

Stop Believing in Reserves*

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Motivation

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- ▶ Central banks typically use interest rates and the size of their balance sheets to conduct monetary policy.
- ▶ Two channels of monetary policy known for interest rates: the “bank deposit channel” and the “non-bank deposit channel”.
 - ▶ Drechsler, Schnabl, Savov (QJE, 2017): \uparrow interest rates, \downarrow bank deposits and lending.
 - ▶ Xiao (RFS, 2020): \uparrow interest rates, \uparrow non-bank deposits.

Research Question

- ▶ How do banks and non-banks demand money when the Fed uses its balance sheet (BS) to tighten monetary policy?

What We Find

Two Main Results:

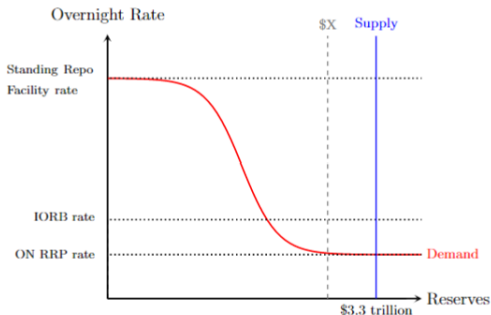
- ▶ The demand for money by non-banks, and the capacity of the repo market to absorb this demand, is the binding constraint on the size of the Fed's balance sheet.
- ▶ Not the demand for money (reserves) by banks.
- ▶ At $\text{IORB} = 4.65\%$, we estimate that the Fed could reduce its balance sheet by \$2.3 trillion while maintaining an ample reserve framework.

- ▶ The higher the Fed sets its policy rate, the smaller its balance sheet can be.

Literature Review

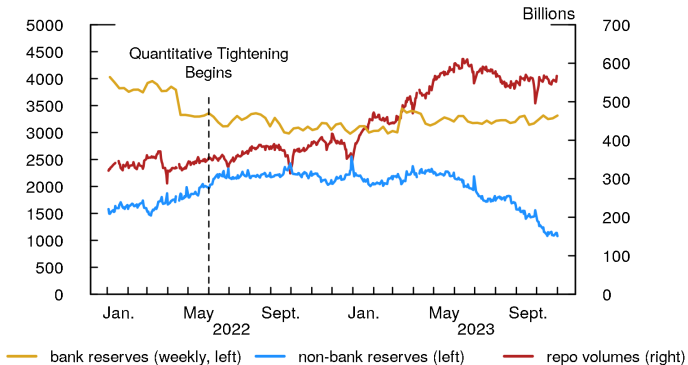
- ▶ Estimations of the reserve demand functions: Lopez-Salido and Vissing-Jorgensen (2022); Afonso, Giannone, La Spada and Williams (2022); Acharya, Chauhan, Rajan, & Steffen (2022)
- ▶ Different effects of QT vs. QE: D'Amico and King (2013), Smith and Valcarel (2022).
- ▶ Substitutability of interest rate and balance sheet policy: Kiley (2014).

Monetary Policy at the Fed



- ▶ Banks deposit money at the Fed and receive the Interest on Reserve Balances (IORB) rate.
- ▶ Money market mutual funds (MMFs) deposit money at the Fed and receive the Overnight Reverse Repo Facility (ON RRP) rate.

Empirical Observations



The Model

The model builds upon Armenter & Lester (2017) and Xiao (2020).

- ▶ Static two-period model.
- ▶ Five types of agents: banks, money market mutual funds (MMFs), broker-dealers (dealers), households and firms.
- ▶ Unit mass for each type of agent.
- ▶ The central bank implements monetary policy:
 - ▶ It sets the interest on reserves (IORB), R ;
 - ▶ and the overnight reverse repo (ONRRP) rate, r .
 - ▶ It chooses how many government bonds to buy from households b^{CB} .

Balance Sheets of the Agents

Central Bank		Banks	
Bonds b^{CB}	Reserves m_r	Loans ℓ	Bank deposits d^b
General goods Px	ON RRP d^{ONRRP}	Reserves m_r	
MMF		Households	
Repo z^m	MMF deposits d^m	Bank deposits d^b	Equity
ON RRP d^{ONRRP}		MMF deposits d^m	
Dealers			
Bonds b^d		Repo z^d	

The Deposit Market

$$i_{db} = (R - k^b) + \frac{\ell(i_\ell - R)}{d^b} - \frac{\chi(\ell)}{d^b} - \frac{\theta}{1 - \theta} \left[\frac{u(q)}{\phi d^b} - (1 + i_{dm}) \right].$$

$$i_{dm} = \rho - k^m$$

- ▶ The pass-through of an increase in the policy rate is going to be larger for MMF deposit rates than for bank deposit rates.
- ▶ As a result, money flows from bank deposits to MMF deposits when the policy rate increases.

Banks

$$\begin{aligned} \max_{\ell} \quad & \phi \ell (i_{\ell} - R) - \phi \chi(\ell) + \phi d^b (R - k^b - i_{d^b}) \\ \text{s.t.} \quad & m - \delta d^b \geq 0. \end{aligned}$$

- ▶ Banks can use deposits to hold reserves or loans.
- ▶ We impose δ as the minimum level of reserves to deposits that banks must hold.

MMFs and the Repo Market

MMFs can lend their deposits, d^m , in the repo market at ρ , or lend their deposits to the CB at r via the ON RRP.

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A repo, or repurchase agreement, is a short-term secured loan backed by collateral. In our model, we consider overnight Treasury repo.

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- ▶ Demand for money is created in the repo market by dealers who need to finance their Treasury bond holdings.
- ▶ When the CB reduces the size of its balance sheet, it reduces the amount of Treasury securities it holds. Then, dealers purchase those bonds that the CB no longer holds.

Supply of liquidity is determined by MMF's maximization problem:

$$\max_{d^m, z^m} z^m(\rho - r) + d^m(r - k^m - i_{d^m}).$$

$$\text{s.t. } d^m - z^m \geq 0.$$

Two Equilibriums

- ▶ We define Excess Liquidity (ample reserves) in the repo market in the following way:
 - ▶ Demand for liquidity by dealers is low relative to the supply of liquidity by MMFs such that $\rho = r$ and $d^{ONRRP} \geq 0$.

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- ▶ Scarce Liquidity in the repo market implies $\rho > r$ and $d^{ONRRP} = 0$.
- ▶ There exists a critical threshold of central bank bond holdings $b^{CB} = \tilde{b}^{CB}$, such that $\rho = r$ and $d^{ONRRP} = 0$.
 - ▶ We refer to this threshold as the minimal size of the balance sheet consistent with an Excess Liquidity regime.

Decrease in b^{CB} (Excess Liquidity Regime)

Central Bank		Banks	
Bonds b^{CB} ↓	Reserves m_r	Loans ℓ	Bank deposits d^b
General goods P_x	ON RRP d^{ONRRP} ↓	Reserves m_r	
MMF		Households	
Repo z^m ↑	MMF deposits d^m	Bank deposits d^b	Equity
ON RRP d^{ONRRP} ↓		MMF deposits d^m	
Dealers			
Bonds b^d ↑		Repo z^d ↑	

Decrease in b^{CB} (Scarce Liquidity Regime)

Central Bank		Banks	
Bonds $b^{CB} \downarrow$	Reserves $m_r \downarrow$	Loans ℓ	Bank deposits $d^b \downarrow$
General goods Px	ON RRP d^{ONRRP}	Reserves $m_r \downarrow$	
MMF		Households	
Repo $z^m \uparrow$	MMF deposits $d^m \uparrow$	Bank deposits $d^b \downarrow$	Equity
ON RRP d^{ONRRP}		MMF deposits $d^m \uparrow$	
Dealers			
Bonds $b^d \uparrow$		Repo $z^d \uparrow$	

Calibration

- ▶ Use data from September 15, 2021 to December 31, 2022.
 - ▶ September 14, 2021 is the peak level of reserve balances held at the Fed.
- ▶ We calibrate the model to match:

ρ	repo rate (TGCR)
D^b	Bank Deposits
i_{dm}	Interest rate on MMF deposits
i_{db}	Interest rate on bank deposits
D^{ONRRP}	Aggregate ON RRP take-up
M_r	Aggregate Reserves

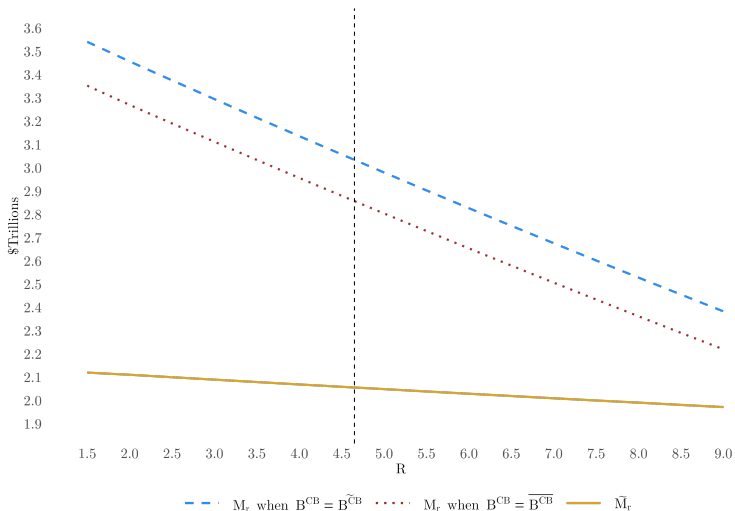
Independent Parameters

Parameter	Description	Value	Source
R	IORB	1.38%	Data
r	ON RRP offering rate	1.28%	Data
i_ℓ	Average interest rate on banks' outside investments	2.71%	Data
$p^g b^{CB}$	Nominal quantity of Treasury securities held by the Fed	\$5.65T	Data
$p^g B$	Nominal quantity bonds in the economy	\$5.77T	Data
δ	Minimal reserve-to-deposit ratio	0.13	Data

February 2023 FOMC Meeting Test

Parameter	Description	Data	Model	Error
ρ	TGCR	4.51%	4.55%	+(0.04)
i_{dm}	Interest rate on MMF deposits	4.38%	4.40%	+(0.02)
i_{db}	Interest rate on bank deposits	0.18%	3.28%	+(3.10)
D^b	Bank Deposits	\$15.76T	\$15.84T	+(0.08)
D^{ONRRP}	Aggregate ON RRP take-up	\$1.82T	\$1.80T	-(0.02)
M_r	Aggregate reserves	\$3.00T	\$3.04T	+(0.04)

Result: Capacity of repo market binds before banks' reserve demand



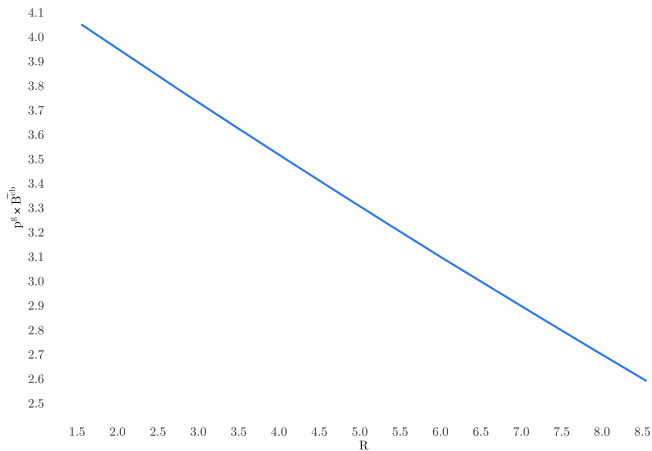
Does the capacity of the repo market matter?

- ▶ Copeland, Duffie, Yang (2022) show that reserve balances reached an all-time low on September 16-17, 2019 leading to a spike in repo rates.
- ▶ We argue that the capacity of the repo market bound also on that day.

Using Calibrated Values to Predict September 2019

Parameter	Description	Data	Model	Error
ρ	TGCR	5.25%	4.80%	-(0.45)
i_{dm}	Interest rate on MMF deposits	1.92%	1.92%	(0)
i_{db}	Interest rate on bank deposits	0.14%	-2.47%	-(2.61)
D^b	Bank Deposits	\$11.23T	\$11.25T	+(0.02)
D^{ONRRP}	Aggregate ON RRP take-up	\$0.0023T	\$0T	-(0.0023)
M_r	Aggregate reserves	\$1.47T	\$1.46T	-(0.01)

Result: Minimal balance sheet size is decreasing in the policy rate



Conclusion

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- ▶ Non-banks have an important role in monetary policy implementation and their demand for money through the repo market affects the size of the Fed's balance sheet.