

The Payment System Puts a Floor on the Fed's Balance Sheet

Brookings Papers on Economic Activity

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Drawing from research with Gara Afonso, Adam Copeland, Lorenzo Rigon, Hyun Shin, Srisht Fateh Singh, Thanawat Sornwanee, Francesco Spizzuoco, Chaojun Wang, Sarah Yu Wang, and Yilin Yang.

Basic message of the paper

If the Fed were to aim for a smaller balance sheet with ample reserves, some policies for it to consider, in increasing order of likely difficulty and impact, are:

1. Offsetting shocks to the supply of reserve balances with open market operations.
2. Changing the regulation and supervision of liquidity regulations.
3. Adding a liquidity savings mechanism to Fedwire.
4. Tiering the remuneration of reserves.

Liabilities of Federal Reserve Banks

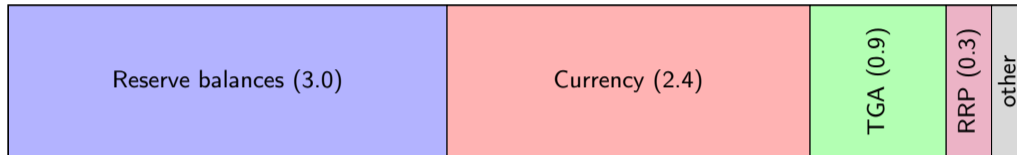
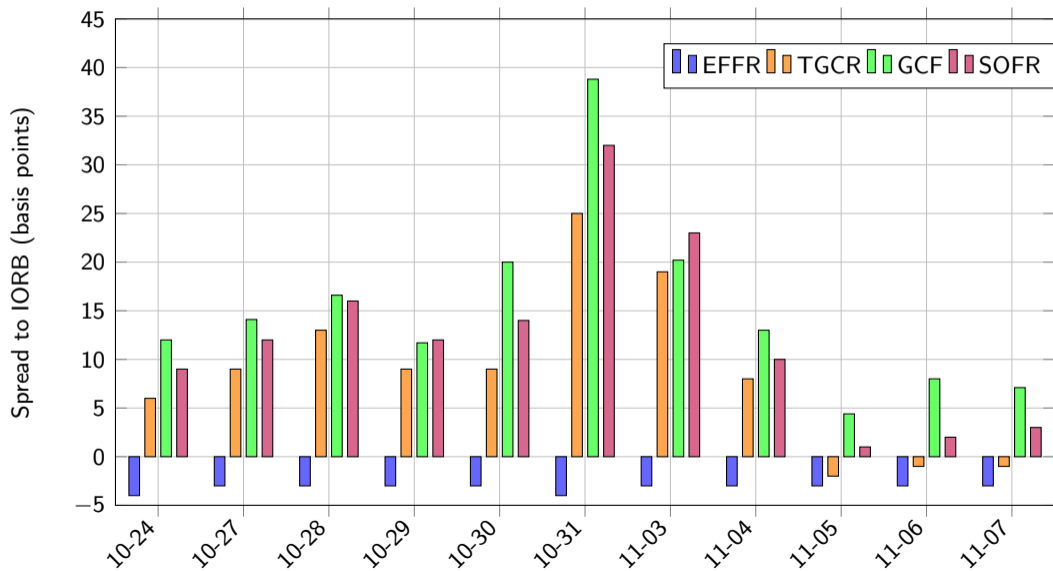


Figure: Liabilities of the Federal Reserve System in trillions of dollars, to scale, as of March 18, 2026. TGA refers to the Treasury General Account. RRP refers to the sum of the Foreign Official Reverse Repurchase pool (\$331 billion) and the Overnight Reverse Repurchase Facility (\$1 billion). Data: [Federal Reserve Board, H.4.1](#).

When reserves are low, as at the end of October 2025, repo rates are high



Sizes of selected money-market segments

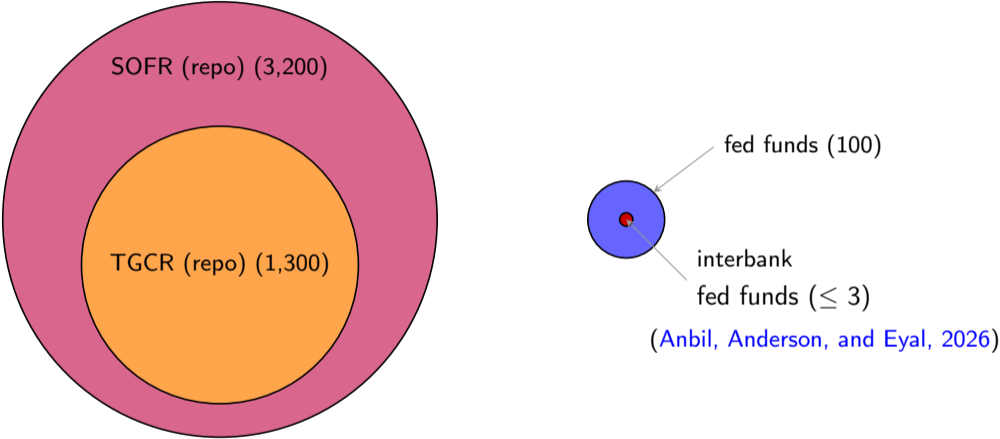
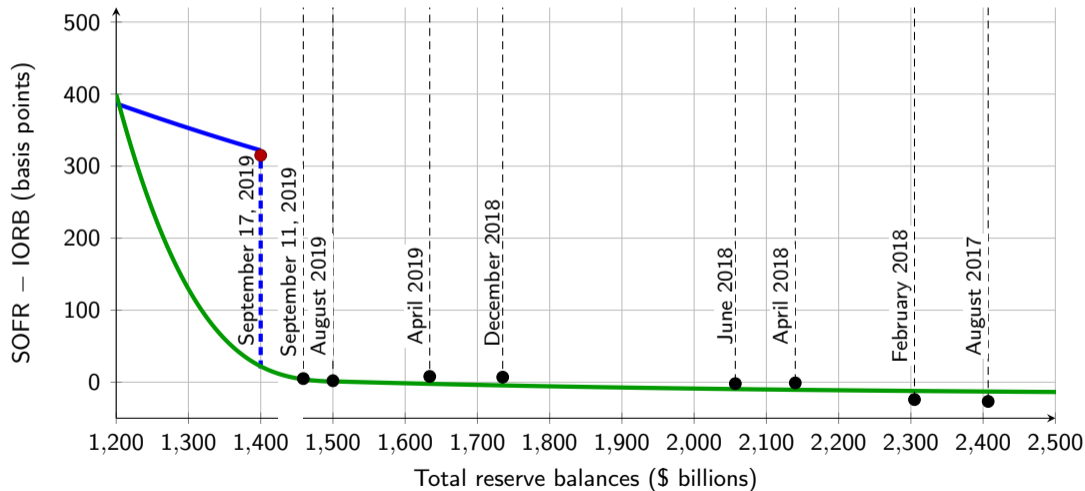


Figure: A Venn diagram showing, to scale, the approximate daily volumes of transactions are shown in billions of dollars underlying the Secured Overnight Financing Rate (SOFR), the Tri-Party General Collateral Repo Rate (TGCR), the effective federal funds rate (EFFR).

How repo rate spreads depend on reserve balances: Alternative concepts



Delayed payments to dealer banks signal stress

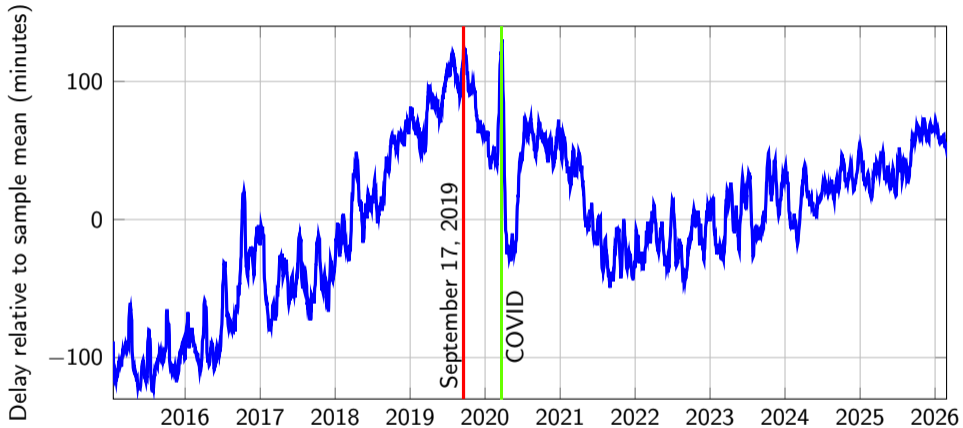


Figure: The 10-day trailing average of the time of day by which the ten largest repo-active bank holding companies had received half of their large (\geq \$100 million) incoming payments, relative to sample mean, in minutes. Source: Copeland, Duffie, Wang, and Yang (2025). Data: Fedwire Funds Service.

Payment delays are higher when balances are lower

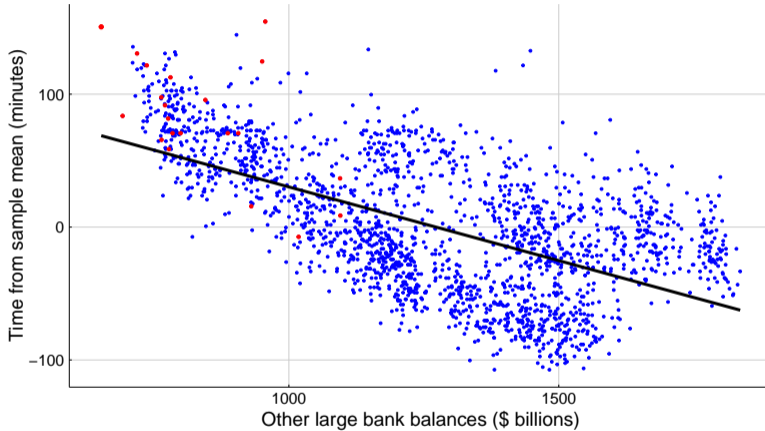


Figure: Delay in the time by which half of payments to the ten largest dealer banks are received the next 90 largest banks, regressed on opening balances of next 90 largest banks. Daily data, 2015 to 2025. $R^2 = 0.36$. Figure source: [Copeland, Duffie, and Yang \(2025\)](#). Data source: Fedwire.

Reserve balances drop at quarter ends

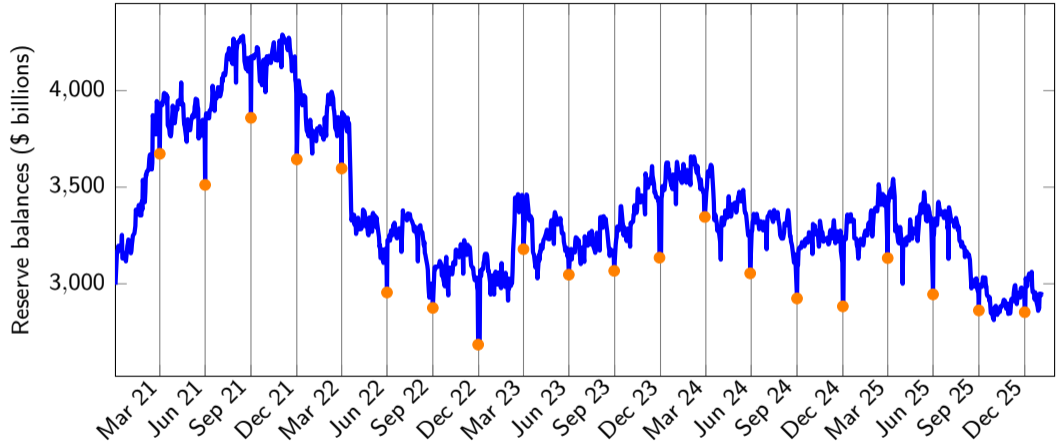


Figure: Total reserve balances, highlighting balances at quarter ends with orange dots. Data: Reconstructed daily total reserve balances, Louis Crandall, Wrightson Associates.

Temporary open market operations that reduce shocks to reserves

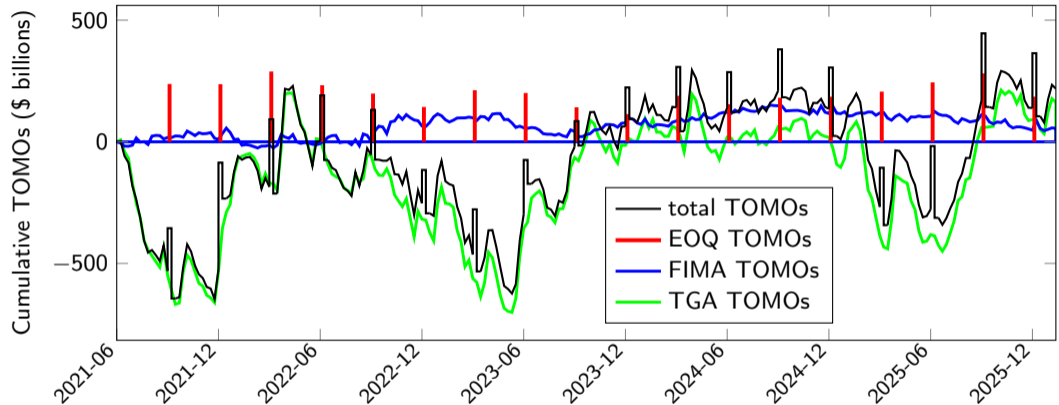


Figure: Cumulative TOMOs offsetting the impacts on actual reserve balances of end-of-quarter drops in reserve balances caused by foreign-bank window dressing (EOQ TOMOs), by changes in FIMA reverse repurchase pool (FIMA TOMOs), and by changes in TGA balances (TGA TOMOs).

Sizes of TOMOs

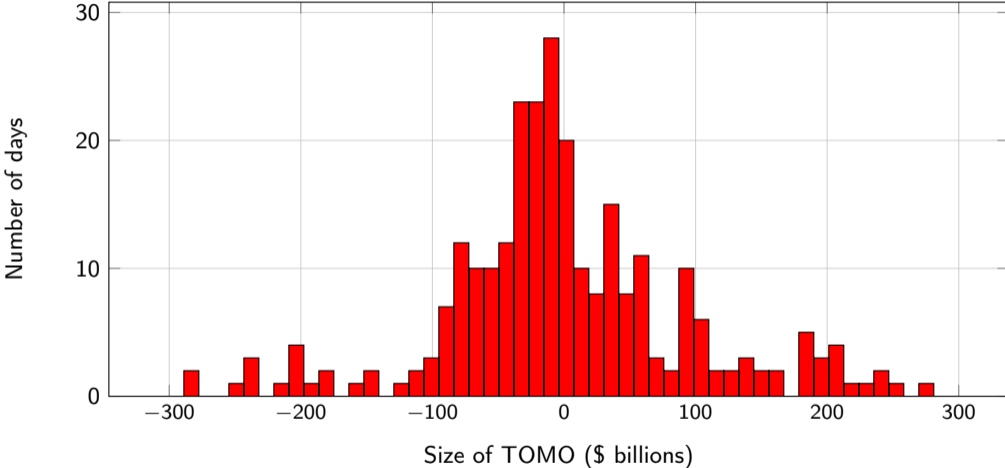


Figure: Histogram of the sizes of the modeled temporary open market operations, excluding days with no TOMOs; sample covers 1329 business days.

How the modeled TOMOs reduce big drops in reserves

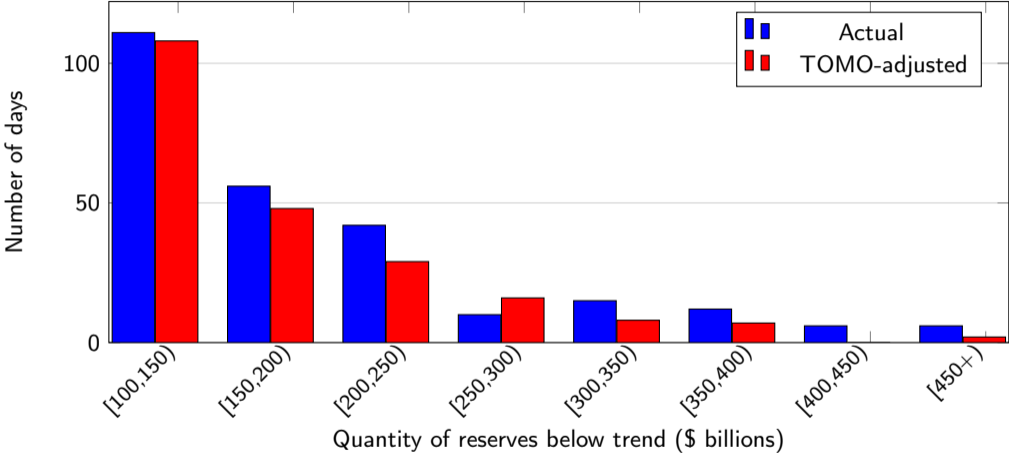


Figure: Histogram of days on which the quantity of reserve balances, actual and TOMO-adjusted, was below 40-day lagged average by amounts in the indicated intervals. Sample covers 1329 business days.

The largest banks have almost stopped daylight overdrafts

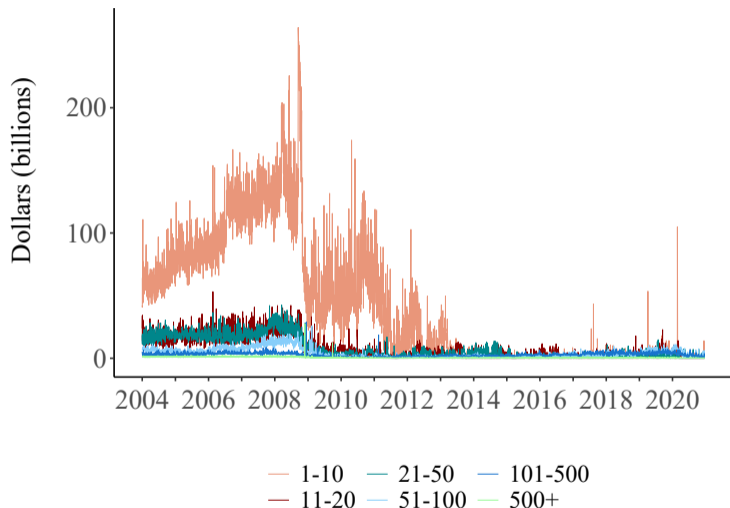


Figure: Overdrafts by bank size ranking. Source: [Badev, Clark, Ebanks, Marquardt, and Mills \(2021\)](#).

Overdrafting significantly reduces the need for reserve balances

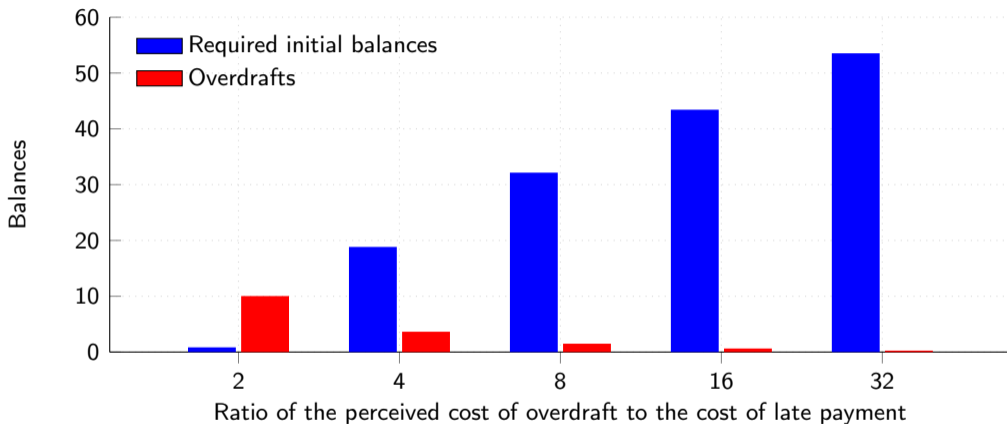
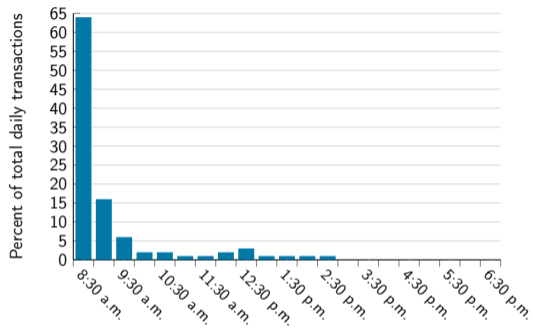
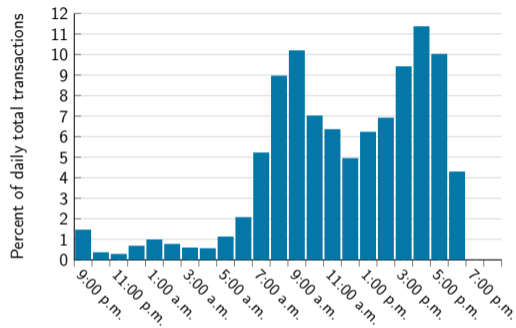


Figure: In order to achieve an expected fraction of 50% of early payments, the vertical axis shows required mean initial balances per bank (blue) and the mean chosen quantity of overdrafts per bank (red). An illustrative case based on the equilibrium payment timing model of [Yang \(2020\)](#).

Payment timing discretion matters mostly for Fedwire Funds Service



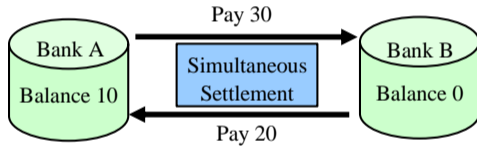
(a) Payment timing in Fedwire Securities.



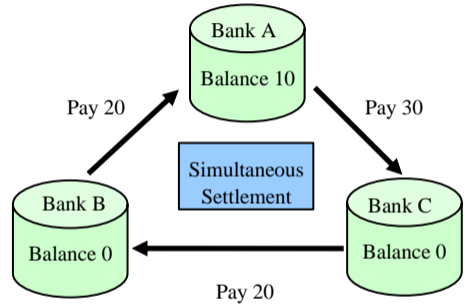
(b) Payment timing in Fedwire Funds Service.

Figure: The fraction of daily transactions occurring in each 1.5-hour period over the operational days of the respective systems. The sample period is the second quarter of 2024. Figure source: Redrawn from [Copeland and Wang \(2024\)](#).

Liquidity savings mechanisms reduce the need for reserves



(a) Bilaterally offsetting payments.



(b) Multilaterally offsetting payments.

Figure: Elements of the Bank of Japan's LSM, BOJNet. Figure source: [Bank of Japan \(2019\)](#)

Illustrative impact of an LSM on the promptness of payments

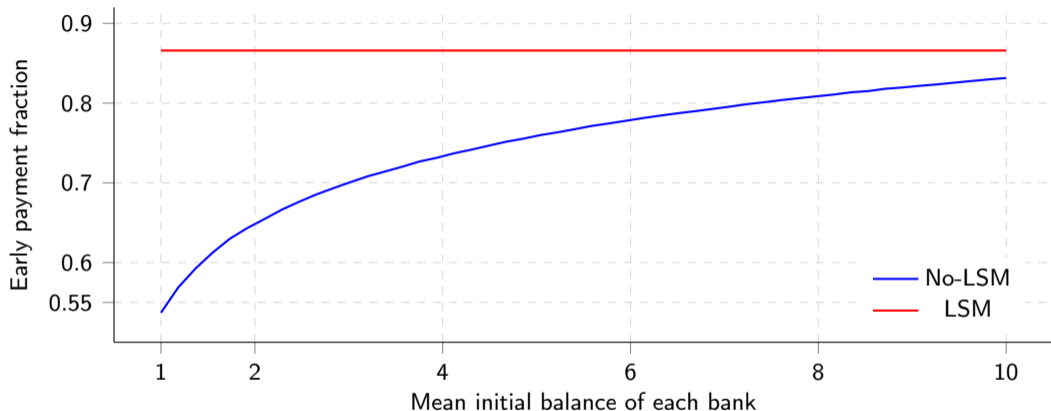
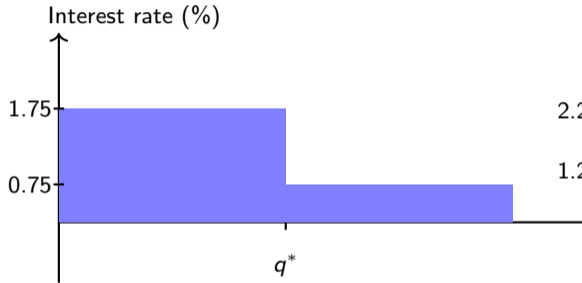
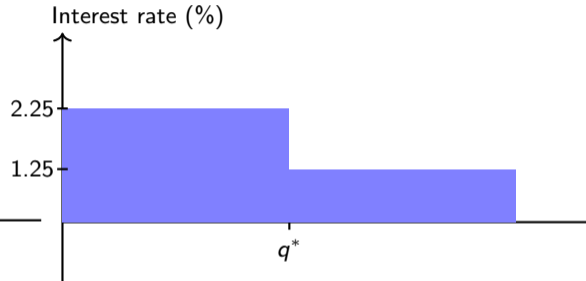


Figure: The mean fraction of early payments depends on the mean opening balances of each bank, with and without an LSM. The perceived proportional cost of overdrafts is assumed to be twice that for late payments. Source: [Duffie, Singh, and Wang \(2026\)](#).

Tiered remuneration in New Zealand and Norway



(a) The RNBZ remunerated reserves below an assigned tier at the policy rate (e.g., 1.75% in [December 2017](#)) and above the tier at a lower level, typically the policy rate less 1%. See [this paper](#) for more information.



(b) The Norwegian Central Bank remunerated 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).

Tiering triggered more interbank lending in Norway

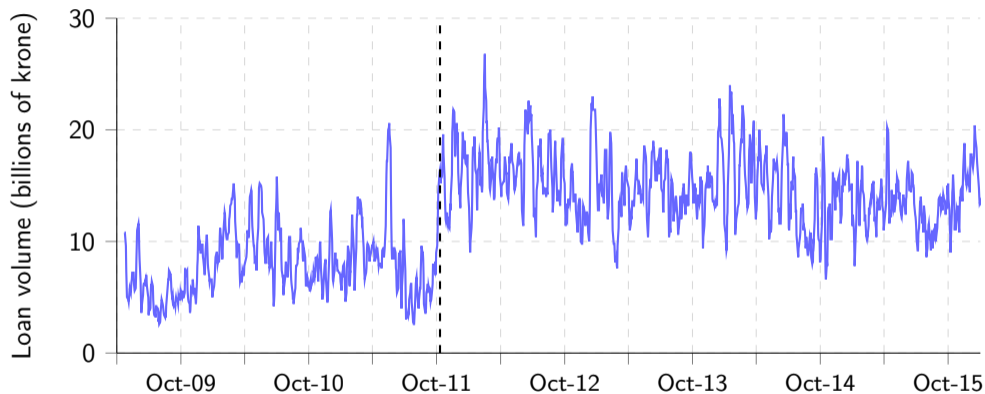
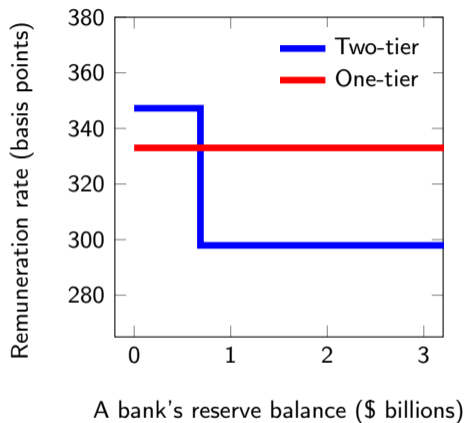
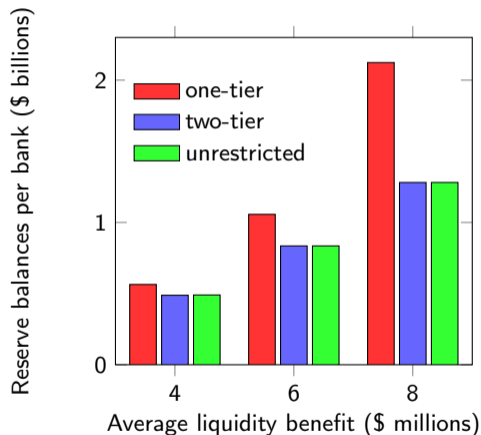


Figure: The total value of overnight interbank loans in billions of Norwegian kroner. The central bank began tiering October 2011. Data: [Akram and Findreng \(2021\)](#).

Illustrative theoretical impact of tiering on total reserve balances

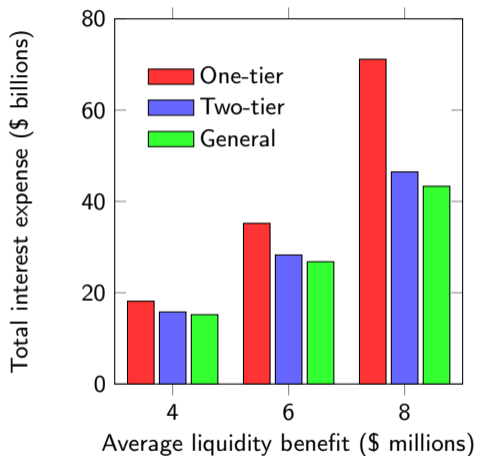


(a) This example assumes that system-wide total reserve balances are sufficient in each case to imply an average equilibrium annualized liquidity benefit per bank of \$6 million.

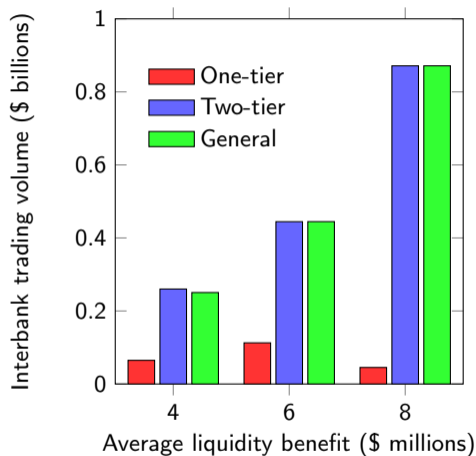


(b) Reserve balances per bank. Source: [Duffie, Sornwallee, and Spizzuocco \(2026\)](#)

Theoretical impacts of tiering on interest expense and interbank lending



(a) Total central bank interest expense. Source: [Duffie, Sornwanee, and Spizzuocco \(2026\)](#)



(b) Total interbank loan volume. Source: [Duffie, Sornwanee, and Spizzuocco \(2026\)](#)

References

- Akram, Farooq and Jon Findreng (2021). Norwegian interbank market's response to changes in liquidity policy. *Journal of Banking & Finance* 125, 106078.
- Anbil, Sriya, Alyssa Anderson, and Benjamin Eyal (2026). [Bankers' Banks and their Role in the Federal Funds Market](#). FEDS Notes, Federal Reserve Board, January.
- Badev, Anton, Lauren Clark, Daniel Ebanks, Jeffrey Marquardt, and David Mills (2021). [Fedwire Funds Service: Payments, Balances, and Available Liquidity](#). Finance and Economics Discussion Series, Working paper 2021-070, October.
- Bank of Japan (2019). [Information Disclosure Based on the Principles for Financial Market Infrastructures: The BOJ-NET Funds Transfer System](#). Bank of Japan, June.
- Copeland, Adam, Darrell Duffie, and Yilin (David) Yang (2025). [Reserves Were Not So Ample After All](#). *The Quarterly Journal of Economics* 140(1), 239–281.
- Copeland, Adam and Sarah Yu Wang (2024). [The Dueling Intraday Demands on Reserves](#). *Liberty Street Economics*, October.
- Duffie, Darrell, Srisht Fateh Singh, and Chaojun Wang (2026). An efficient liquidity savings mechanism. Working paper, Stanford University.
- Duffie, Darrell, Thanawat Sornwanee, and Francesco Spizzuocco (2026). Work in progress on tiered remuneration. Stanford University.
- Yang, Yilin (David) (2020). [What Quantity of Reserves Is Sufficient?](#) SSRN Working Paper.