"Monetary Policy Operations: Theory, Evidence, and Tools for Quantitative Analysis"
by
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- Overview
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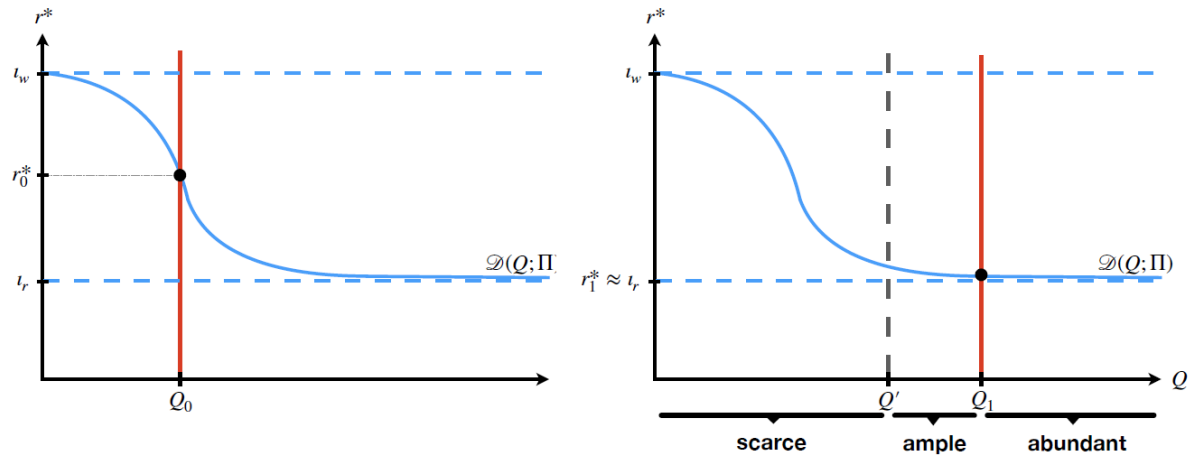
What is the optimal level of Reserves?

- Following GFC, QE lead to rapid expansion of CB balance sheet, and large increase in Bank (excess) reserves ($<$\$50 Billion before 2007 to $>$\$2.5 Trillion in 2014).
- As result monetary policy implementation moved from open market operations to *corridor framework* with floor {IOR, ONRRP} and ceiling {DWR} rates.



- With 'normalization' (QT) what is the optimal size of the CB balance sheet and the optimal amount of reserves?
- CB have decided to target **an 'ample' amount of reserves**.
- This paper focus on **the slope of the demand curve** in FF market to determine target level.

How to estimate reserve demand curve?

Standard Reduced-Form Econometric Approach

- Standard approach (Hamilton (1997), Carpenter and Demiralp (2006)): regress EFFR-IOR spread (s_t) on reserves. For example:

$$s_t - s_{t-1} = \gamma_0 + \gamma(Q_t - Q_{t-1}) + \epsilon_t$$

→ ad-hoc $EFFR = D(Q; \Pi)$ model with **reduced-form parameters** $\Pi = \{\gamma_0, \gamma\}$

- This approach:
  - Requires valid instrument for **exogenous** demand shock.
  - Provides **local** estimate
  - Cannot cope with changes in environment that may significantly affect the slope of the demand curve, such a change in corridor (DWR, ONRRP, IOR) rates.

How to estimate demand curve?

Structural Equilibrium Model Implied Demand-Curve

- This paper uses structural search-bargaining model of FF-market:
  - Continuum of Small, Medium, and Large banks of respective size n_i $(i = S, M, L)$.
  - Random (uniform) matching with intensity β_i to trade reserve level: a
  - Bargaining power $(\theta_{i,j})$ over end of day repayment.
  - Random payments of size z from i to j drawn from $G_{ij}(z)$ arrive with intensity λ_i.
  - Maximize expected end of day profit $U(a) = a(1 + \mathbf{i_o}\mathbf{1}_{a\geq 0} + \mathbf{i_w}\mathbf{1}_{a<0})$.

$\rightarrow$ generates cross-section of trade sizes and rates among S,M,L banks over the day.

$\rightarrow$ calibrate **deep parameters** $\Pi = \{n_i, \lambda_i, \beta_i, \theta_{i,j}, i_o, i_w, G_{ij}\}$ to match key statistics of fed fund trading activity (fedwire).

- Build demand curve $EFFR = D(Q; \Pi)$ by shifting initial distribution of reserves $\{n_i, F_0^i(a)\}$ which pins down Q, and solving for model-implied equilibrium EFFR.

$\rightarrow$ Structural demand curve estimate should be **more robust** for informing policy out of sample, e.g., to estimate 'ample reserve level' conditional on different corridor rates.

The Random Search Model Assumptions

- How deep are the deep parameters?
  - Deep parameters of the model are trading intensity, payment shocks, bank type specific costs associated with using discount window...
  - Likely to change in times of (liquidity) crisis.
  - If parameters can change within the model, may have different implications for demand for reserves (as banks anticipate the crisis).
- Random search model assumptions vs. Fed Fund market trading dynamics?
  - Continuum of price-taking banks $\neq$ 10 largest banks do more than 90% of FF lending.
  - Random matching $\neq$ Repeated game with long-term relationships (search costs?).
  - No aggregate risk.
  - No counterparty risk.
  - No systemically important financial institutions.
- Yet, the model seems able to match very well many features of the FF trading network. So does it matter?

What Drives Demand for Reserves?

- Why do banks hoard liquidity in certain periods?
  - Changes in **risk** (market volatility, counterparty risk) and anticipation thereof.
  - **Strategic** considerations (Lehman crisis, Sept 2019 spike in Repo).
  - **Precautionary** holdings also regulatory LCR motivated (cf., Dimon speech).

- Liquidity crisis in the interbank market difficult to predict with level of reserves, but Copeland, Duffie, Yang (2024) suggest that intra-day delay in reserve flows to 10 largest (lending) banks is a good crisis indicator:

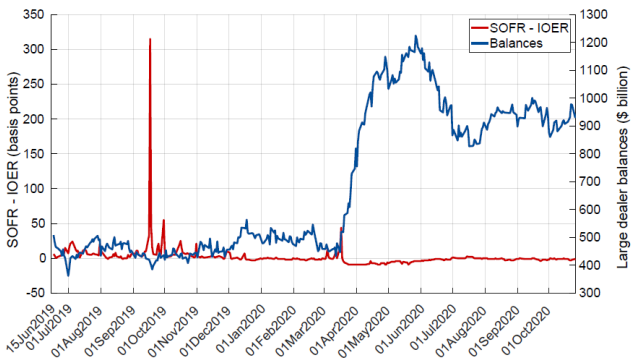


Figure 1: Reserve balances and the spread of SOFR over IOR

Note: SOFR is the Secured Overnight Financing Rate. IOR is the interest rate paid on reserves. The reserve balances of the large repo-active banks are shown in blue (right axis). The spread of SOFR from IOR is shown in red (left axis). Sources: Fedwire Funds Service, FRBNY.

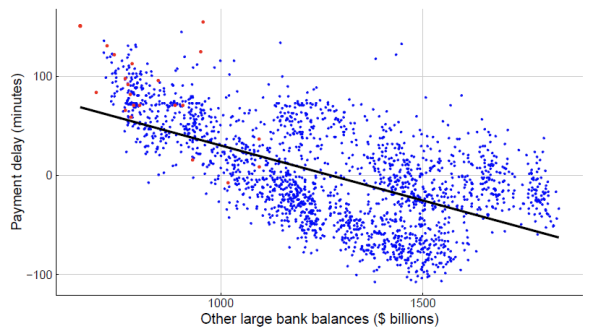


Figure 3: Non-dealer bank reserve balances and the timing of payments to dealer banks

Note: "Other large bank balances" for a given day is the total of the opening-of-day reserve balances of all accounts in our sample, except for the ten dealer banks. The payment timing measure is the half-received time of payments to the dealer banks. The solid line is the estimated linear relationship, which has an R^2 of 0.36. The slope coefficient, −0.11, is estimated with a standard error of 0.00325. The red dots in the scatter plot correspond to the observations for the 20 dates on which SOFR−IOR attained the highest 20 levels of those in the list of rate "spikes" shown in the Table 10. The date corresponding to the red dot in the upper left corner is September 17, 2019, on which SOFR−IOR spiked to its sample-record high and the total opening balances of the other large banks reached its sample-record low. Data source: Fedwire Funds Service.

→ consistent with strategic self-fulfilling hoarding equilibrium (Yang (2022)).

Final Remarks

- Regulators likely need both **ex-ante** tools (this paper) and **ex-post** tools (price and quantity based) to **monitor liquidity** and mechanisms to **supply liquidity** when needed.
- What is the optimal size of the CB balance sheet and of reserves?
- What is cost/benefit of more/less reserves?
- Involves both macro and micro considerations (and likely depends on state of the economy).