Monetary Policy Implementation with an Ample Supply of Reserves

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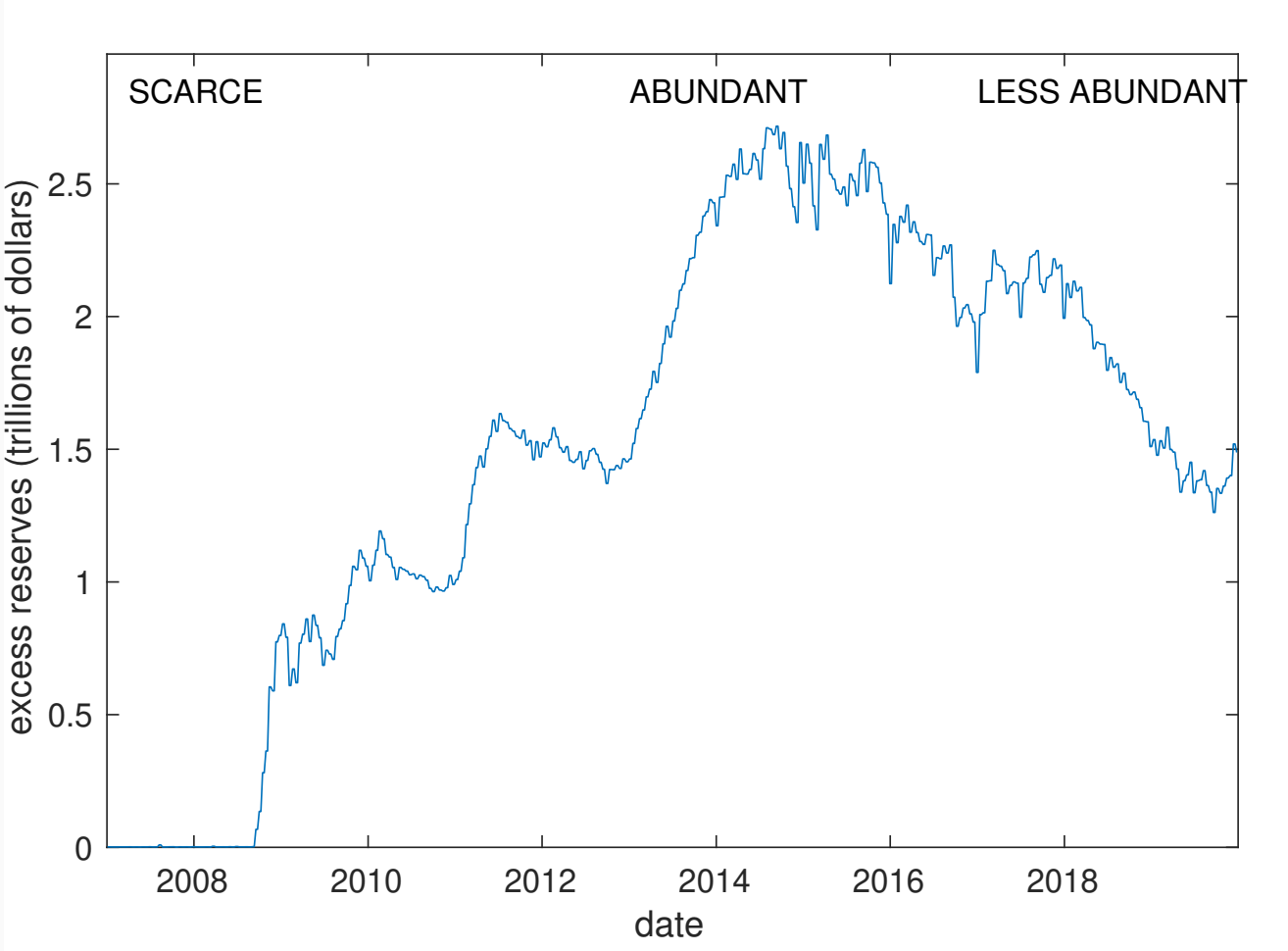
* Material represents the authors' view, not those of any Federal Reserve Bank, the Federal Reserve Board or the Federal Reserve System.

Motivation

- In 2019, the Federal Reserve announced that it would implement monetary policy with an ample supply of reserves.
- Is this a good idea?
- What is the optimal level of reserve supply?

Reserve Supply 2007-2019 in the U.S.

- Level of reserve supply has been changing.

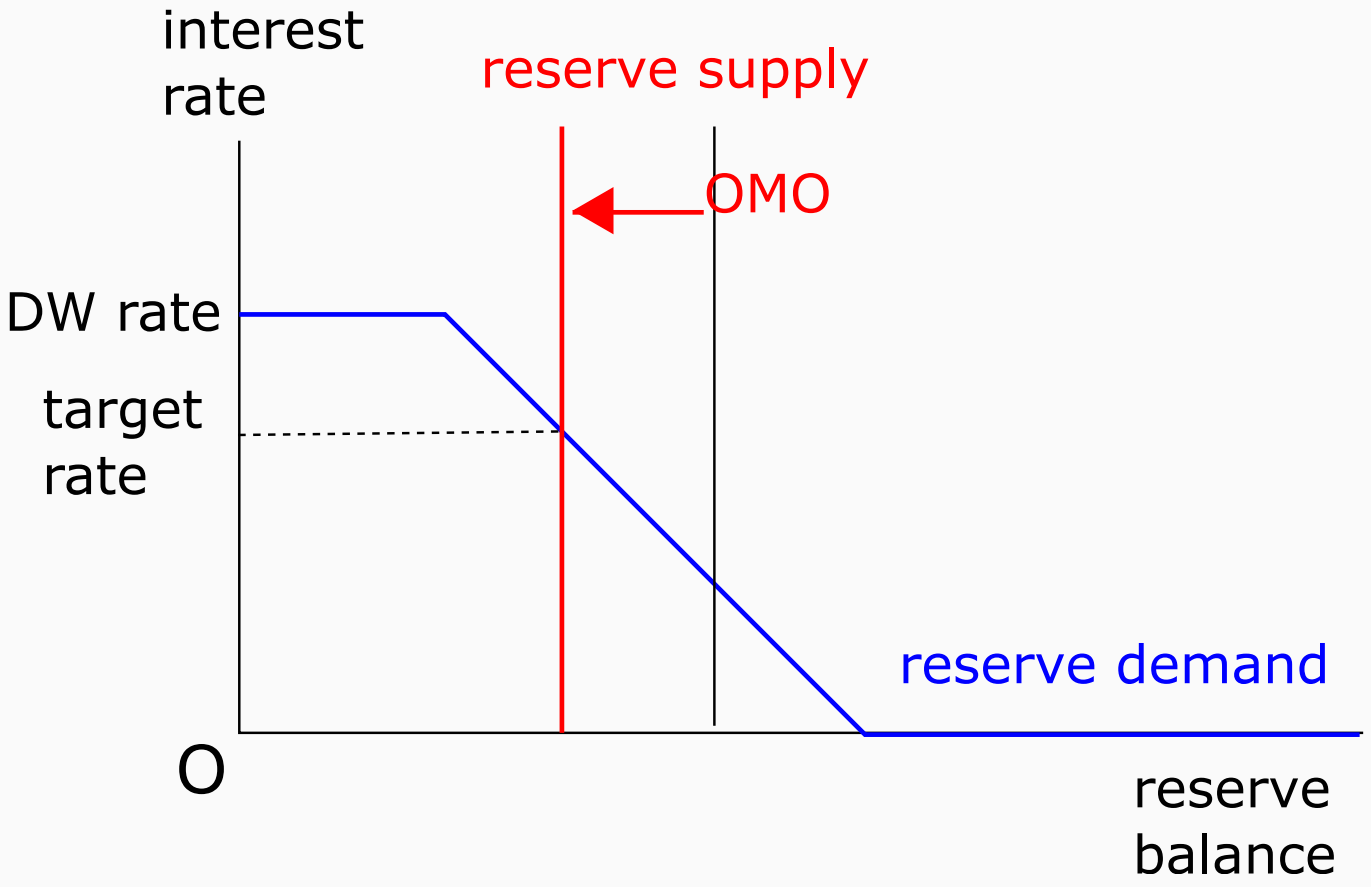


Pre-2008 Regime: Scarce Reserves

- Tightly managed reserve supply to control the fed funds rate.
  - (Excess) Reserve supply was very low, $\sim$ \$2B in 2007.
  - Daily forecast of reserve demand and open market operations: $\sim$ a few \$B.

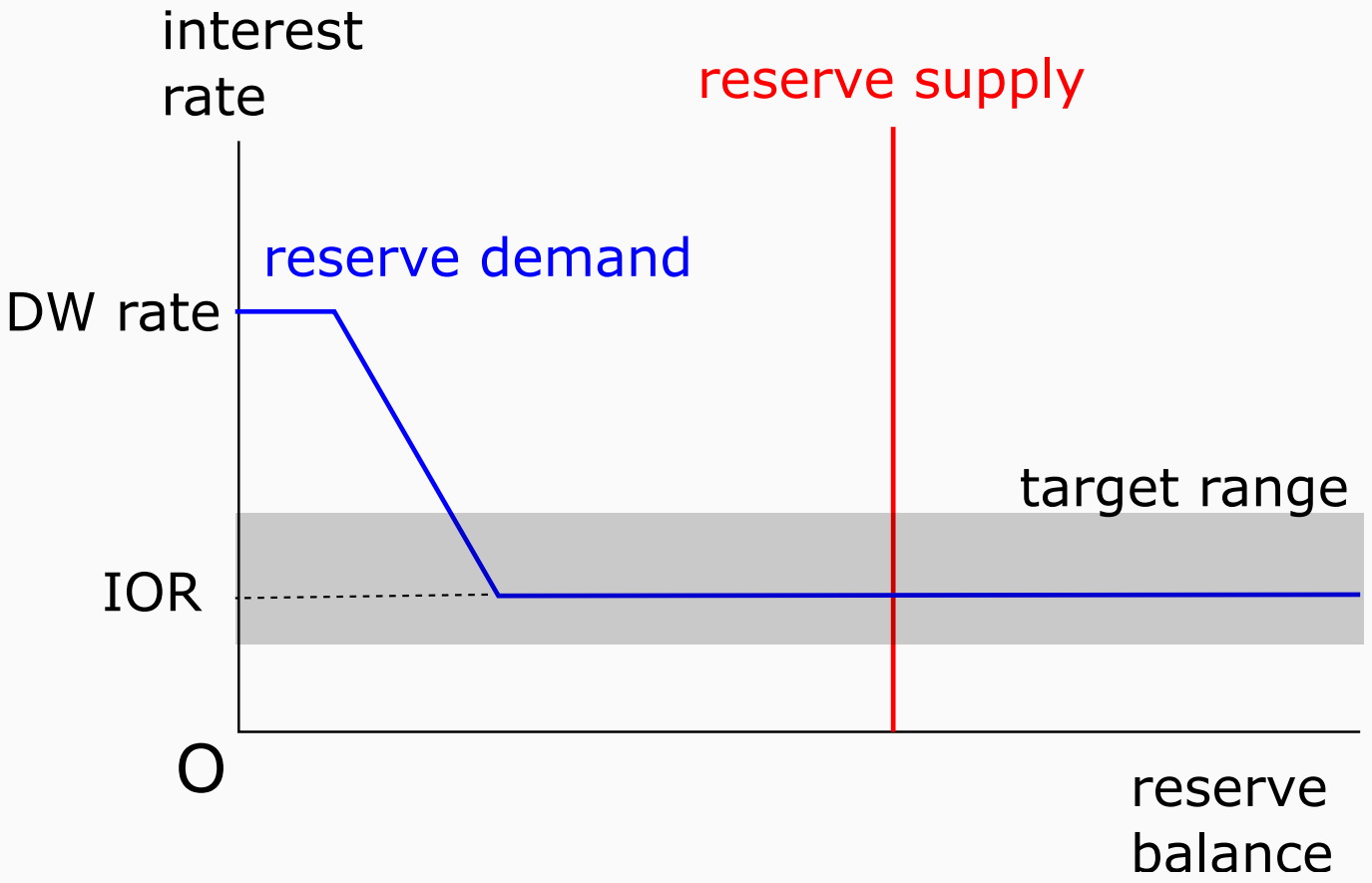
Pre-2008 Regime: Illustration

- Daily open market operations to adjust reserve supply (vertical bar):



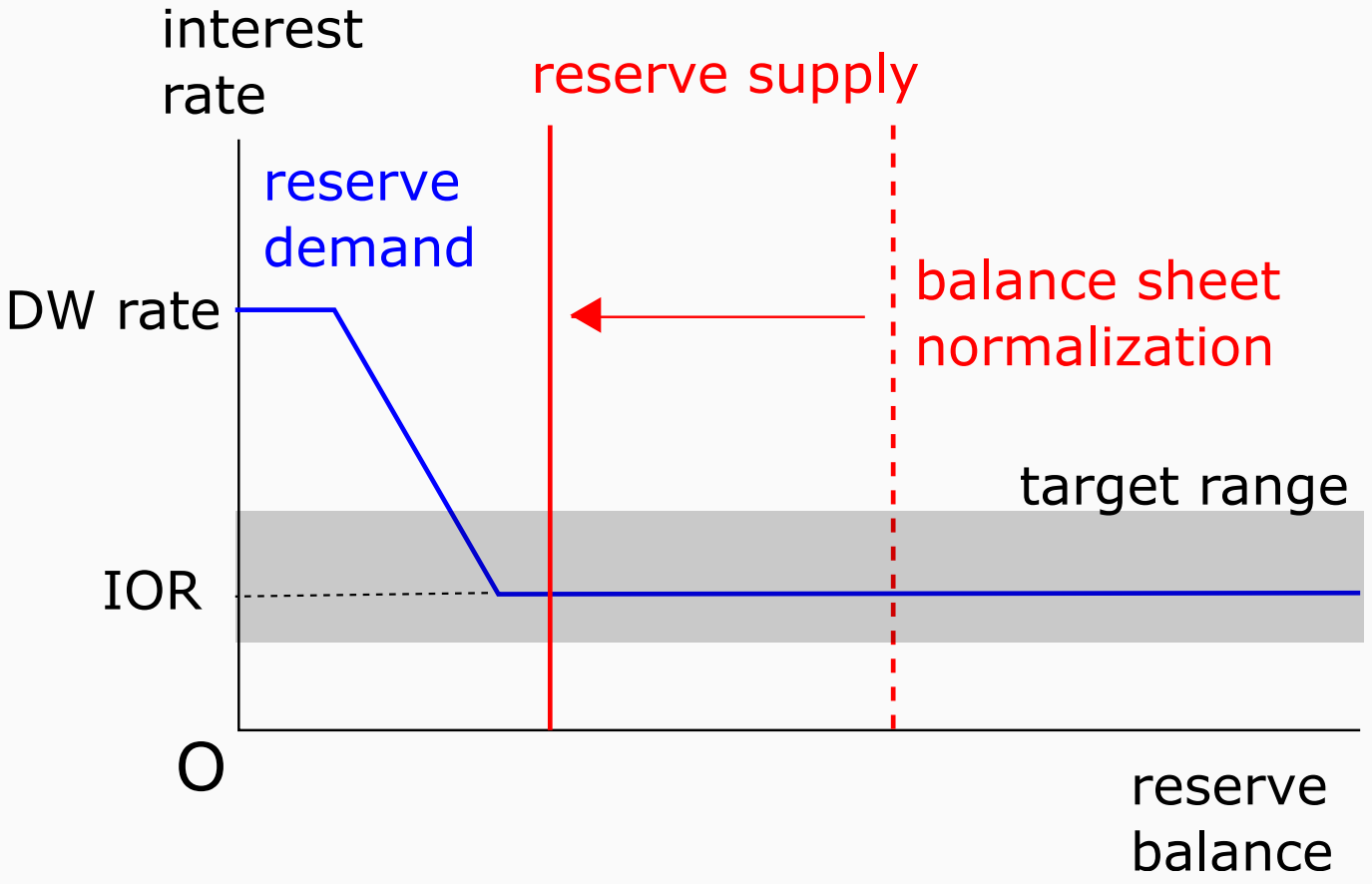
Post-2008 Regime: Abundant Reserves

- Large scale reserve injections through quantitative easing post-2008: Fed funds rate was essentially at a floor.



Balance Sheet Normalization 2017-2019

- Only occasional and minimal movements in the fed funds rate emerged.

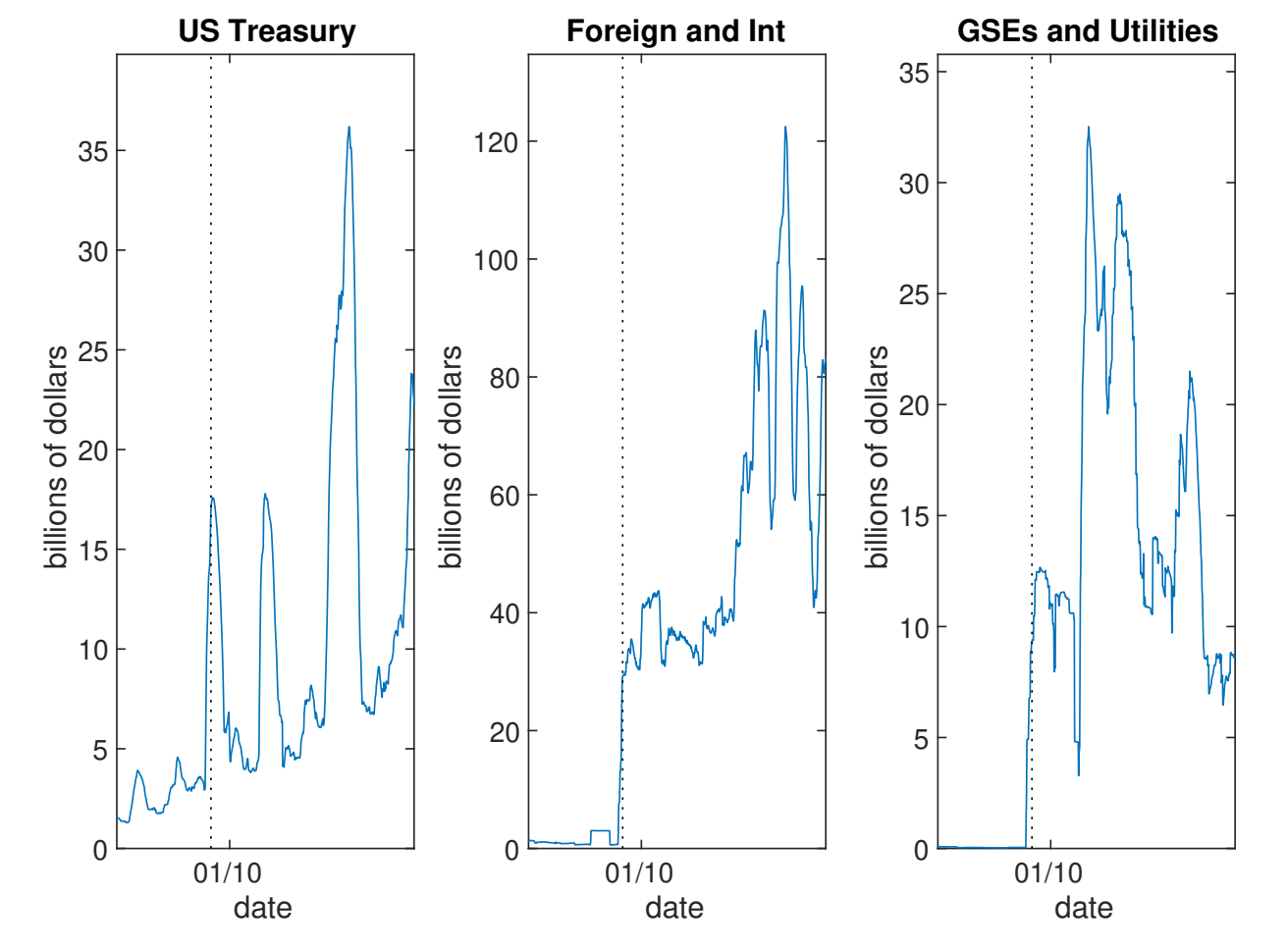


Determining a Policy Regime

- Federal Reserve stopped draining reserves in late 2019 and did not return to scarce reserve supply.
- What has changed from the past?
    - Reserve supply and demand have become more volatile and harder for CB to forecast.

Changes in Banking Environment: Reserve Supply

- With no CB action, Δ(reserve supply to banks) = -Δ(reserves held by non-bank entities).
- The right-hand side has become more volatile:



Changes in Banking Environment: Reserve Demand

- Banks are willing to hold a large amount of excess reserves to meet regulatory requirements.
  - And willing to pay substantially more than IOR (Senior Financial Officer Survey, for example).
- More complex regulations: CB might find it difficult to forecast reserve demand precisely.
  - Liquidity Coverage Ratio (LCR): Banks needs to hold enough high-quality liquid assets (HQLA).
  - Can choose between reserves, government securities, lower-quality assets.

Framework

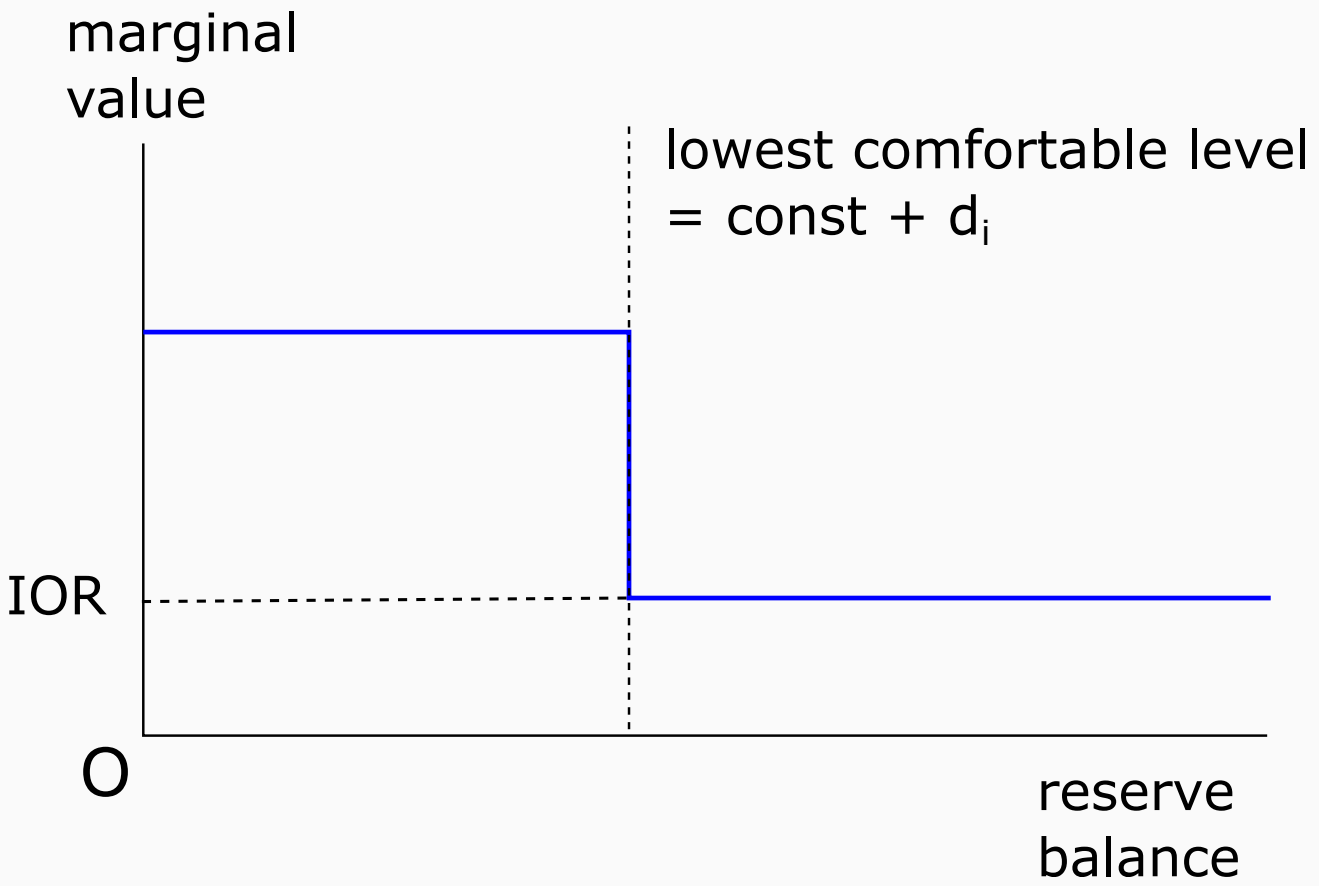
- A stylized model of MP implementation.
  - CB chooses the optimal level of reserve supply.
- Depending on model parameters, either scarce or ample supply is optimal.
  - Defines ample.
  - Illustrates how efficiency of implementation affects the optimal choice.

Model

- A six-period model describing events happening over a day.
  1. CB chooses the baseline supply of reserves R.
  2. Reserve supply shock s is revealed.
  3. CB adds x (drains $-x$) reserves.
  4. Demand shock d is revealed. $d = \sum d_i$, where d_i is bank i's demand shock.
  5. Fed funds market clears in a competitive market and the fed funds rate r is determined.
  6. Each bank i receives a further shock to reserves, u_i (Poole 1968).

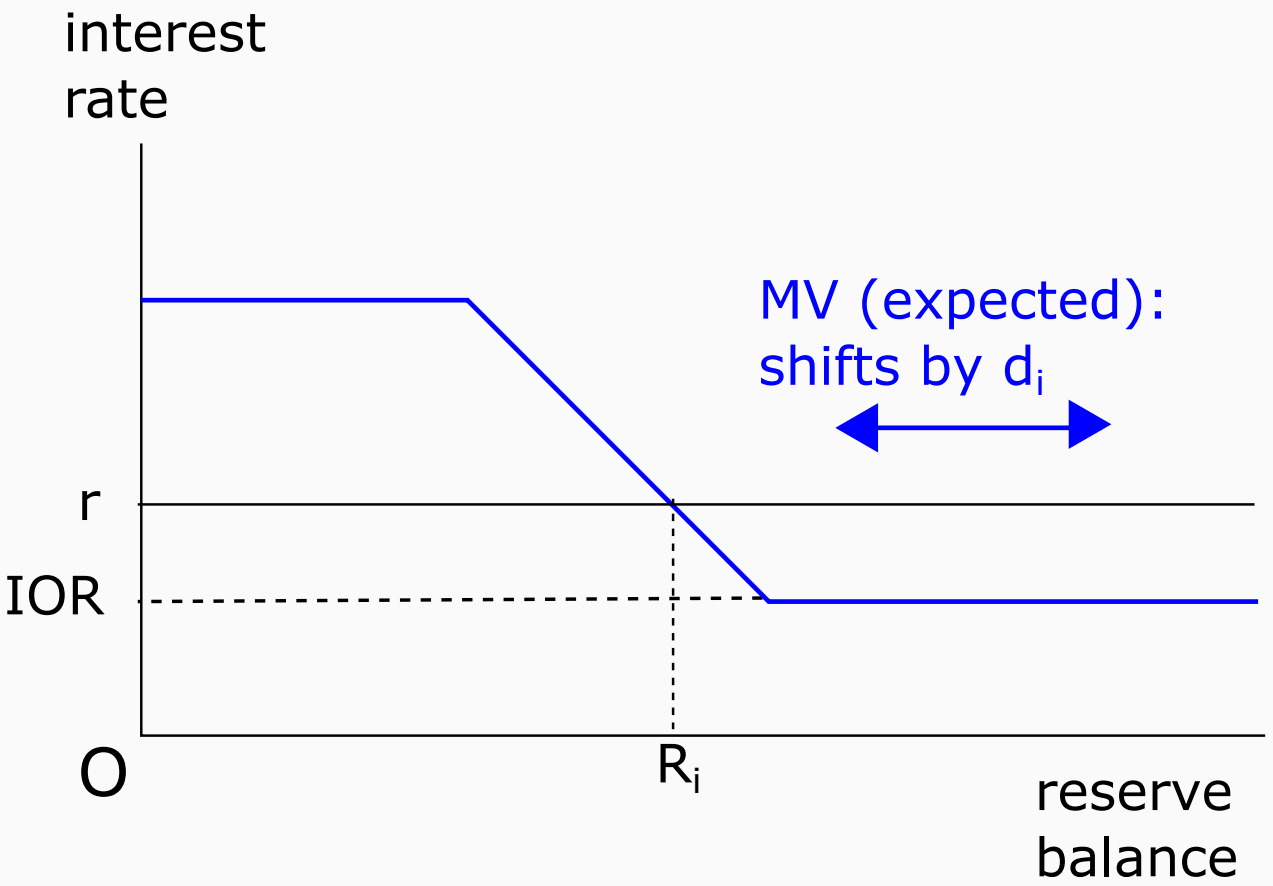
Banks' Reserve Valuation

- Date 6: Bank *i*'s MV for reserves is a step function.



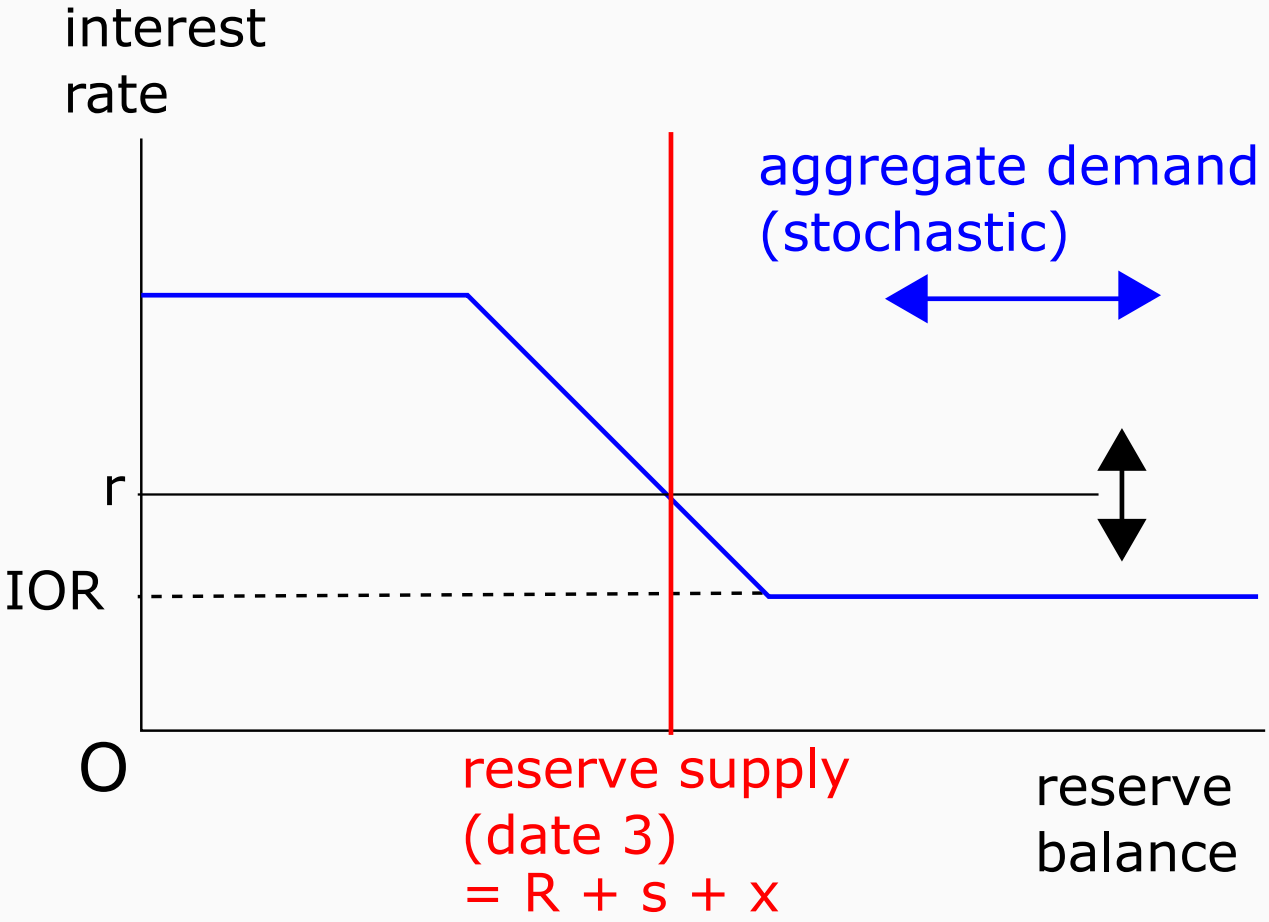
Federal Funds Market

- Date 5: bank *i* trades using its expected MV.



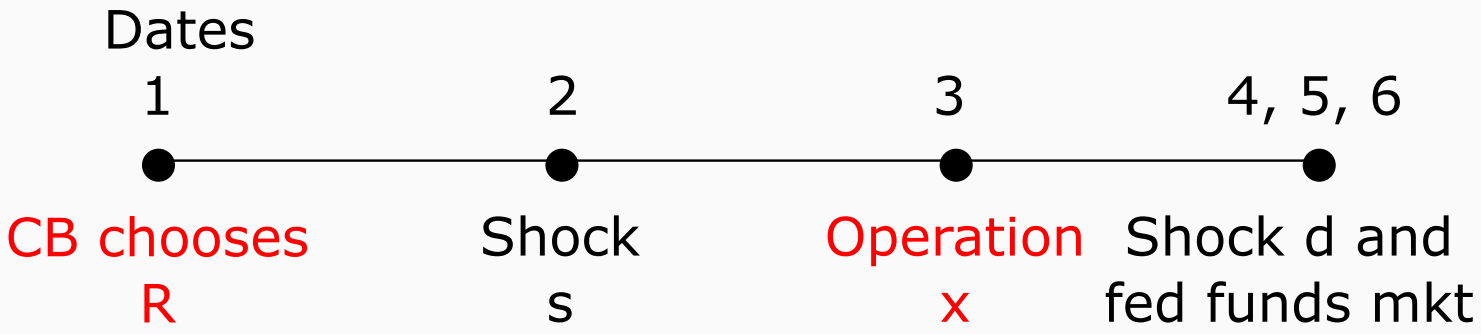
Aggregate Demand

- From CB's perspective (date 3): Aggregate demand factor $d = \sum d_i$ is a random variable.



CB Actions

- CB chooses the initial reserve supply R and conducts operations $x(R, s)$ conditional on realized supply shocks:



- CB chooses x to offset $s + d$.
- Initial choice R determines how large x needs to be.

CB Objective

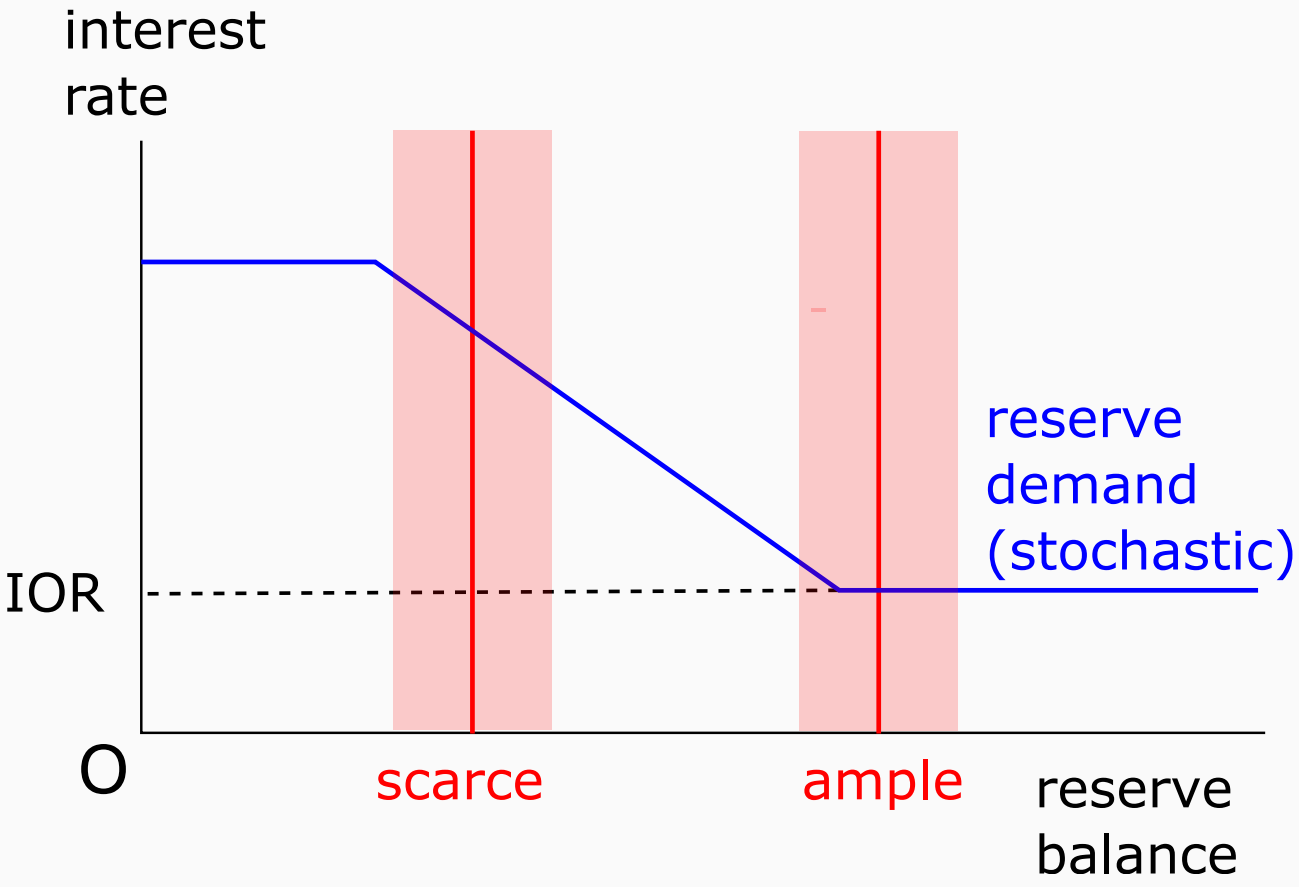
- CB wants to minimize:
  1. Interest rate uncertainty.
  2. Size of operations.
  3. Level of reserve supply (political cost).
- The objective function is a weighted average of these:

$$\min_{R \geq R_{LC}, x(R,s)} E[\alpha |r(R+s-d+x(R,s)) - r(R)| + \beta |x(R,s)| + R]. \tag{1}$$

  - $R \geq R_{LC}$: CB wants to supply at least some level of reserves for market functioning.

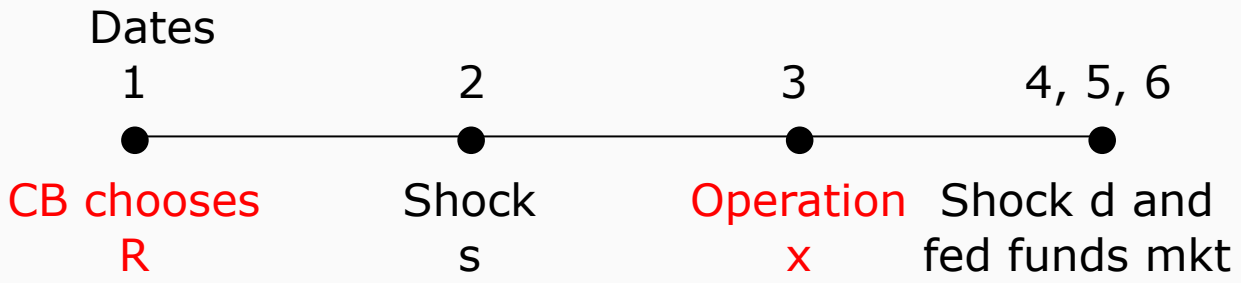
Ample Reserves

- Result 1: There are two local optima in choosing *R*: 'scarce' and 'ample'.



Environment: Shocks

- Choice between scarce and ample depends on the distribution of s and d:



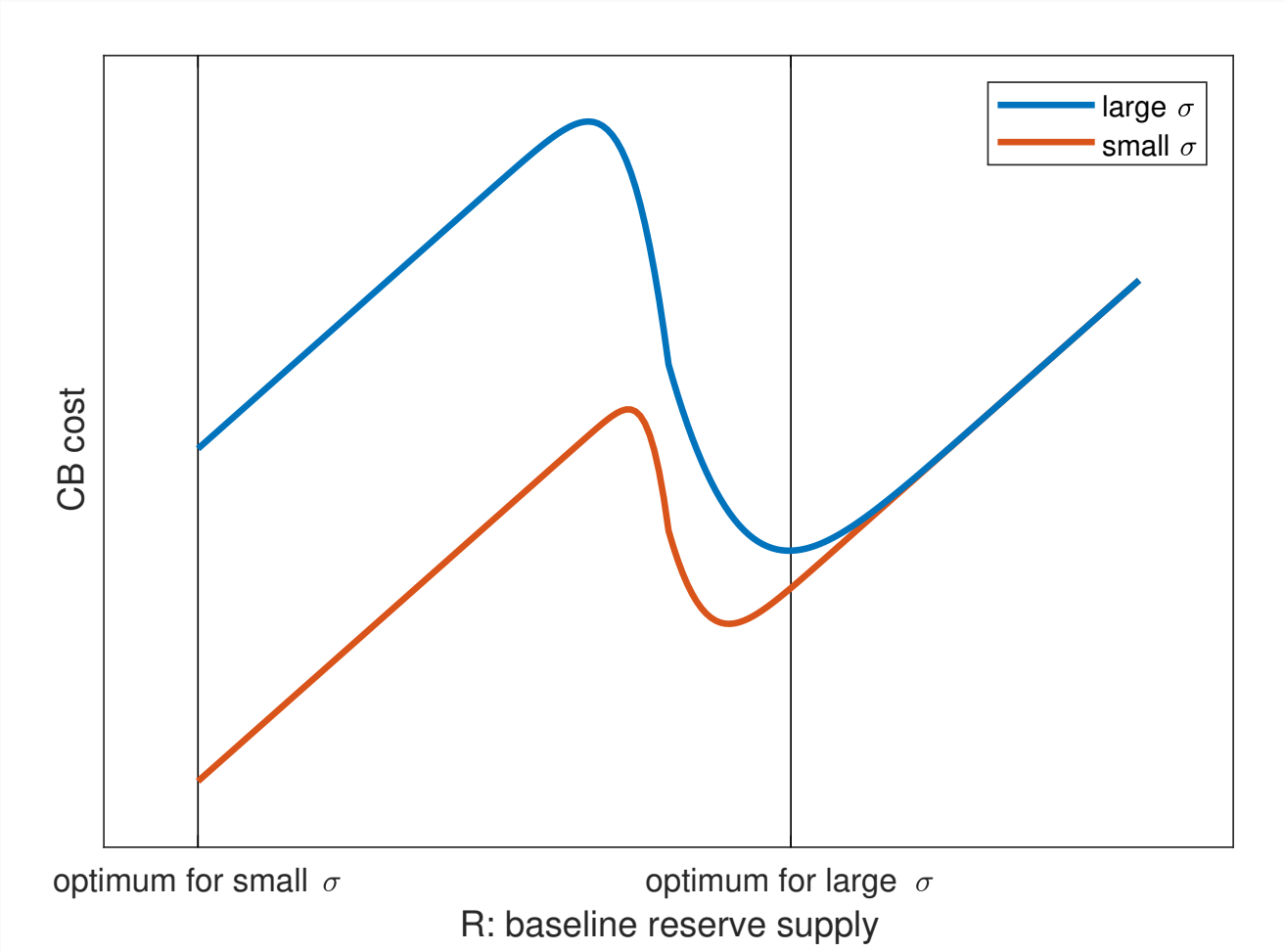
- Two shocks s (date 2) and d (date 4):

$$\begin{bmatrix} s \\ d \end{bmatrix} \sim \mathcal{N}\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \sigma^2 \begin{bmatrix} 1-\rho^2 & 0 \\ 0 & \rho^2 \end{bmatrix}\right). \tag{2}$$

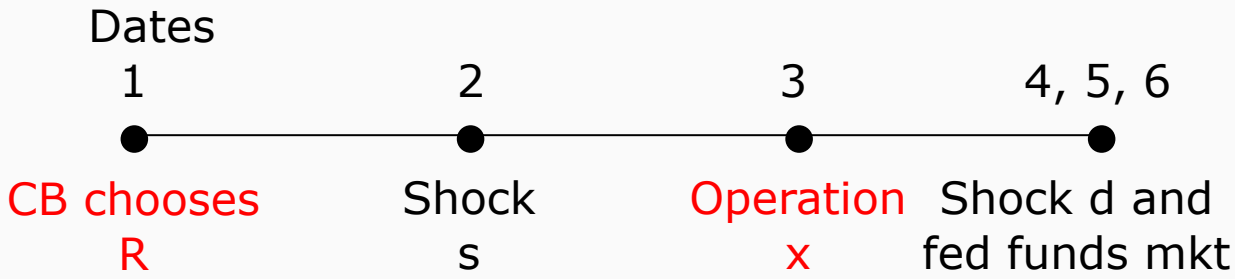
- σ: total magnitude of shocks.
- ρ: relative size of demand shocks.

Ample vs. Scarce for Larger Shocks

- Result 2: Ample reserves are relatively preferred for larger shocks (larger σ).



Supply vs. Demand Shocks: an Example



- Example: s and d can be $+1$ or -1 with equal prob. CB wants to offset $s + d$.
  - If $s = -1$, then $s + d$ can be either -2 or 0.
  - No operation.
  - Interest rate uncertainty.
- If instead s and d were both known, CB would totally offset interest rate movement.

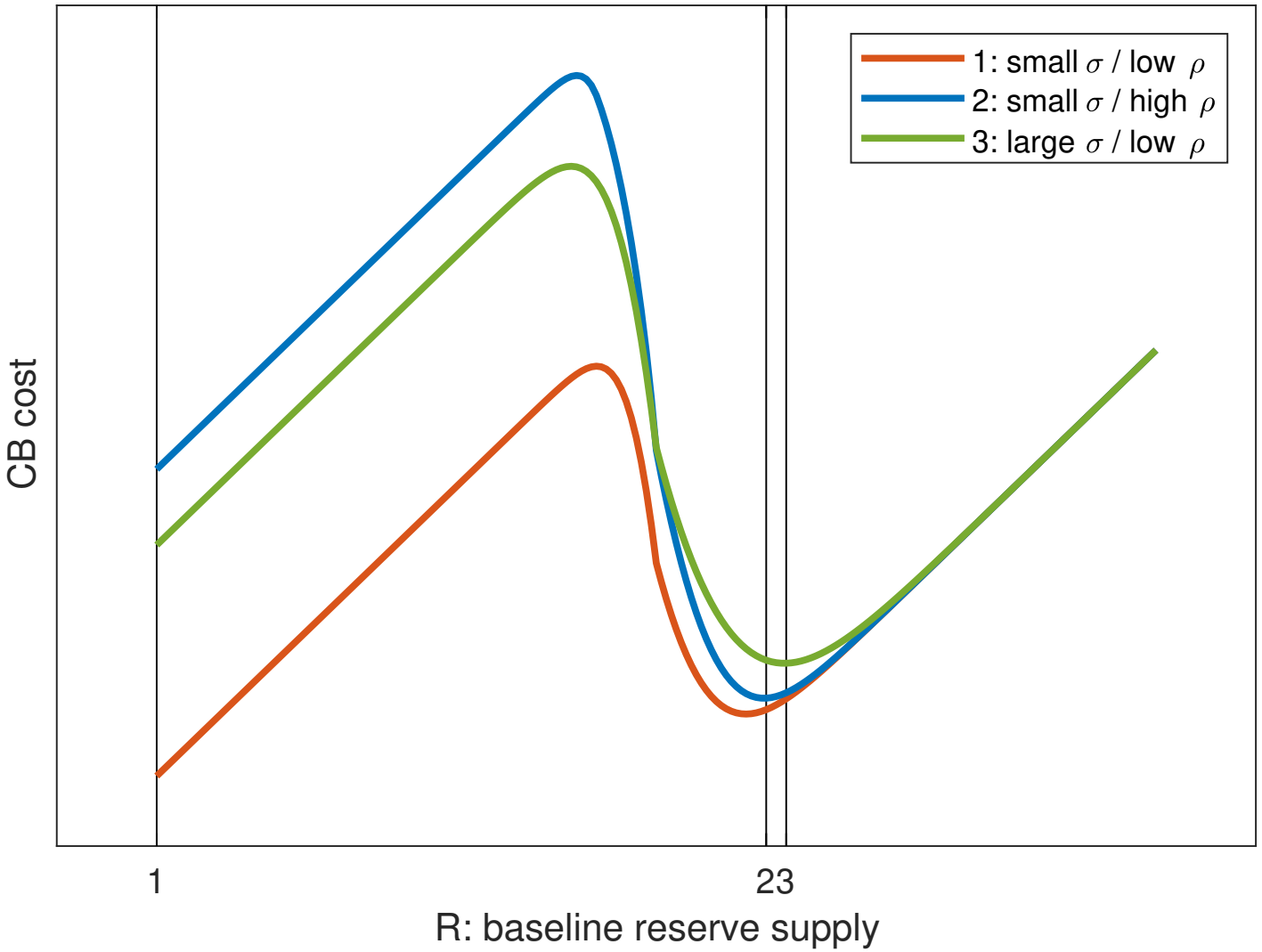
Ample vs. Scarce for Different Shock Composition

- Recall

$$\begin{bmatrix} s \\ d \end{bmatrix} \sim \mathcal{N}\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \sigma^2 \begin{bmatrix} 1-\rho^2 & 0 \\ 0 & \rho^2 \end{bmatrix}\right). \tag{3}$$

- Result 3: More uncertain (higher ρ) shocks increase the relative cost of the scarce-reserve regime.
  - Remaining uncertainty at the time of operations (d, variance $\rho^2\sigma^2$) makes open market operations less effective.

Cross-Model Comparison



Results Summary

- Recall: s on date 2 and d on date 4.

$$\begin{bmatrix} s \\ d \end{bmatrix} \sim \mathcal{N}\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \sigma^2 \begin{bmatrix} 1-\rho^2 & 0 \\ 0 & \rho^2 \end{bmatrix} \right). \tag{4}$$

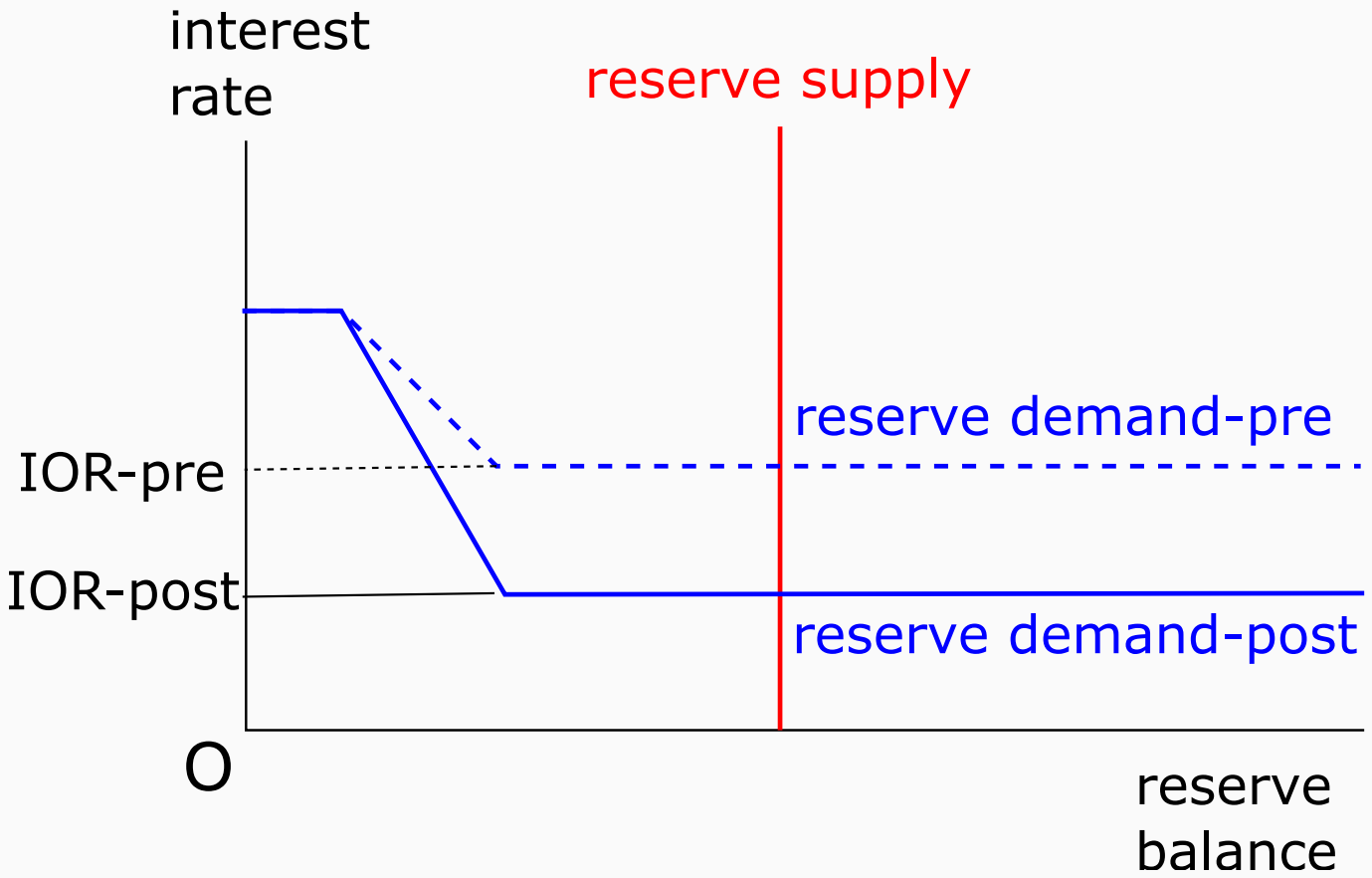
- Larger σ: CB wants to avoid costs associated with reserve supply and demand shocks by supplying ample reserves.
  - Increases in the volatility of reserve supply and the complexity in regulations.
- Larger ρ: open market operations are less effective and thus ample reserves are preferred.
  - Emphasize the role of regulatory complexity.

Other Practical Concerns

- The stylized model emphasizes efficiency of implementation and operational cost.
- There are other potential considerations:
  - Robustness of transmission to money market rates.
  - CB liquidity interventions.

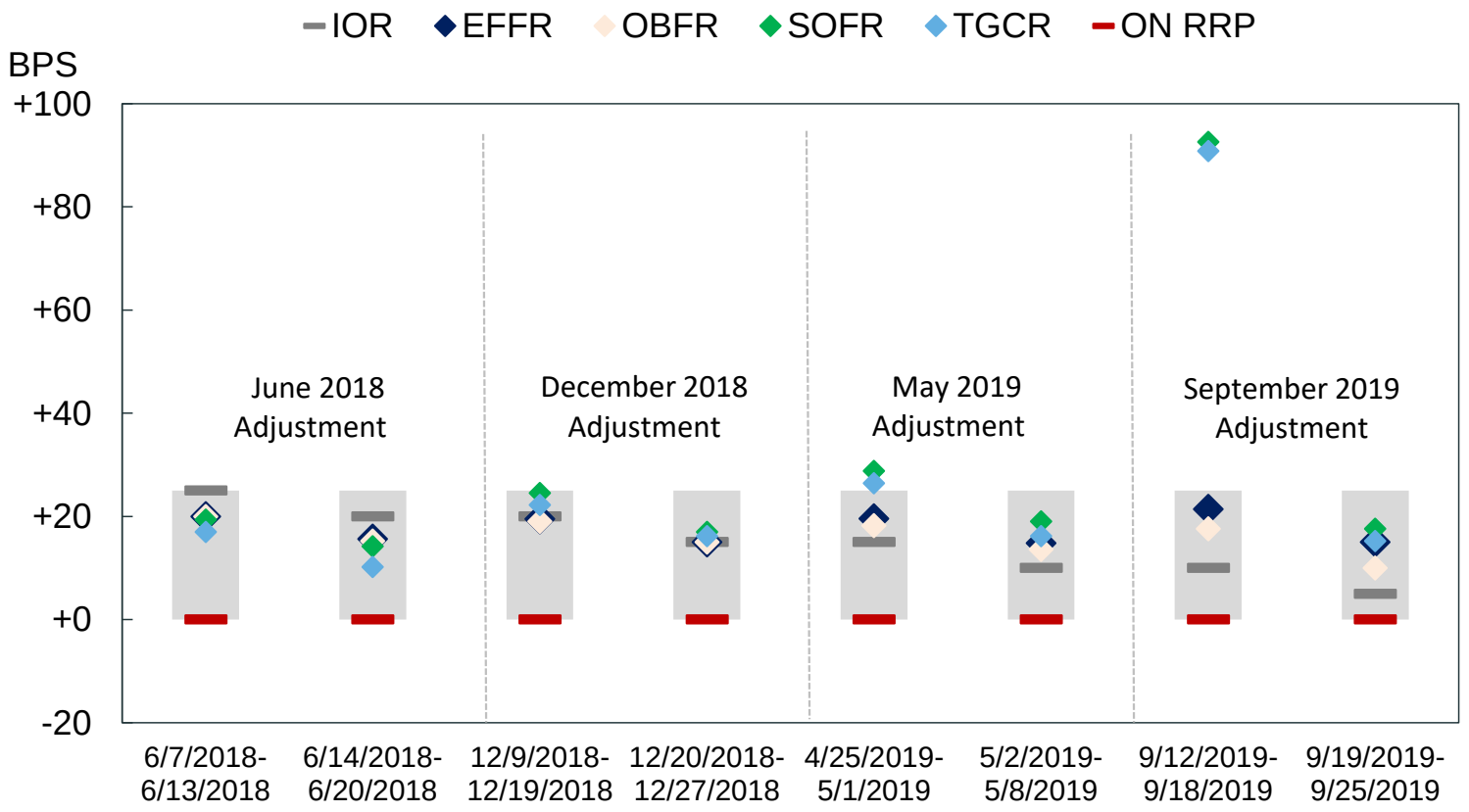
Transmission to Money Market Rates

- Theory predicts near one-to-one transmission from IOR to money market rates with ample or abundant reserves.



Transmission: Empirical Observations

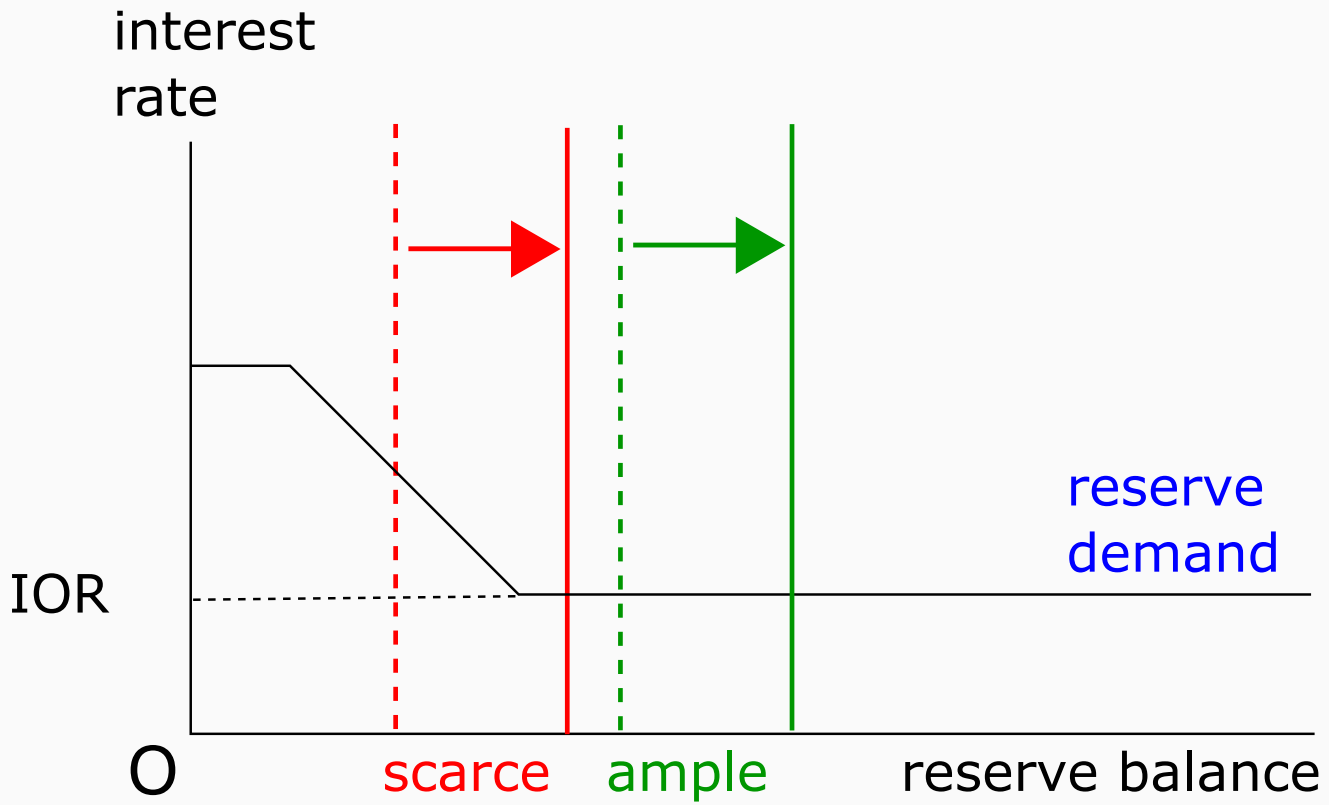
Changes in Interest on Reserves Pass Through to Other Overnight Rates



Source: Federal Reserve Bank of New York, Board of Governors

Liquidity Injections

- With ample reserves, large-scale liquidity injections has little impact on money market rates.
  - With scarce reserves, need to switch interest rate control regime.



Liquidity Injection Examples

- In 2007-2008, Federal Reserve had to ‘sterilize’ its own lending programs.
- Standing repo facility and FIMA repo facility: little concern about sterilization.

Conclusion

- Conceptual framework to understand the change in monetary policy implementation regime.
  - Stylized model captures changes in the banking environment post-2008.
  - Concept of ample reserves naturally emerges.
- Discussion of ample reserves may re-emerge if Federal Reserve ends ongoing asset purchases.