

Why are central banks struggling to reduce their balance sheets?

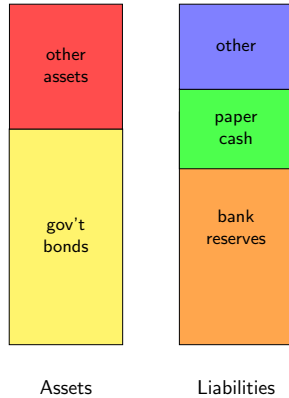
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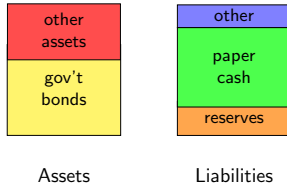
Based on work with Adam Copeland and Yilin Yang and work in progress with Francesco Spizzuoco

Major central banks now have large balance sheets



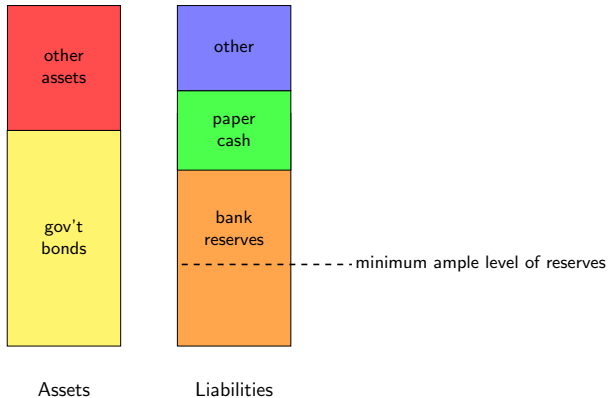
Pre-crisis, the Fed steered rates by adjusting the scarcity of reserves

With post-crisis liquidity regulations, this would make the shadow cost of reserves too volatile.



Major central banks now have abundant reserves, mostly because of QE

Market interest rates are steered mainly by the administered interest rate paid on reserves

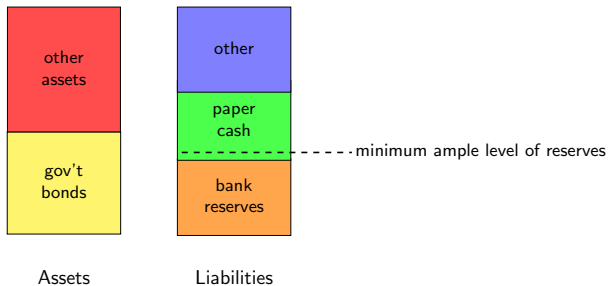


Central banks are aiming for smaller balance sheets

- ▶ Larger balance sheets increase a central bank's footprint on financial markets and raise the total interest paid to banks on reserves.
- ▶ These concerns also have political implications for central bank independence (Warsh, 2025).
- ▶ But pressing the central bank's balance sheet down too far risks leaving large banks with too little reserves to "run the financial system," leading to:
 1. Unstable monetary policy implementation (for example, September, 2019).
 2. Reputational costs.
 3. Financial instability: cash hoarding and funding rollover risks for levered investors.

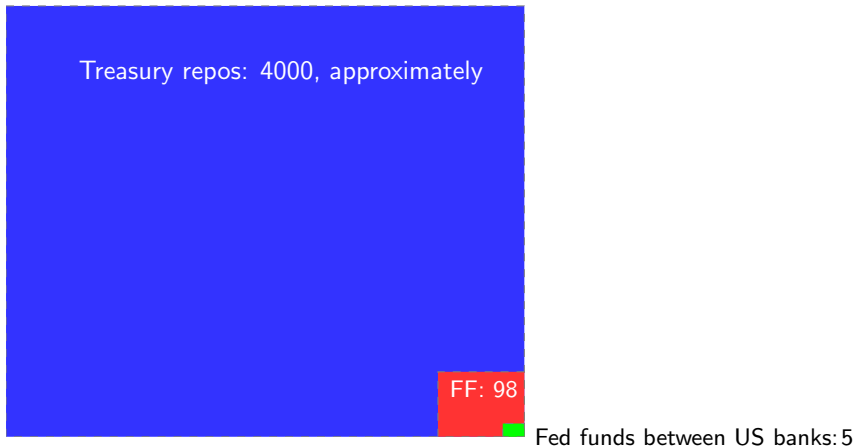
Less than ample reserves causes cash hoarding and interest-rate spikes

This happened in the U.S. repo market in September, 2019



In the U.S., the repo market is the elephant in the room

daily transaction volumes (\$ billions), to scale



Data: Federal Reserve, ICMA

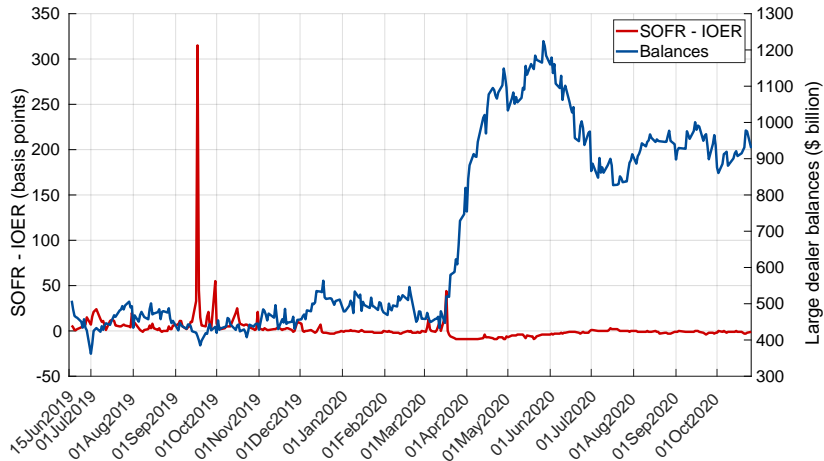


Figure: Copeland, Duffie, and Yang (QJE, 2025). Left scale: The difference between the Treasury repo rate market benchmark (Secured Overnight Financing Rate, SOFR) and the interest rate paid by the Fed to banks on their reserve balances (IOER). Right scale: The total reserve balances of the ten bank holding companies that are most active in repo markets (the “dealer banks”). Data: Fedwire Funds Service, FRBNY.

Achieving the minimum ample level of reserves is tricky

- ▶ Market rates are not a reliable gauge of reserve ampleness because they spike unexpectedly when reserves are minimally ample.
- ▶ Structural changes in the financial system interfere with direct estimation of the minimum ample level of reserves:
 1. liquidity regulations, stress tests, and discount-window policy.
 2. bank capital regulations.
 3. regulation of money funds.
 4. ratchet effects in the demand for reserves (Acharya and Rajan, 2020).
- ▶ Increasing intra-day payment delays signals the disappearance of abundant reserves.

The biggest repo dealer banks get paid later when other banks have lower balances

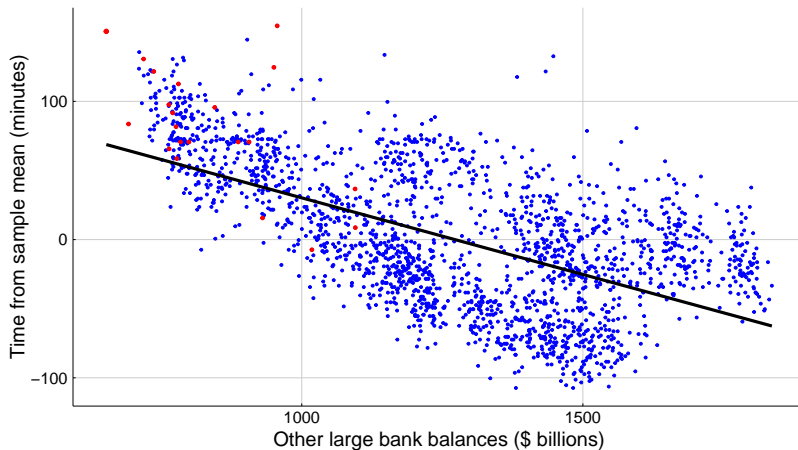


Figure: Time, relative to sample average, at which half of payments to the ten largest dealer banks is received from the next 90 largest banks, regressed on opening balances of next 90 largest banks. $R^2 = 0.69$. Red dots are days on which SOFR-IOR attained its highest 20 levels. Copeland, Duffie, and Yang (QJE, 2025).

Early warning sign: 10-day trailing average intra-day payment delays to the repo dealer banks

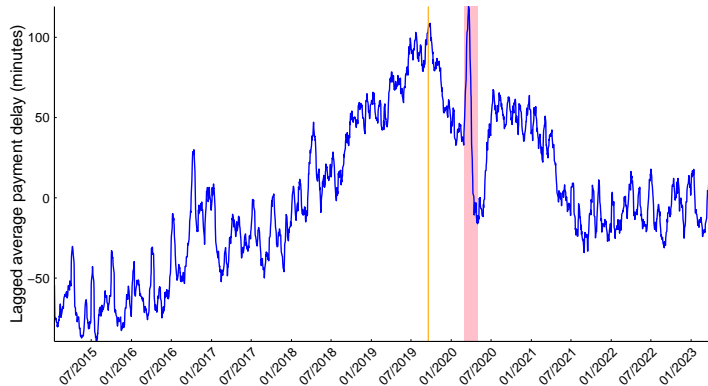


Figure: The lagged average of the time of day by which the ten largest repo-active bank holding companies had received half of their incoming payments, relative to sample mean, in minutes. The observation shown for date t is the average delay for business days $t - 10$ through $t - 2$ (inclusive). A vertical line is marked at September 18, 2019, the end of the three-day repo-market liquidity crunch of September 2019. A shaded bar marks the COVID shock period of March–April 2020. OLS regression: A one-standard-deviation increase in the trailing average payment delay predicts a 7-basis-point increase in SOFR–IOR. Copeland, Duffie, and Yang (QJE, 2025). Data: Fedwire Funds Service.

Central banks can reduce their balance sheets with more efficient allocation of reserves

1. Improve the regulation and supervision of bank liquidity requirements and leverage-ratio capital requirements.
2. Improve and de-stigmatize central-bank liquidity facilities, providing reserves when demanded by banks (ECB).
3. Improve liquidity savings mechanisms for large value payment systems (Bank of Canada, Lynx)
4. Open intra-day repo markets (BNYM).
5. Encourage all-to-all repo markets.
6. Tier the interest rates paid on reserves (work in progress with Francesco Spizzuoco).

Tiered remuneration in Norway

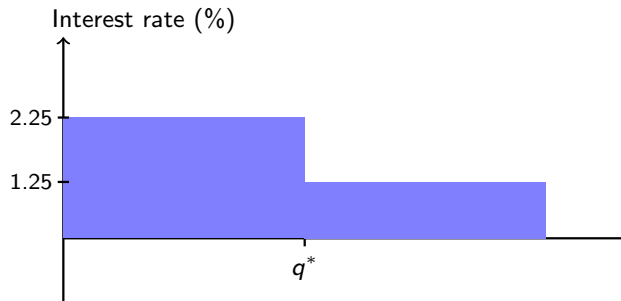


Figure: The Norwegian Central Bank remunerates reserves below the quota at the policy rate (for example, 2.25% in October 2022) and above the quota at the reserve rate (for example, 1.25% in October 2022).

Tiered remuneration in South Africa

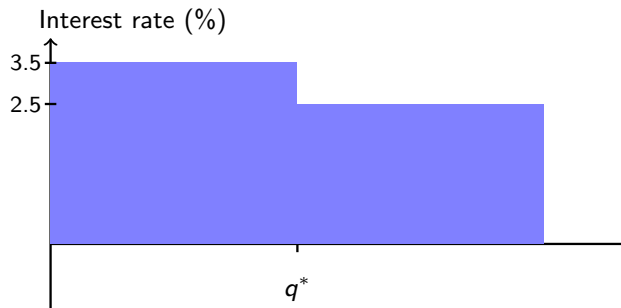


Figure: Reserve Bank of South Africa remunerates reserves below the quota at the repo rate (for example, 3.5% in April 2021), and above the quota at the repo rate less 1 percentage point.

Remuneration Rates on Excess Reserves: New Zealand

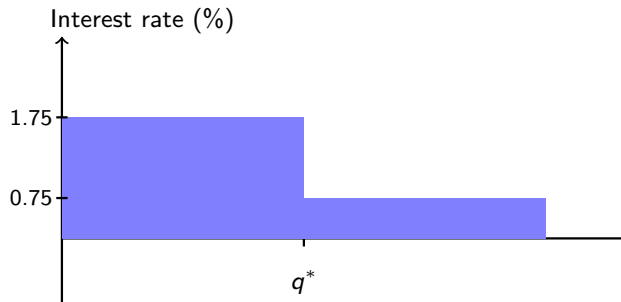


Figure: How RNBZ tiered remuneration in December 2017.

Why do some central banks tier their remuneration of reserves?

"In principle, there is no reason why the level of cash should not be allowed to rise to accommodate the needs of the financial system. However, we considered that our role was to satisfy the demand for settlement account balances that were required for payment system purposes, rather than for investment demand. Therefore, in 2007 we introduced a pricing mechanism to discourage holdings of settlement balances beyond those needed for payment system purposes."

The Reserve Bank of New Zealand, 2023.

"In response to the decline in demand for balances following the introduction in August 2007 of the tiered remuneration system, the RBNZ was able to reduce the overall quantity of settlement balances while keeping overnight market rates stable."

Bowman, Gagnon, and Leahy, Federal Reserve Board, 2010

Tiered remuneration to minimize aggregate reserves subject to the targeted market rate

1. The central bank targets some interbank market rate R .
2. The central bank chooses the marginal remuneration schedule $\{\rho(q) : q \geq 0\}$ that solves

$$\min_{\rho} B(\rho, R),$$

where $B(\rho, R)$ is the aggregate quantity of reserves necessary to achieve the interbank market rate R with remuneration schedule ρ .

Tiered remuneration minimizes total reserves, subject to hitting the targeted interbank rate

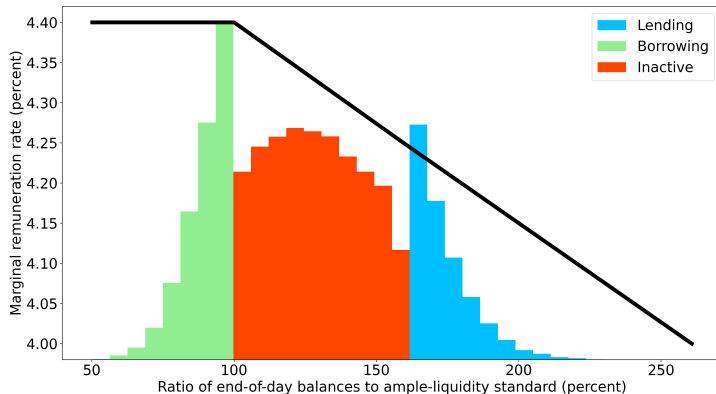


Figure: For a central bank that minimizes the total quantity of reserve balances subject to hitting the targeted interbank market interest rate, the plotted curve shows the optimal marginal rate of remuneration of reserves as a function of a bank's end-of-day reserve balances. Blue banks are lenders. Green banks are borrowers. Red banks are inactive in the interbank market. Assumes a frictional cost of borrowing of 10 basis points. From work in progress with Francesco Spizzuoco.

Illustrative Poole curves for tiered and fixed remuneration rates

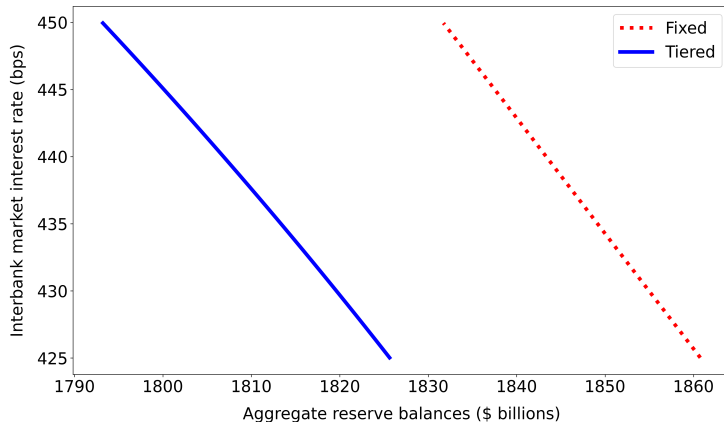


Figure: For a frictional borrowing cost of 10 basis points, the blue Poole curve shows the dependence of interbank rates on aggregate reserves with optimal tiered remuneration. The dotted red Poole curve corresponds to a fixed remuneration rate. From work in progress with Francesco Spizzuoco.

Appendix: Central banks also try to shield depositors from negative rates

Tiered remuneration in Switzerland

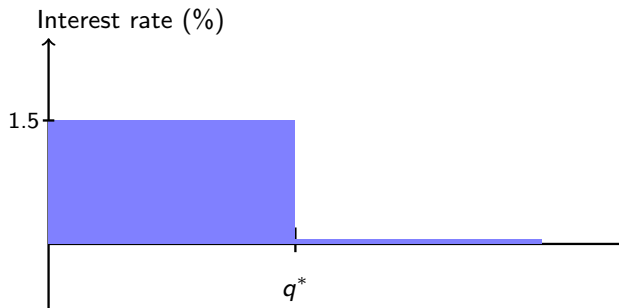


Figure: The [Swiss National Bank](#) remunerates reserves below the threshold at the policy rate (for example, 1.5% in March 2023), and above the threshold at 0%.

Tiered remuneration in Denmark

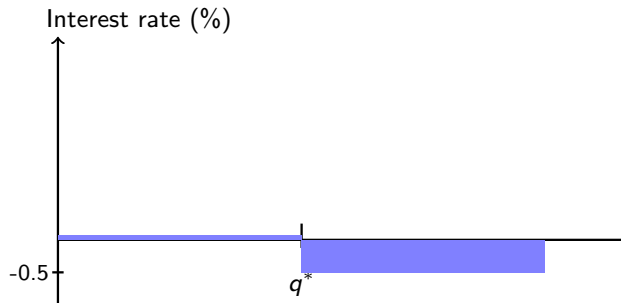


Figure: Between 2012 and 2021, [the Danish National Bank](#) remunerated reserves at 0%. All reserves held above the limit quantity were converted into certificates of deposits and remunerated at a negative rate, for example, -0.5% as of January 2019.

The ECB's tiered remuneration

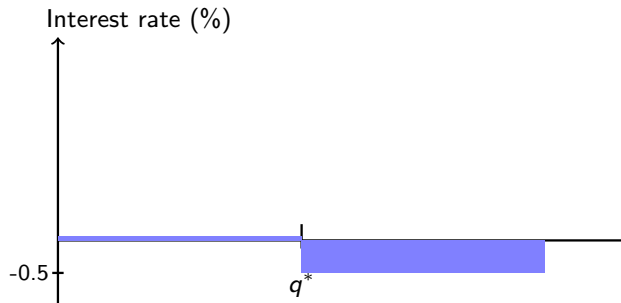


Figure: In 2019, the ECB exempted six times required reserves from being remunerated at the deposit facility rate -0.5% .

Tiered remuneration in Japan

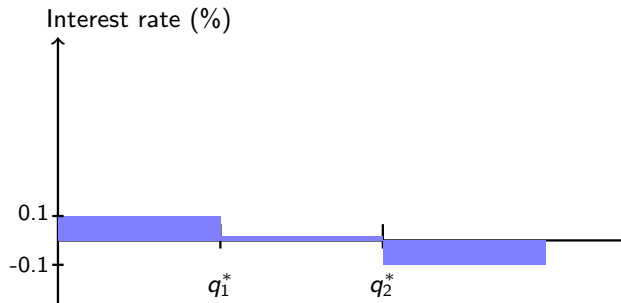


Figure: Bank of Japan had three-tiered remuneration from January 2016 to March 2024, with 0.1% for the "basic balance," 0% for the "macro add-on balance," and -0.1% for the "policy-rate balance."