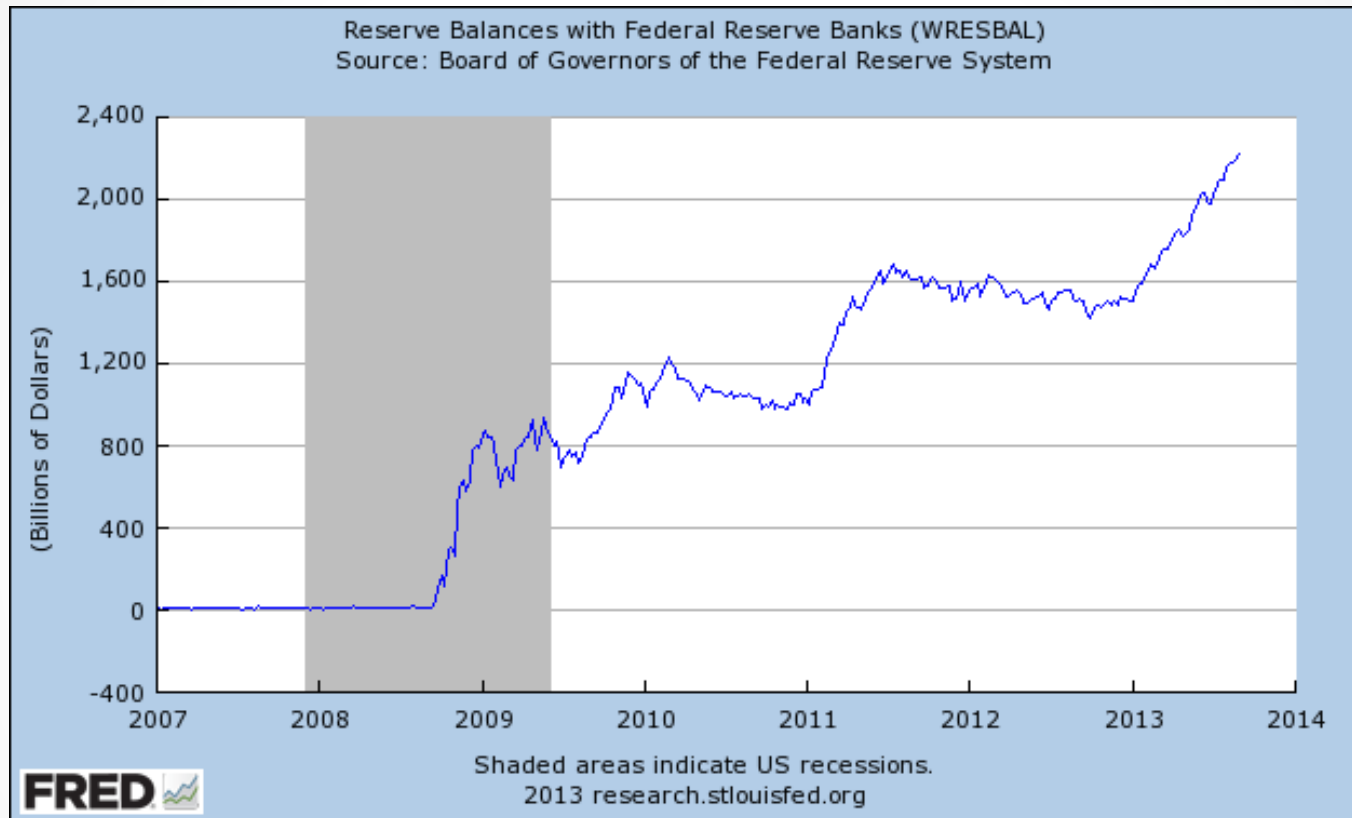# Federal Reserve Tools for Managing Rates and Reserves

David Skeie*
Federal Reserve Bank of New York

(with Antoine Martin, James McAndrews and Ali Palida)

Frankfurt School of Finance and Management
October 2, 2013

# Large Quantity of Reserves



Reserve Balances with Federal Reserve Banks (WRESBAL)
Source: Board of Governors of the Federal Reserve System

Shaded areas indicate US recessions.
2013 research.stlouisfed.org

- Reserves are assets, issued by the Fed and held by banks

- Large level of reserves is by-product of Fed's LSAPs (QE)

# Rates are below IOER and are negatively correlated with reserves
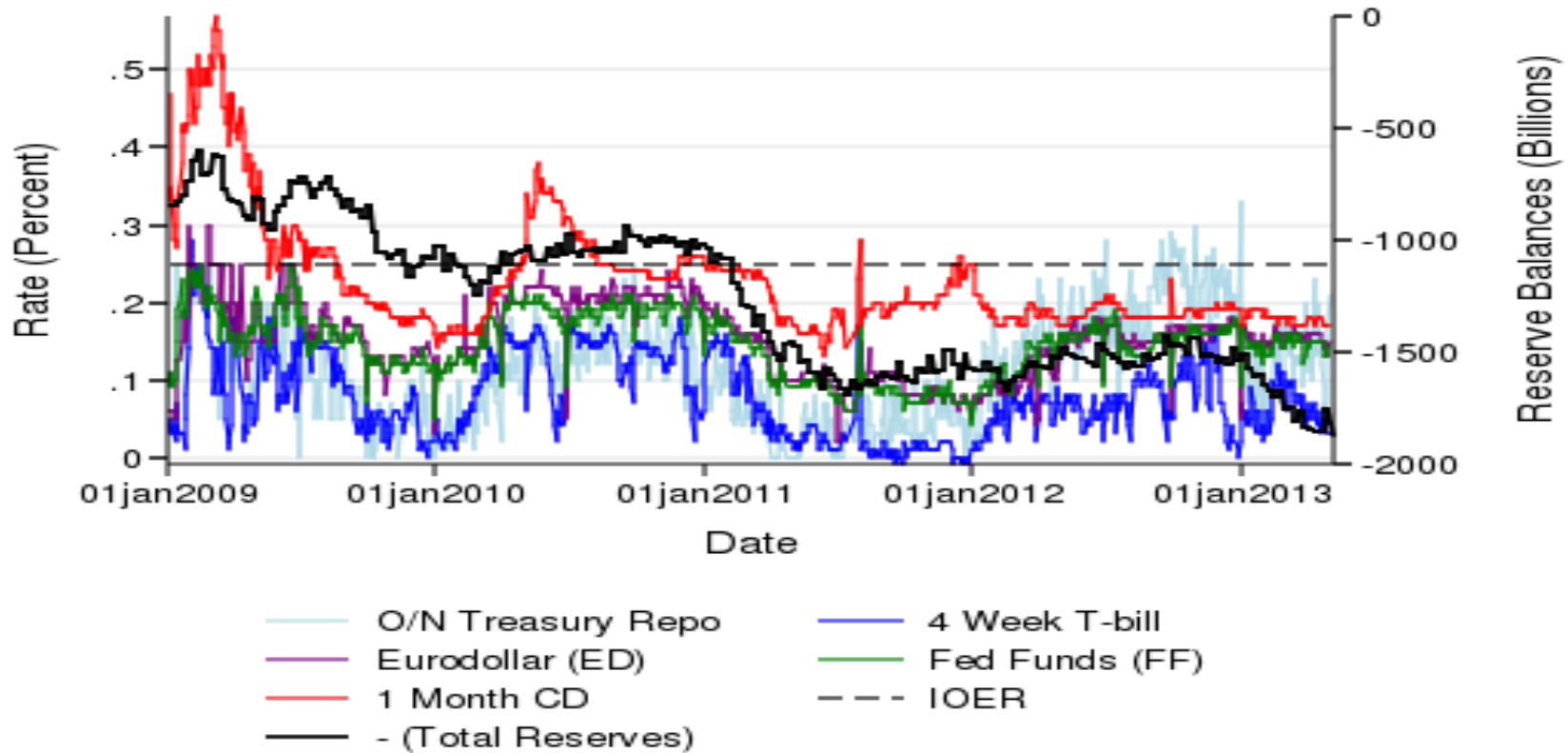


- Reserves receive interest on excess reserves (IOER ) rate

- IOER rate = 25 bps has not acted as a floor for short term rates

- How does the Fed control rates when IOER is raised to 100 bps? 500 bps?

# New Federal Reserve Tools

- TDF
  - Term Deposit Facility
  - Banks can deposit reserves with the Fed for a term maturity

- RRP
  - Reverse Repo
  - Non-banks such as money market mutual funds can do collateralized repo lending to the Fed

- FRFA ON RRP
  - Fixed-rate, full-allocation overnight RRP

# Research Questions

- Theory question
  - How are interest rates determined?

- Policy question
  - What is the effect of these tools?
  - Which are most effective at managing rates?
  - How should these tools be used?

# Research Approach

- Theory
    - General equilibrium model of banking and monetary policy implementation

    - Key drivers in the model:
        - Bank balance sheet costs
        - Bank liquidity shocks
        - Interbank lending costs

- Policy
    - For a given IOER rate, we contrast:
        - Fixed-rate vs. fixed-quantities RRPs
        - Term vs. overnight RRPs
        - RRPs vs. TDF

# Outline

1. Model

2. Benchmark equilibrium with balance sheet costs

3. Equilibrium results with liquidity shocks

4. Comparison of tools and results with interbank lending

5. Conclusion

# Participants in the Economy

- Banks (*B*)

- Firms (*F*)

- Money Market Funds (*MMF*)

- Households (*H*)
  - The rest of the economy

- Central Bank (*CB*)

- Government (*G*)

# Assets

- Three periods: dates $t$=0,1,2

- Bank deposits
  - Term deposits at date 0 ($D^0$) and overnight deposits at date 1 ($D^1$)
  - Held by households

- Loans ($L$)
  - From banks to firms

- Government bonds ($B$)
  - T-bills
  - Held by the central bank ($B^{CB}$)
  - Held through shares in MMFs by households ($B^H$)

- Money ($M$)
  - Reserves

- Market returns on assets:  $R^{D0}$, $R^{D1}$, $R^L$, $R^B$
  - $R^M \equiv$ IOER

# Sectors and Competition

- Two "sectors" of the economy

  - Each has a representative household, bank, and firm that transact with each other

  - Banks behaves competitively within sectors, but face limited competition across sectors

  - Simplify: no credit risk

- Bonds can be held across both sectors

# Timeline

Date *t*=0:  Initial bonds, deposits, and loans
- o  Bonds, deposits and loans have term (two-period) maturities

Date *t*=1:  One sector has a liquidity shock
- o  Probability of shock is one-half for each sector
- o  Fraction ($\lambda$) of depositors from liquidity-shocked sector must relocate to the other sector
  - •  Return of one on early withdrawal of term deposits
- o  Depositors can make new (one-period) overnight deposits at the bank in the other sector
  - •  Otherwise invest in MMF shares when available
- o  Banks can engage in interbank trading to fund withdrawals
- o  In the benchmark case, $\lambda = 0$ (there is no shock)
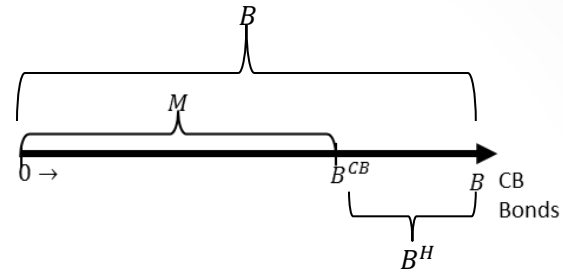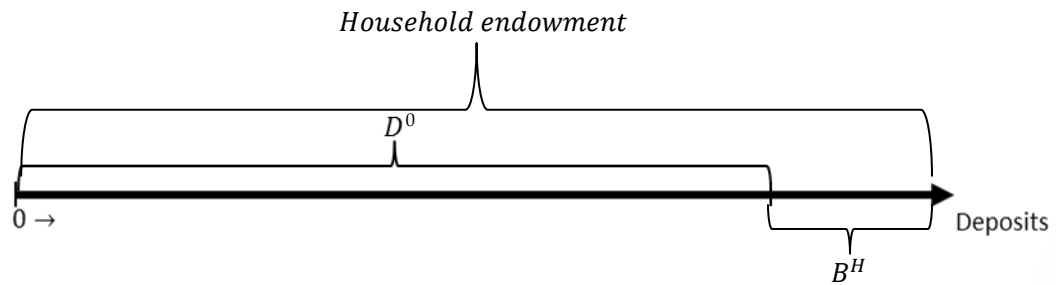
Date *t*=2:  Assets mature and consumption occurs

# Outline

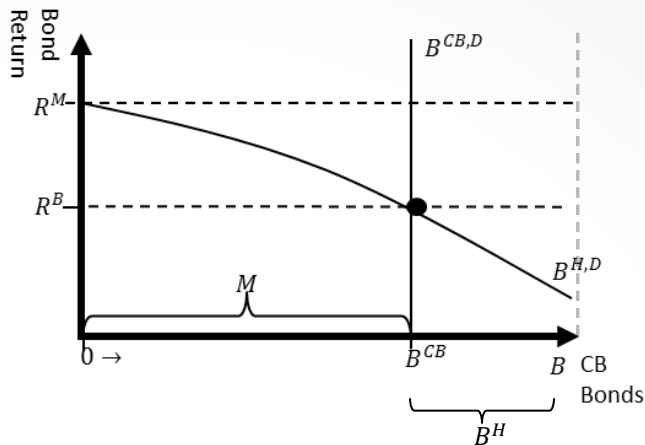# Benchmark Equilibrium
## Quantities

**Bonds**
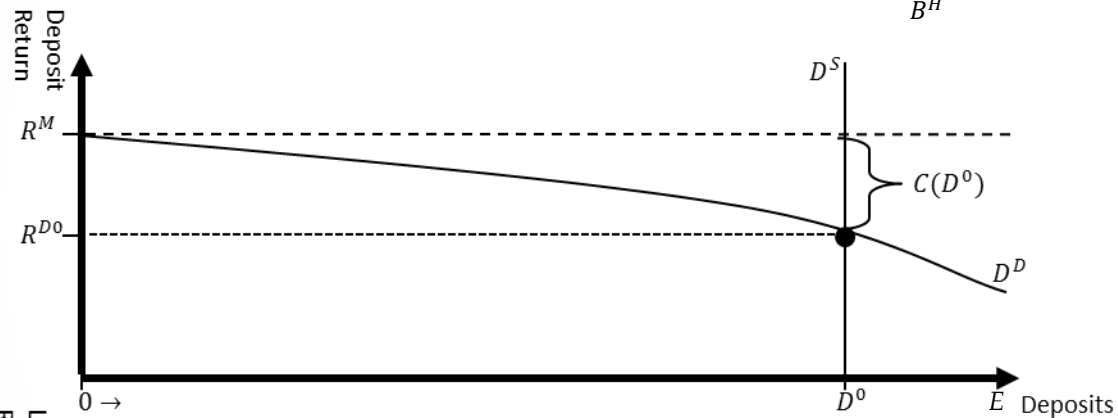


**Term Deposits**



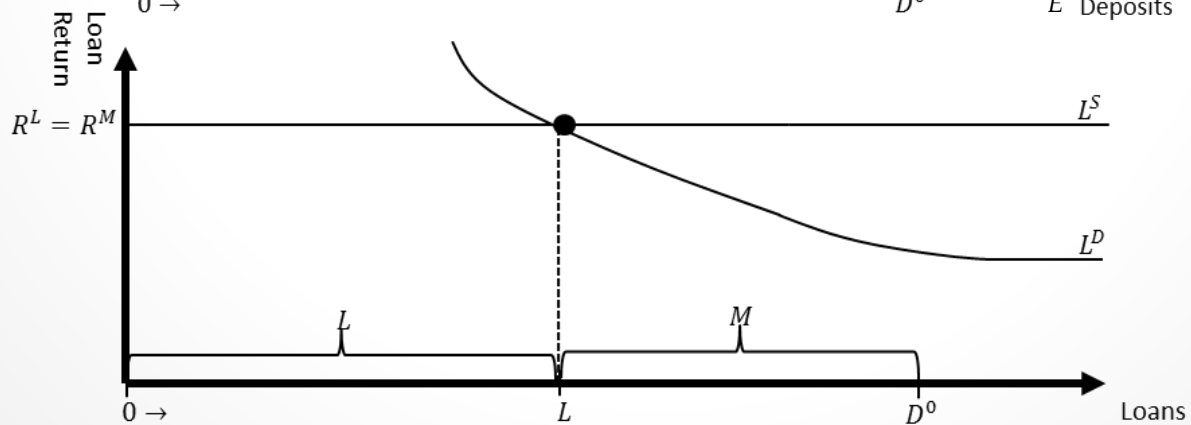**Loans**
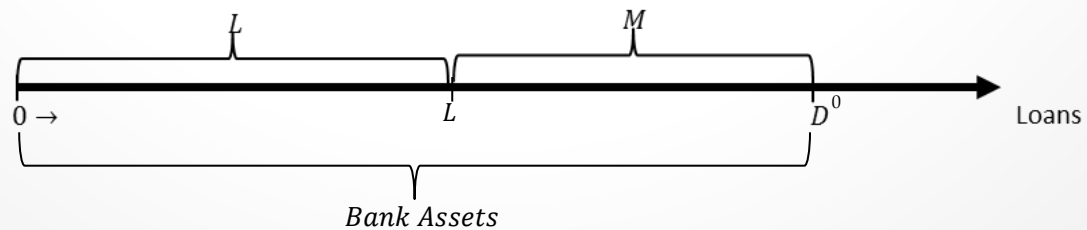
# Benchmark Equilibrium
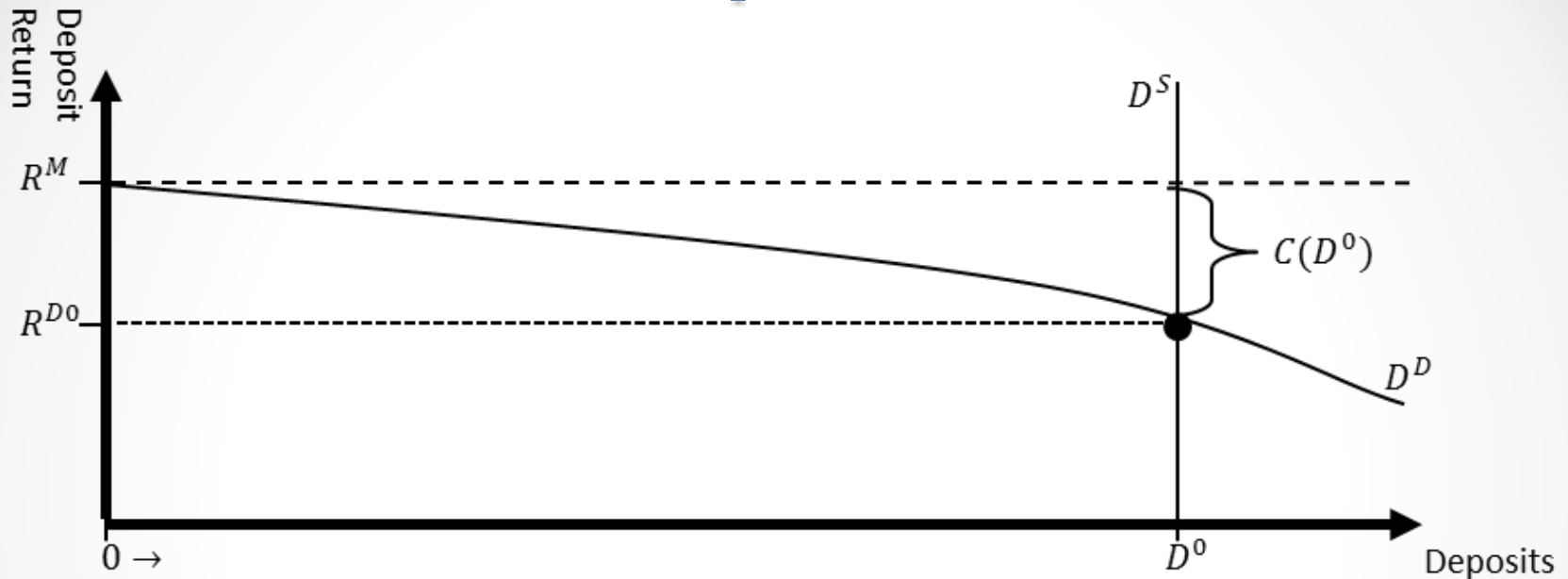## Rates

Bond
Market

Term
Deposit
Market

Loan
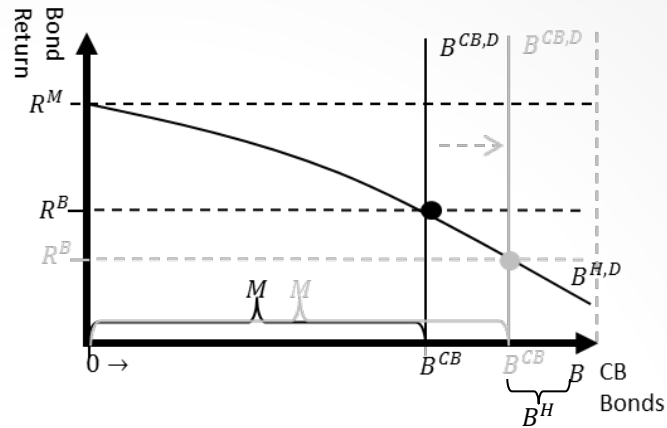Market

# Term Deposit Market



- $C(D^0)$ is a bank's marginal balance sheet cost
  - $C(D^0)$ increases with the size $D^0$ of a bank's balance sheet

- Balance sheet cost includes:
  - shadow price of leverage requirements
  - deposit insurance

- $C(D^0)$ pushes banks' demand curve for deposits $D^D$ below $R^M$
  - The balance sheet cost is pushed onto depositors

# Benchmark Equilibrium
### Example: Increase in Reserves
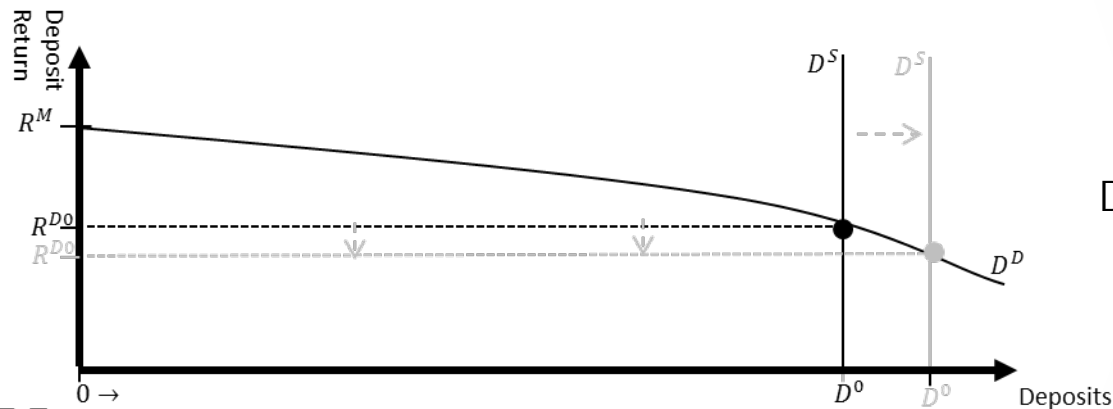


Bond Market

Term Deposit Market

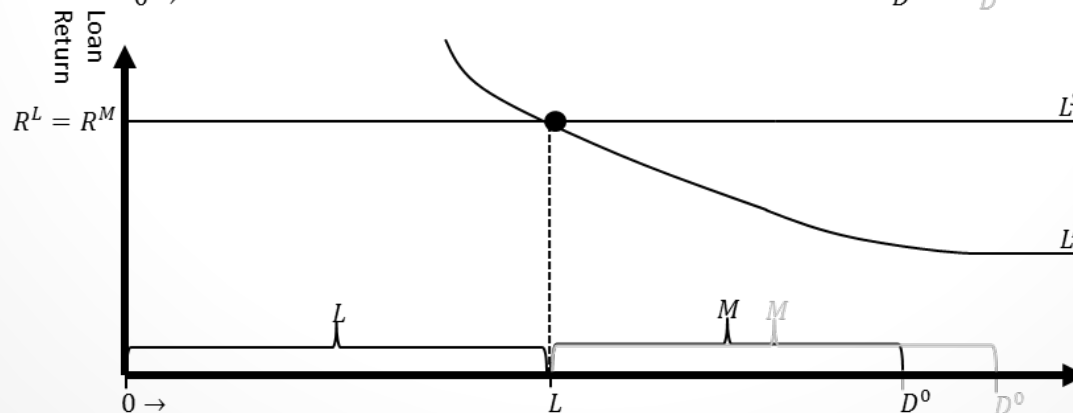Loan Market

An increase in $M$:
  Increases $B^{CB}$
  Decreases $B^H$

Increases:
  Term deposits
  and balance
  sheet size
  and costs $C(D^0)$

Decreases:
  Bond rate $R^B$
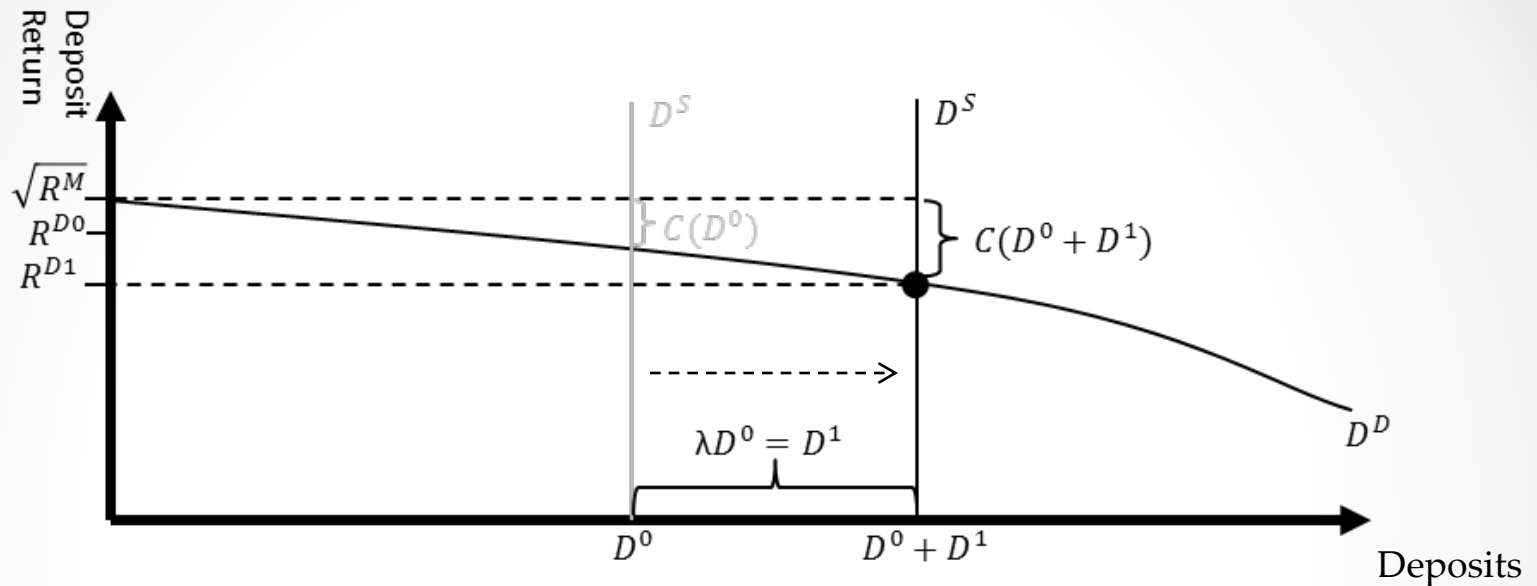  Term deposit
  rate $R^{D0}$

# Outline

1. Model

2. Benchmark results with balance sheet costs

3. **Results with liquidity shocks**

4. Comparison of the tools

5. Conclusion

# Overnight Deposit Market (t=1)
## Liquidity shock



Liquidity shock creates a need for new overnight deposits

- $D^1$ are new overnight deposits at *t*=1 for the bank with a liquidity shock inflow
  - $R^{D1}$ is the rate on new overnight deposits (one-period, t=1 to t=2)
  - $R^{D1} < R^{D0}$ because accumulative balance sheet costs $C(D^0 + D^1) > C(D^0)$

- $R^B < R^{D0}$ because bonds can be held across sectors
  - Bonds have a liquidity premium (rate discount)

- Note: $\sqrt{R^M}$ is 1-period IOER; $R^M$ is cumulative 2-period IOER

# Outline

1. Model

2. Benchmark results with balance sheet costs
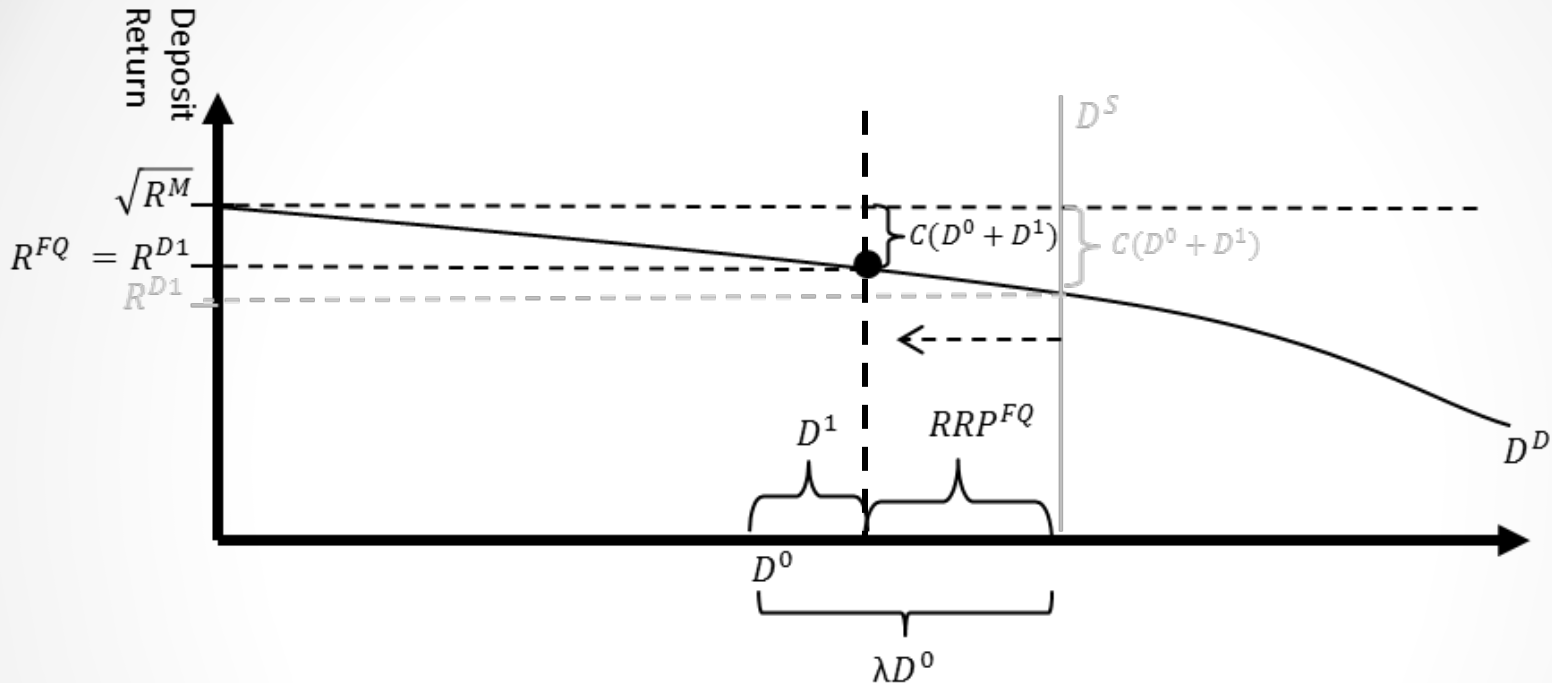
3. Results with liquidity shocks

4. Comparison of tools

5. Conclusion

# Fixed-rate vs. fixed quantity RRPs

- Overnight (one-period) RRP
  - Offered by the central bank at $t$=1

- Fixed-quantity RRP
  - Auctions the quantity $RRP^{FQ}$
  - Equilibrium stop-out rate is $R^{FQ}$

- Fixed-rate, full-allotment RRP
  - Sets rate $R^{FR}$
  - Equilibrium quantity is $RRP^{FR}$
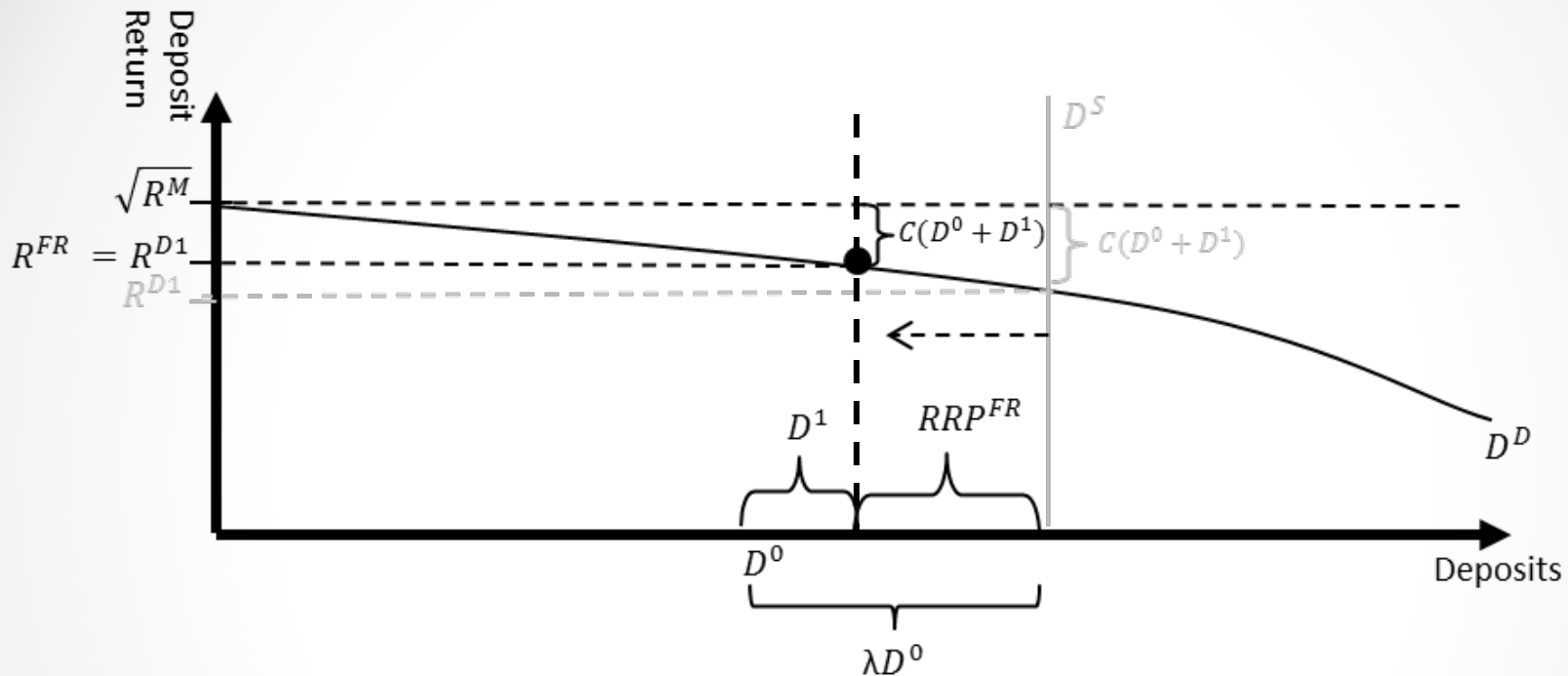
- Smaller overnight deposits $D_1$ reduce $C(D_0 + D_1)$, raising $R^{D1}$
  - The RRP stop-out rate $R^{FQ}$ equals the overnight deposit rate $R^{D1}$ in equilibrium
  - The $t=0$ bond rate $R^B$ in equilibrium increases with $R^{D1}$
- Fixed-quantity o/n RRP can set a floor on rates
- But if $\lambda$ is uncertain
  - Then upwards volatility of rates

# Overnight Deposit Market (t=1)
## Overnight RRP (fixed-rate)



- Fixed-rate $R^{FR}$ set at the equilibrium rate $R^{FQ}$ for the fixed-quantity RRP
  - Provides an equivalent floor on rates, and can raise rates
- With uncertain $\lambda$
  - Fixed-rate RRP dampens volatility of rates

# Term RRP

- Term (two-period) RRP offered by the central bank at $t=0$

  o Either fixed-quantity RRP or fixed-rate RRP

  o The equilibrium quantity is $RRP^{TM}$ and the rate is $R^{TM}$

# Term Deposit Market (t=0)
## Term RRPs
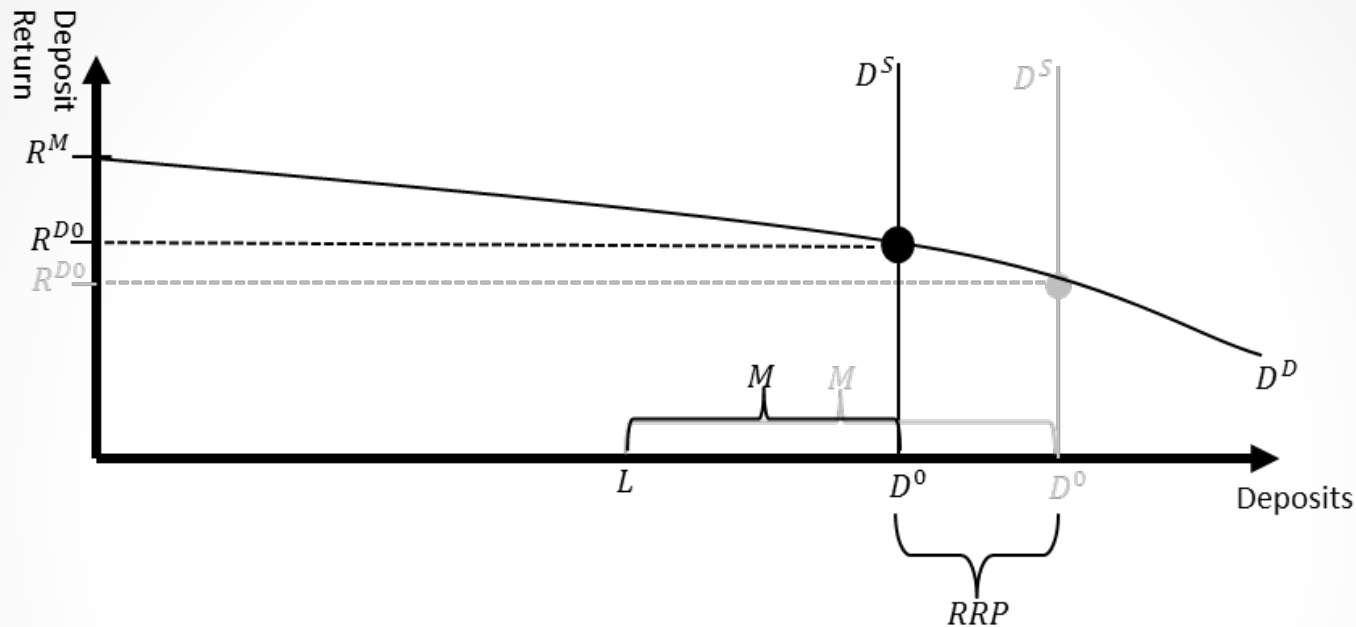


Term RRP:
- Reduces the size of the bank's balance sheet at date and thus reduces balance sheet costs
  - Provides a floor on the date-0 term deposit rate: $R^{D0} = R^{TM}$
  - Can raise term and overnight deposit rates
- But does not provide a floor on date-1 overnight rates $R^{D1}$
  - Term RRP not available for date-1 liquidity-shock needs
  - Overnight RRPs provide a stronger floor for overnight rates

# RRPs vs. TDF

Term (two-period) RRP and/or TDF offered to banks by the central bank at $t=0$

- Either fixed-quantity RRP/TDF or fixed-rate RRP/TDF
- The equilibrium quantity is $RRP^{TM}$/$TDF$ and the rate is $R^{TM}$/$R^{TDF}$
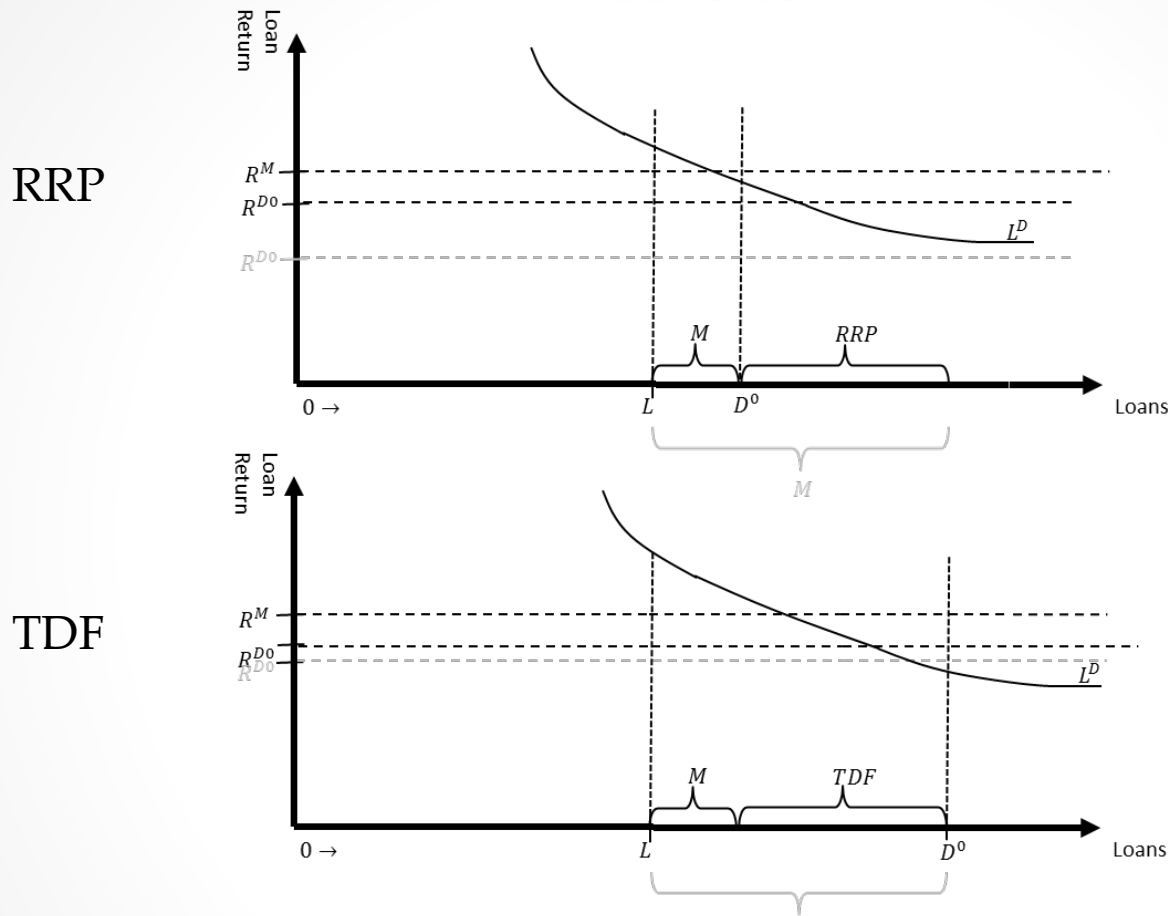
Two channels to increase deposit rates:

- Balance sheet cost channel
- Interbank market channel

Which channel is stronger?
- Are RRPs or TDF most effective at raising rates?

# Balance Sheet Costs Impact on Deposit Rates (t=0)
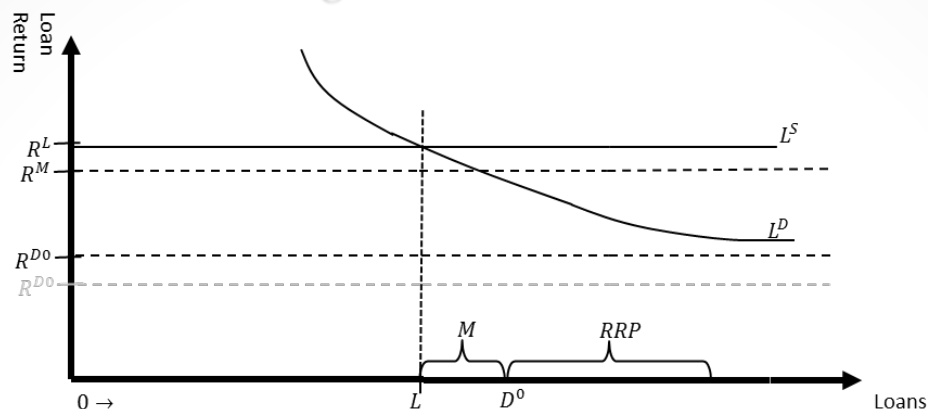## RRP vs. TDF



- RRPs decrease reserves by the same amount as equal-sized *TDF*
- RRPs (with non-bank counterparties, e.g. MMFs):
  - Draw bank term deposits into MMFs
  - Reduce banks' balance sheet size
    - *TDF* replaces reserves and balance sheet size is unchanged
  - Raises overnight & term deposit rates through lower balance sheet costs
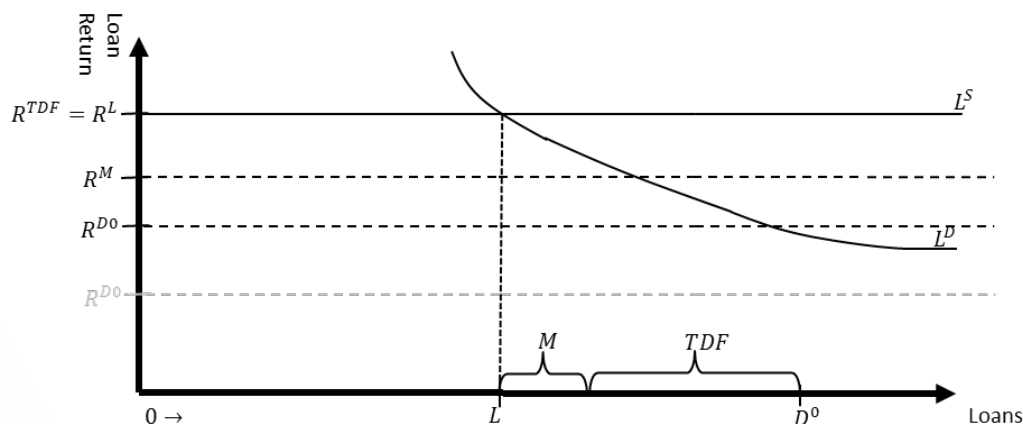    - The TDF does not

RRP



TDF



- RRP and TDF reduce reserves that could be used by banks for liquidity shocks
  - Large-enough size RRP/TDF creates an active interbank market
  - Interbank monitoring costs raise banks' asset rates, pulling up deposit rates
- RRPs reduce banks' balance sheet size; TDF does not
  - Smaller bank deposits reduce the size of potential liquidity shocks
  - Less effect on increasing illiquid loan rates above IOER than TDF…
    - …or on increasing deposit rates through interbank channel than TDF

27

# RRPs vs. TDF

- The tool which raises bank term deposit rates $R^{D0}$ the most
  - depends on which marginal cost is increasing faster:
    - balance sheet costs or interbank monitoring costs

  - Balance sheet costs increasing faster: RRP increases $R^{D0}$ more
    - Will occur when term deposits are large relative to interbank loans

  - Monitoring cost increasing faster: TDF increases $R^{D0}$ more
    - Will occur when interbank loans are large relative to term deposits

- Result: Maximizing $R^{D0}$ (and consequently other rates e.g. $R^B$)
  - may require usage of both tools concurrently

# Outline

1. Model

2. Benchmark results with balance sheet costs

3. Results with liquidity shocks

4. Comparison of the tools

5. Conclusion

# Conclusion

- Model of banking and monetary policy to determine short term interest rates
  - Bank balance sheet costs
  - Liquidity shocks
  - Interbank lending costs

- Analytical framework to analyze the Fed's monetary policy tools
  - Fixed-rate RRPs provide better floor on rates with less volatility than fixed-quantity RRPs
  - Overnight RRPs absorb liquidity shocks, provide rate floor, and reduce rate volatility better than term RRPs
  - RRPs increase deposit rates by decreasing balance sheet costs
    - TDF pulls up deposit rates by raising interbank lending rates and loan rates above IOER more than RRPs do
    - Using RRPs and TDF concurrently may best increase rates

# Future Research

## Extensions of the model

- Optimal contracting over a richer set of deposit and bond contracts
- Aggregate liquidity shocks; financial stability shocks
- Greater role for price determination with fiscal dominance
- Central bank objective function and welfare analysis
- Effects of tools on real economy: bank lending, output and inflation

## Expansions of policy analysis

- Consider other combinations of tools
- Consider other frictions, economic agents, and broader policy tools
  - Securities dealers, repo market, bond collateral, and RRP collateral
  - RRP floor without take-up
  - GSEs and fed funds market
  - Tapering, forward guidance, raising IOER, and asset sales
- Diagnostic tool to interpret market rates and flows during the unwind