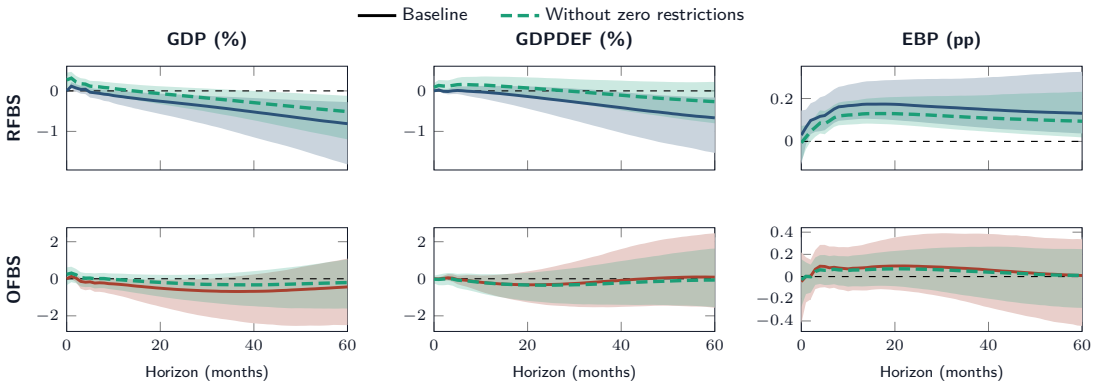
- Demand and supply, since output and price data arrive with a lag and purchases and runoff run on preannounced schedules (Leeper et al., 1996)
- MP, since administered rates since 2008 separate the rate instrument from asset holdings
- EBP, since the preannounced schedules and caps keep SOMA from responding within the month

ZERO RESTRICTIONS ON GDP AND THE DEFLATOR (ASSUMPTION 3)

- The EBP shock does not reach GDP or prices within the month (Gilchrist and Zakrajšek, 2012)

Robustness: No zero restrictions

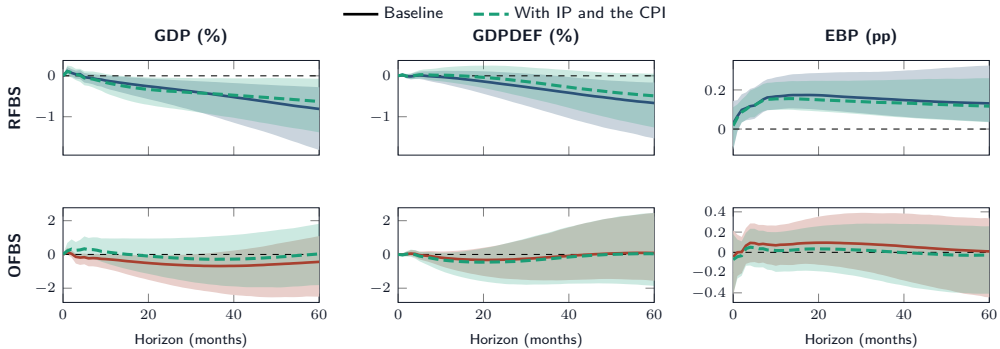
← Back



Without zero restrictions a reserve-financed contraction still raises the EBP and lowers GDP, from forty months onward. The decline in the deflator does not appear, and the ON RRP-financed contraction moves none of the three.

Robustness: IP and the CPI

← Back

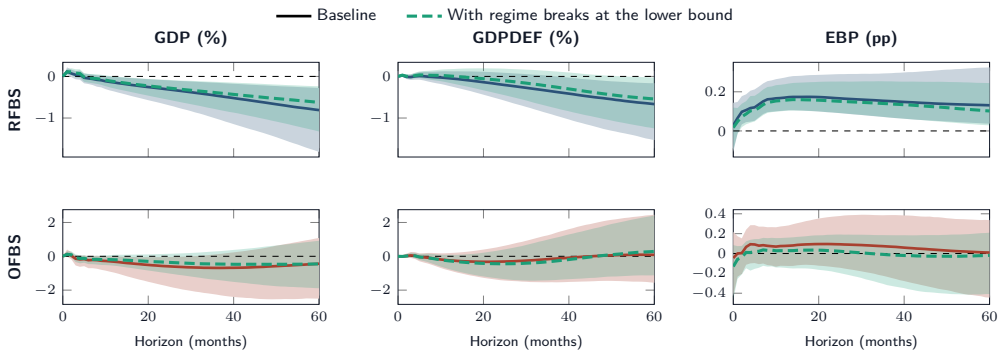


The first two panels of each row plot GDP and GDPDEF for the baseline and IP and the CPI for the alternative.

A reserve-financed contraction still raises the EBP and lowers industrial production, from fourteen months onward. The CPI band includes zero at every horizon, and the ON RRP-financed contraction moves none of the three.

Robustness: Breaks at the zero lower bound

← Back

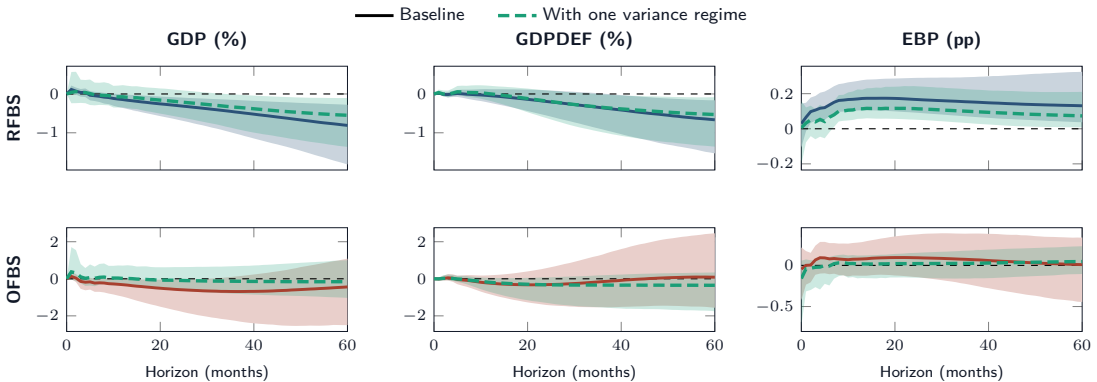


Regime breaks at 2015:M11, 2020:M3, and 2022:M2 in place of the balance-sheet episodes.

A reserve-financed contraction raises the EBP and lowers GDP and the deflator, the deflator from fifty-three months onward. The ON RRP-financed contraction moves none of the three.

Robustness: One variance regime

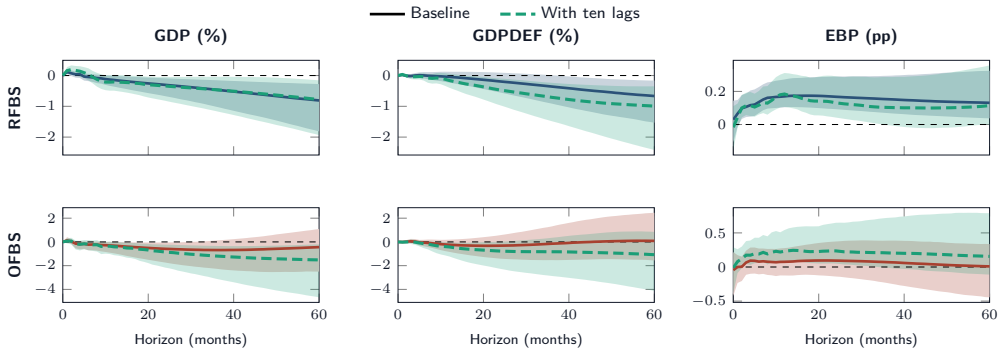
← Back



A reserve-financed contraction raises the EBP and lowers GDP and the deflator, both from thirty-five months onward. The ON RRP-financed contraction moves none of the three.

Robustness: Ten lags

← Back



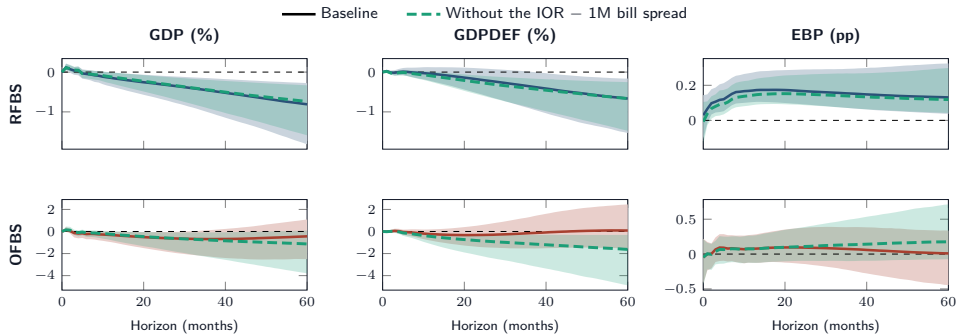
The alternative pools three chains of 10,000 draws each, and each chain gives the same signs.

A reserve-financed contraction raises the EBP and lowers GDP and the deflator. The ON RRP-financed contraction also raises the EBP, from three to thirty-three months, and lowers GDP and the deflator.

Without the bill-yield control

← Back

- MMFs move cash between ON RRP and bills according to which pays more, and that choice moves the ON RRP ratio



Without the control an ON RRP-financed contraction lowers GDP and the deflator. With it the decline in the deflator disappears, and the decline in GDP becomes less certain and shorter-lived.

Forecast-error variance at three years

← Back All horizons →

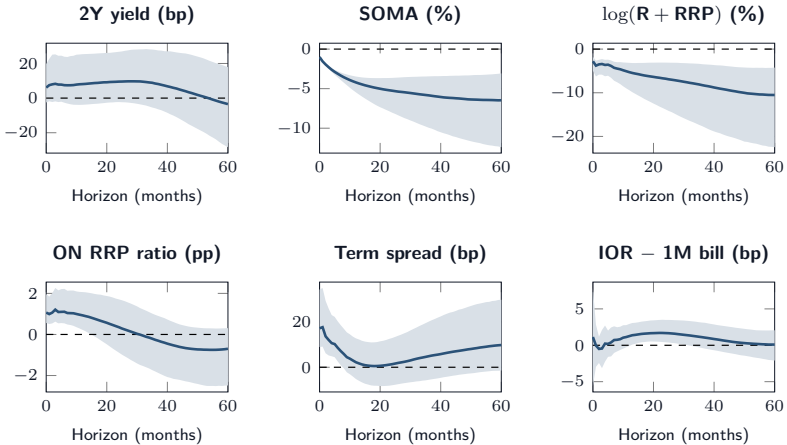
	Demand	Supply	MP	RFBS	OFBS	EBP
GDP	7.0	10.0	7.0	**4.9**	**3.6**	4.3
	[3.1, 16.9]	[3.2, 23.2]	[2.1, 18.8]	[1.1, 13.6]	[0.7, 11.5]	[0.7, 15.6]
GDP deflator	8.7	20.3	7.1	**3.4**	**3.7**	4.0
	[2.3, 26.2]	[5.5, 42.0]	[1.9, 22.5]	[0.7, 11.6]	[0.7, 13.1]	[0.8, 15.7]
EBP	5.0	4.0	5.0	**19.7**	**4.3**	14.4
	[1.6, 15.0]	[1.1, 13.5]	[1.4, 15.7]	[7.3, 37.0]	[1.2, 12.6]	[4.6, 32.9]

- The two balance-sheet shocks together account for 8.5% of the forecast variance of GDP and 7% of that of the deflator
- They account for about a quarter of the forecast variance of the EBP, mostly through the RFBS shock

The balance-sheet shocks move the risk premium more than output and prices, and they move it through reserve financing.

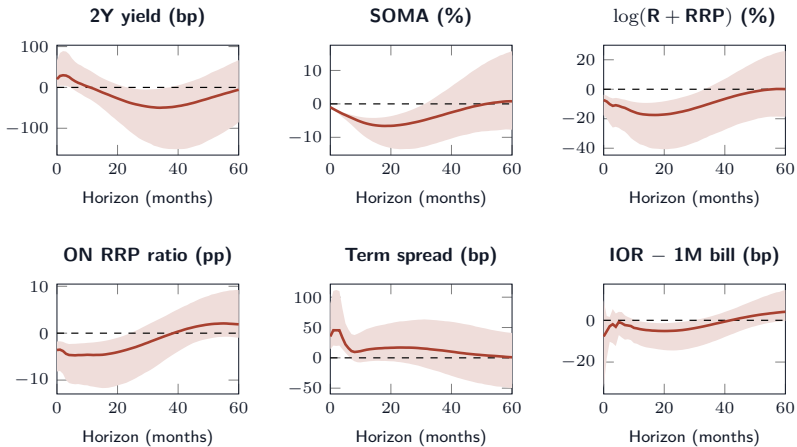
Reserve-financed, other responses

← Back



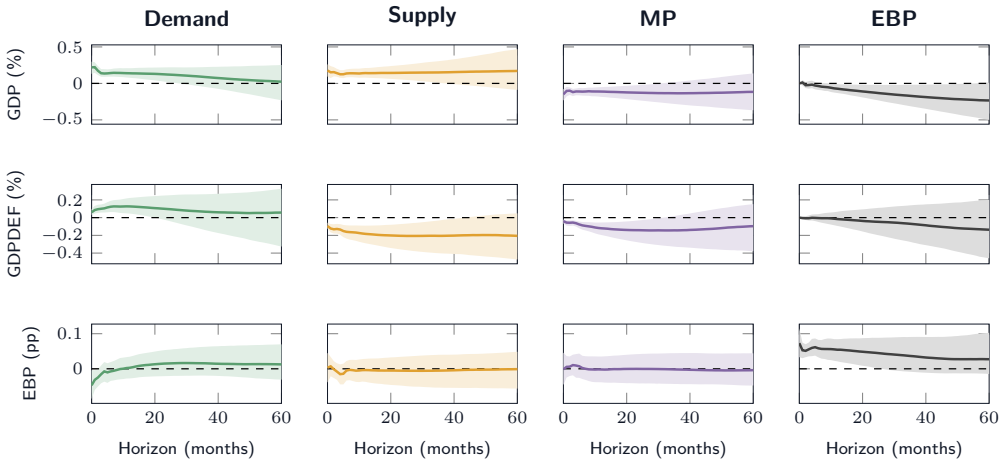
ON RRP-financed, other responses

← Back



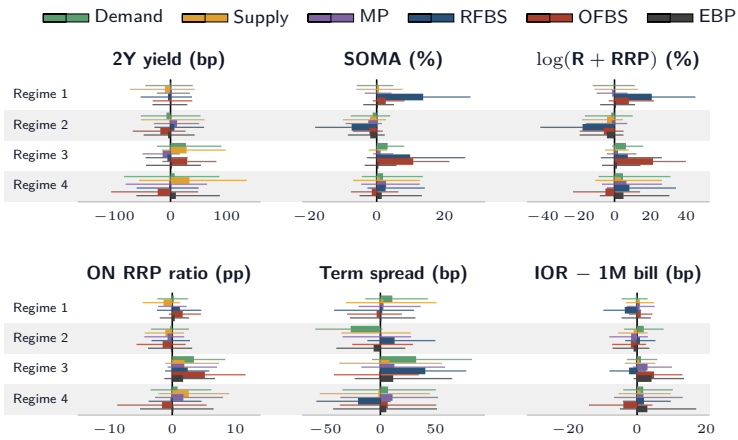
Demand, supply, MP, and EBP shocks

← Back



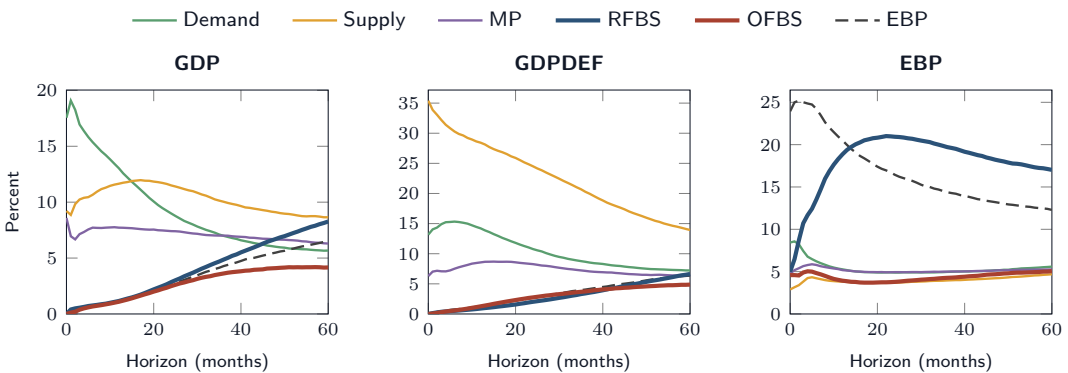
The other six variables by regime

← Back



Variance decomposition, all horizons

← Back



From fourteen months on, the RFBS share of the EBP forecast variance exceeds that of the EBP shock itself.

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