Money Supply Process

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Spring 2019

Meaning of Money

- **Money or Money supply:** anything that is generally accepted in payment for goods or services or in the repayment of debts.
- **Money is a stock concept and different from:**
  - **wealth:** the total collection of pieces of property that serve to store value
  - **income:** flow of earnings per unit of time (a flow concept)

Functions of Money

Medium of Exchange

- **Double coincidence of demand:**
  - **barter economy:** being a lecturer of economics I need to find a person who can give me paddy in exchange of learning economics.
  - very difficult to find such a person (very high degree of transaction cost involved) in barter economy.
  - **economy with money:** reduces transaction costs and promotes specialization by allowing me to specialize in economics and others in job where they have their talent and interest.

Functions of Money

Unit of Account

- **Used to measure value in the economy and reduces transaction costs:** Suppose we have n goods
  - **barter economy:** $\binom{n}{2}$ prices to be quoted
  - **economy with money:** only n prices

Functions of Money

Store of Value

- **Used to save purchasing power over time**
  - money is the most liquid of all assets but loses value during inflation
  - other assets serves this function better: bond, stock, equity, etc.

Evolution of the Payments System

- **Commodity Money:** Commodity with intrinsic value used as money
  - cigarettes in Prisoners of War (P.O.W.) camp (Radford, 1945)
  - stone in Pacific Island (Mankiw, 2012)
  - Gold (Acharyya, 2013)
- **Deflation:** when the commodity used for other purpose and reduce its supply as money

- **A medium of exchange should be:**
  - be easily standardized and widely accepted
  - be divisible and easy to carry
  - not deteriorate quickly

Evolution of the Payments System

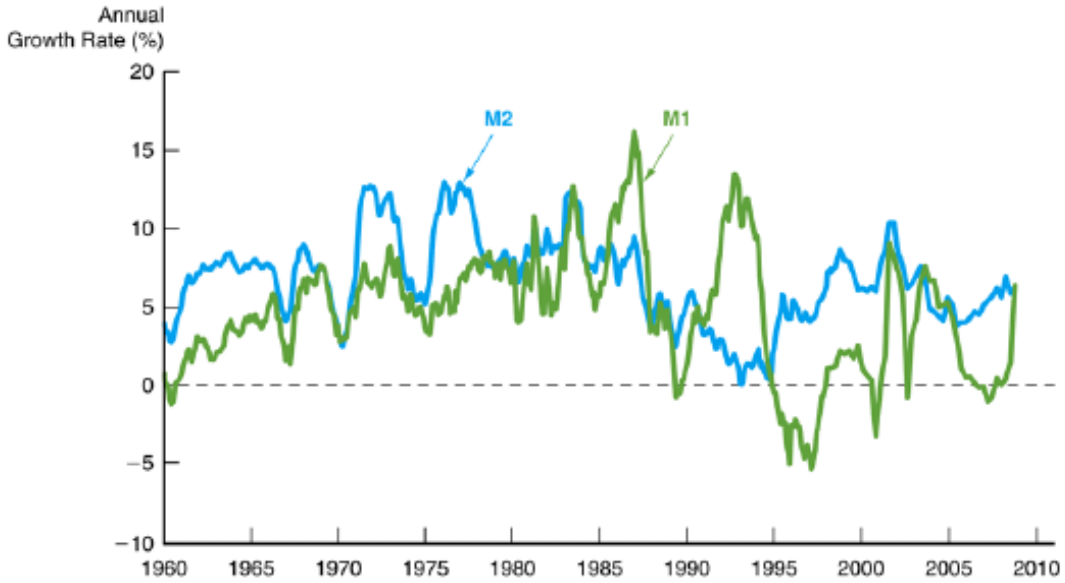
- **Fiat Money:** paper currency or coin decreed by governments as legal tender
- **Checks:** an instruction to your bank to transfer money from your account
- **Electronic Payment:** debit card, paytm, credit card, etc
  - **trade-off:** reduces possibility of theft, easy to carry but increases possibility of online forgery

Measuring Money

- **M1 (most liquid assets)** = currency + traveler's checks + demand deposits + other checkable deposits
- **M2 (less liquid than M1)** = M1 + small denomination time deposits + savings deposits and money market deposit accounts + money market mutual fund shares

Measuring Money

- **M1 and M2 can go different direction:** Choice of monetary aggregates important for policy makers



Sources: Federal Reserve *Bulletin*, p. A4, Table 1.10, various issues; Citibase databank; www.federalreserve.gov/releases/h6/hist/h6hist1.txt.

- **Assets:**
  - reserves (required reserves, excess reserves)
  - cash items in process of collection
  - deposits at other banks including Central Bank
  - government bond
  - loans
  - other assets

- **Liabilities:**
  - deposits (checkable deposits, nontransaction deposits)
  - borrowings
- **Balance Sheet:** Asset equals to Liability

Banking Sector

Balance Sheet

Commercial Bank

Asset	**Liability**
Reserves Required Reserves (RR) + Excess Reserves (ER)	Deposit (D)
Bond	
Loan	

Central Bank

Asset	**Liability**
Foreign Exchange Reserves	Currency in Circulation (C)
Bond	Reserves (R)
Loans	
Gold	
	H=C+R

Money Supply

- **M=** C+D
- **Monetary Base or High Powered Money (H) =** C+R = C+RR+ER

$$\begin{aligned} \frac{M}{H} &= \left(\frac{cr+1}{cr+rr+er}\right) \\ M &= \left(\frac{cr+1}{cr+rr+er}\right) H \\ &= \mu H \end{aligned} \tag{1}$$

$$rr = \frac{RR}{D}, er = \frac{ER}{D}, cr = \frac{C}{D}$$

- $\mu > 1$: **money multiplier**

Multiple Deposit Creation and Money Supply

- **Suppose, deposit to first commercial bank rises to ΔD**
  - it keep $(rr + er)\,\Delta D$ in reserves and gives $(1 - rr - er)\,\Delta D$ loans
- **Suppose, $(1 - rr - er)\,\Delta D$ deposited to second commercial bank**
  - it keep $(rr + er)\,(1 - rr - er)\,\Delta D$ in reserves and gives $(1 - rr - er)^2\,\Delta D$ loans
- **Suppose, $(1 - rr - er)^2\,\Delta D$ deposited to second commercial bank**
  - it keep $(rr + er)\,(1 - rr - er)^2\,\Delta D$ in reserves and gives $(1 - rr - er)^3\,\Delta D$ loans

Multiple Deposit Creation and Money Supply

- **Continuing in this fashion gives:**

$$\begin{aligned} \Delta R &= (rr + er)\left[(1 - rr - er) + (1 - rr - er)^2 + ...\right]\Delta D \\ &= \Delta D \end{aligned} \tag{2}$$

- **Change in initial deposit (ΔD) causes identical change in reserves (ΔR) to the entire system**
- **Total Deposit to Entire Banking system is**

$$\begin{aligned} D &= \left[1 + (1 - rr - er) + (1 - rr - er)^2 + ...\right]\Delta D \\ &= \frac{\Delta D}{rr + er} = \frac{\Delta R}{rr + er} > \Delta D \end{aligned}$$

Monetary Policy Tools

- **Tools to control money supply:**
  - **Open Market Operations (OMO)**
  - **required reserves rate** (rr)
  - **discount rate:** the rate at which commercial banks borrow money from central bank

Monetary Policy Tools

OMO

- **Suppose central bank purchases bond from commercial bank and gives them money/cheque**
  - Asset of central bank rises⇒ liability of central bank should rise by same amount⇒reserves of central bank rises of same amount
  - commercial banks generates the extra deposit compatible with this extra reserves by multiple deposit creation
  - money supply rises

Monetary Policy Tools

OMO

- **Suppose central bank purchases bond from common public and gives them money/cheque**
  - bond holding of central bank rises $\Rightarrow$ rise in assets$\Rightarrow$ there should be corresponding rise in liability
  - currency in circulation rises
  - money supply rises
- **Similarly, Open Market sale of bond by central bank reduces money supply**

Monetary Policy Tools

Required Reserves Rate

- A rise (fall) in *rr* reduces (increases) money multiplier and reduces (increases) money supply

Monetary Policy Tools

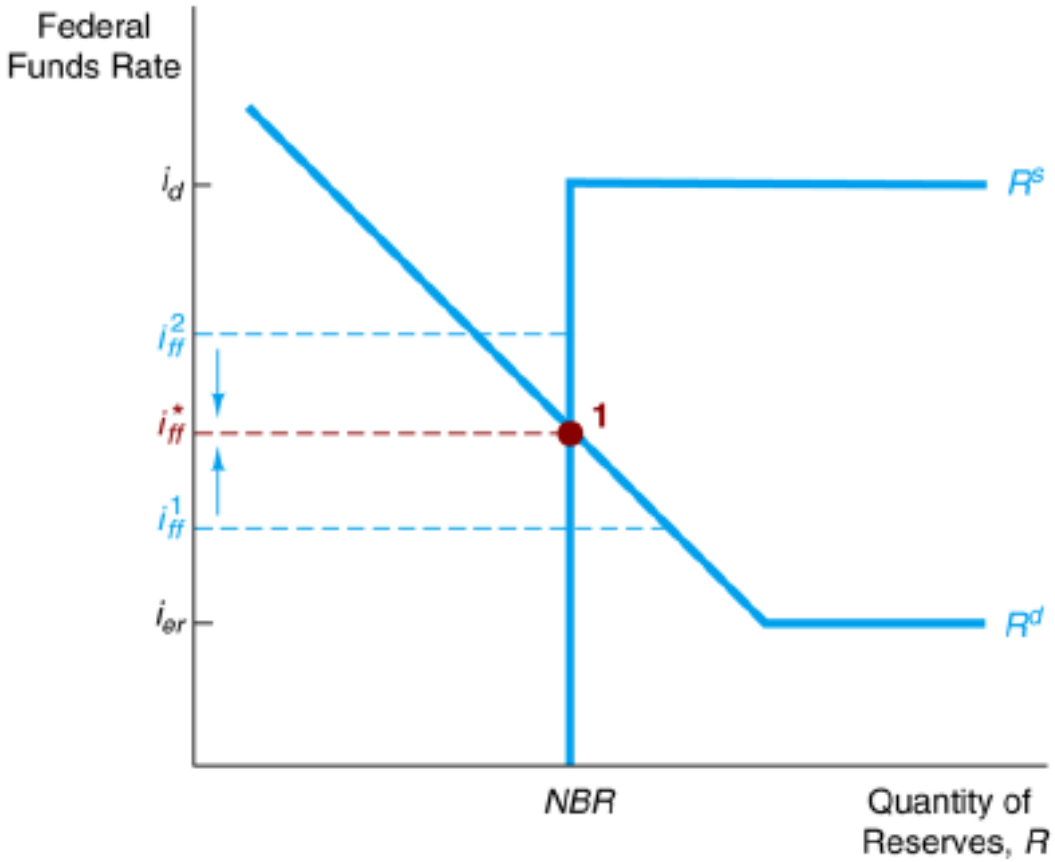
Discount Rate

- **Commercial bank borrow from central bank either to maintain excess reserves or to satisfy demand for withdrawal**
  - **a fall in discount rate reduces the cost of borrowing and induces commercial bank to borrow more from central bank when required**
  - either increases reserves or currency in circulation
  - money supply rises from equation (1)

Reserves Market

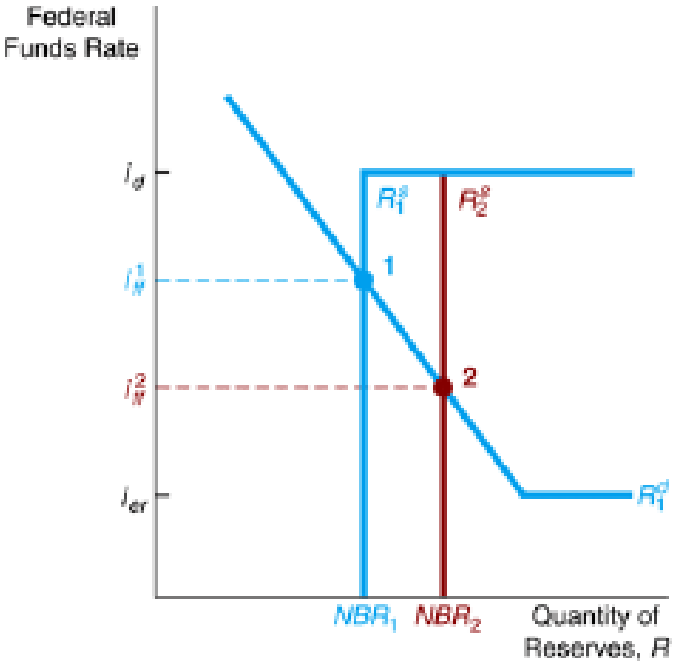
- **Demand for Reserves:**
  - rise in interest rate induces bank to give more loans and keep less resereve
  - bank does not give any loan and keep only resserves when interest rate less that interest rate on excess reserves (i_{er})
- **Supply of Reserves:**
  - central bank does not give loand to commercial bank/commercial bank does not borrow from central bank when interest rate less that discount rate (i_d)
  - central bank gives infinite amount of loans when interest rate as much as discount rate
- Intersection of demand and supply of reserves determines the market clearing interest rate and reserves

Reserves Market

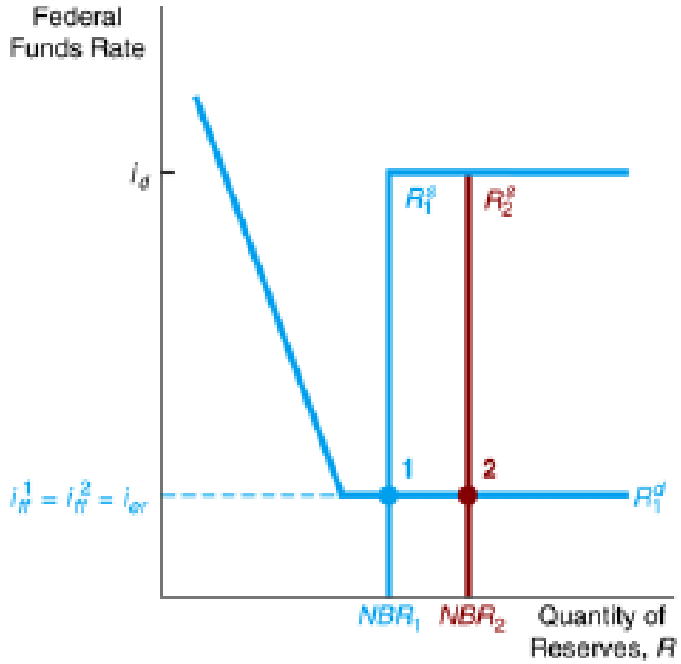


Tools of Monetary Policy

OMO



(a) Supply curve initially intersects demand curve in its downward-sloping section



(b) Supply curve initially intersects demand curve in its flat section

Tools of Monetary Policy

Panel (a)

- **Effective OMO:**
  - open market puchase of bond shifts the reserves supply curve to right
  - increases non-borroed reserves and increases money supply
  - interest rate falls causes consumption and investment rise (IS-LM)
  - causes income and price to increase (AD-AS)
- **Open Market Purchase is an expensionary monetary policy**

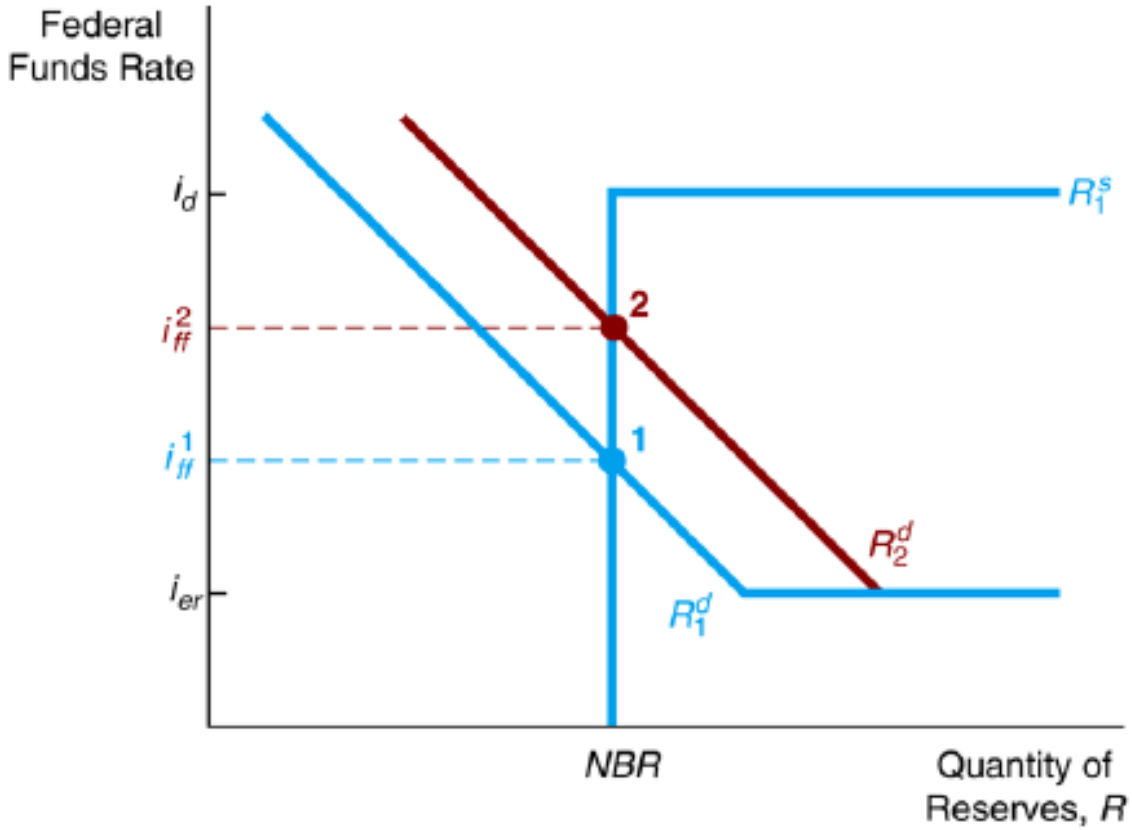
Tools of Monetary Policy

Panel (a)

- **Ineffective OMO:**
  - open market puchase of bond shifts the reserves supply curve to right
  - increases non-borroed reserves and increases money supply
  - interest rate does not change keeps output unchanged

Tools of Monetary Policy

Change in Required Reserves Rate



Tools of Monetary Policy

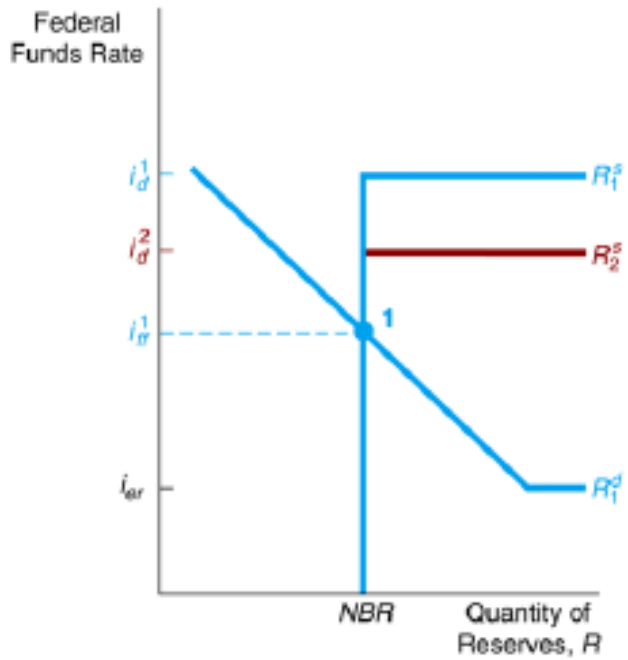
Rise in Required Reserves Rate

- **Rise in required reserves rate shifts demand for reserves curve up**
  - interest rate rises causes consumption and investment and income to fall (IS-LM)
  - keeps total reserves unchanged but reduces money supply by reducing money multiplier
  - fall in output and rise in interest rate reduces money demand$\Rightarrow$ keeps money market equilibrium
- **Rise in required reserves rate is an contractionary monetary policy**

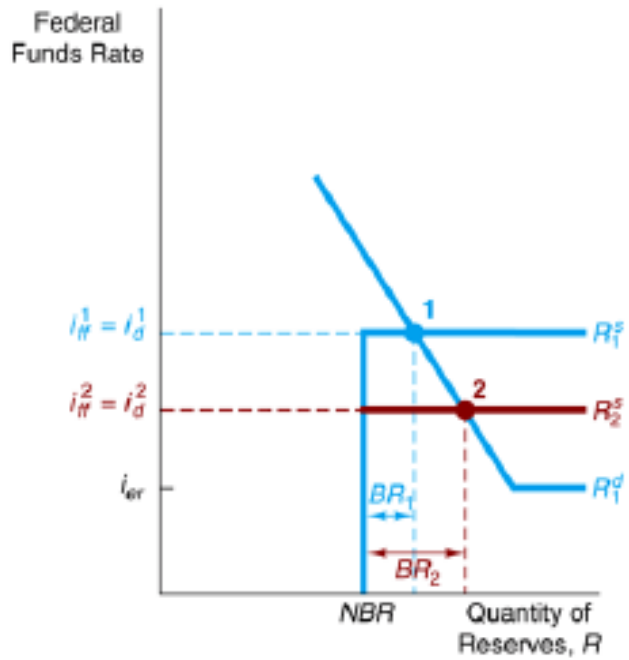
Tools of Monetary Policy

Change in Discount Rate

- **Panel (a):** Ineffective Policy
- **Panel (b):** Effective Policy



(a) No discount lending ($BR = 0$)



(b) Some discount lending ($BR > 0$)

Tools of Monetary Policy

Advantages of OMO

- **Widely and Frequently Used:**
  - central bank has complete control over the volume
  - flexible and precise
  - easily reversed and quickly implemented

Tools of Monetary Policy

Required Reserves

- **Not used frequently:**
  - No longer binding for most banks
  - Can cause liquidity problems and Increases uncertainty for banks

Tools of Monetary Policy

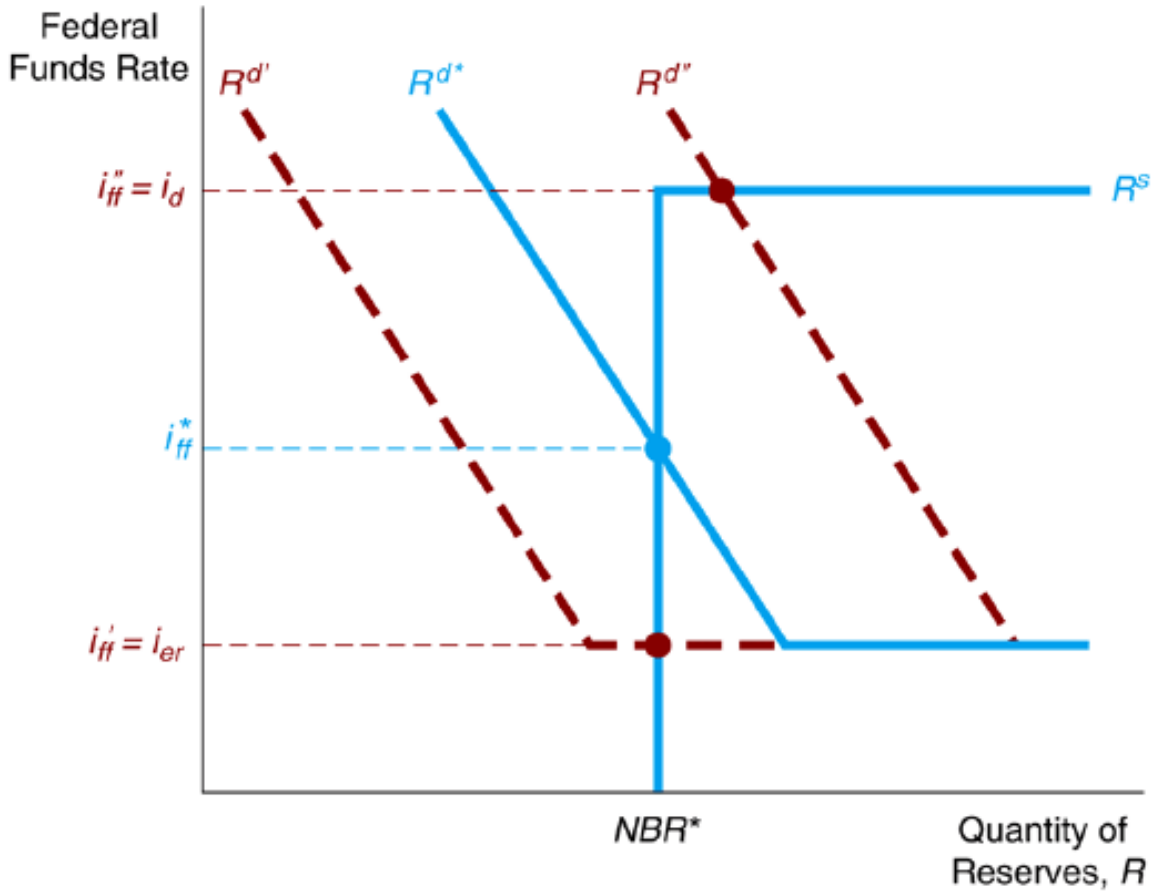
Discount Rate

- **Used to perform role of lender of last resort:** Important during the subprime financial crisis of 2007-2008.
- Cannot be controlled by the Fed; the decision maker is the bank
- Discount facility is used as a backup facility to prevent the federal funds rate from rising too far above the target

Tools of Monetary Policy

Ceiling and floor of interest rate

- $i_{er} \leq i \leq i_d$



Tools of Monetary Policy

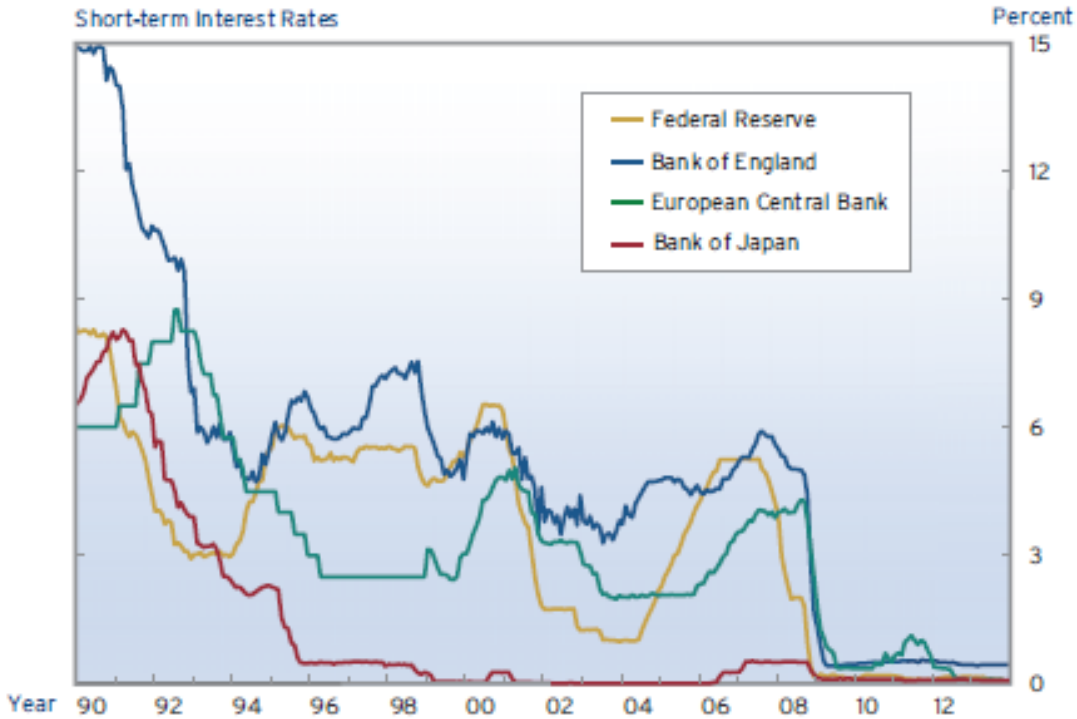
Ceiling and floor of interest rate

- **Zero Lower Bound (ZLB):** Nominal interest rate has ZLB. Nominal interest rate is zero and banks faces liquidity crunch in US during financial crisis
- **Liquidity Trap:** Tradiatonal monetary policy ineffective
- **Fed started paying interest on excess reserves**
  - encourages commercial bank to keep excess reserves
  - helps maintaining liquidity
  - restricts nominal interest rate to go to zero
- $i_{er} = 0$ for India

Tools of Monetary Policy

Ceiling and floor of interest rate

- **Zero Lower Bound and Liquidity Trap:** No longer a theoretical curiosity

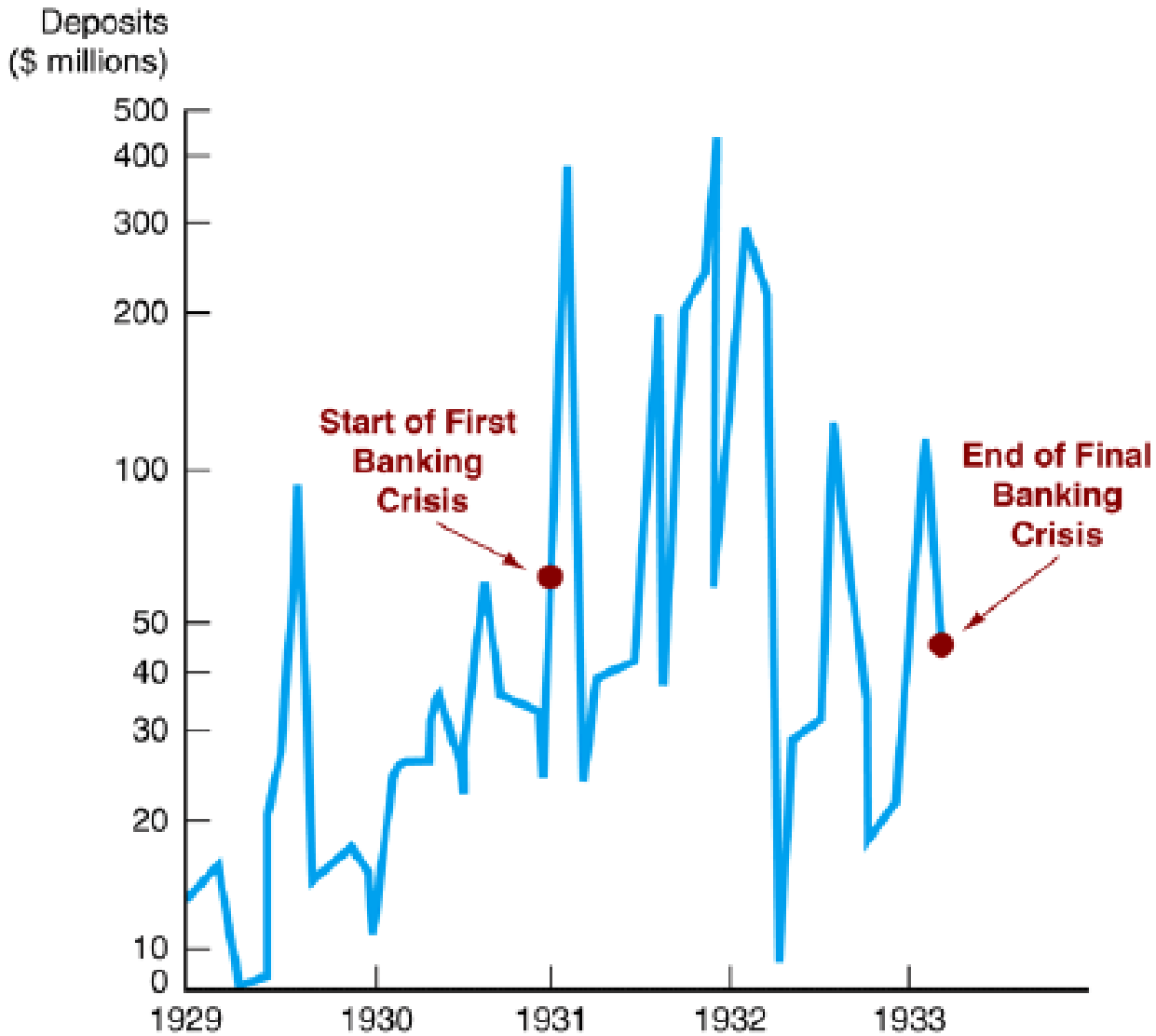


Sources: Board of Governors of the Federal Reserve System (2013); Organisation for Economic Co-operation and Development (OECD; 2013).

Application

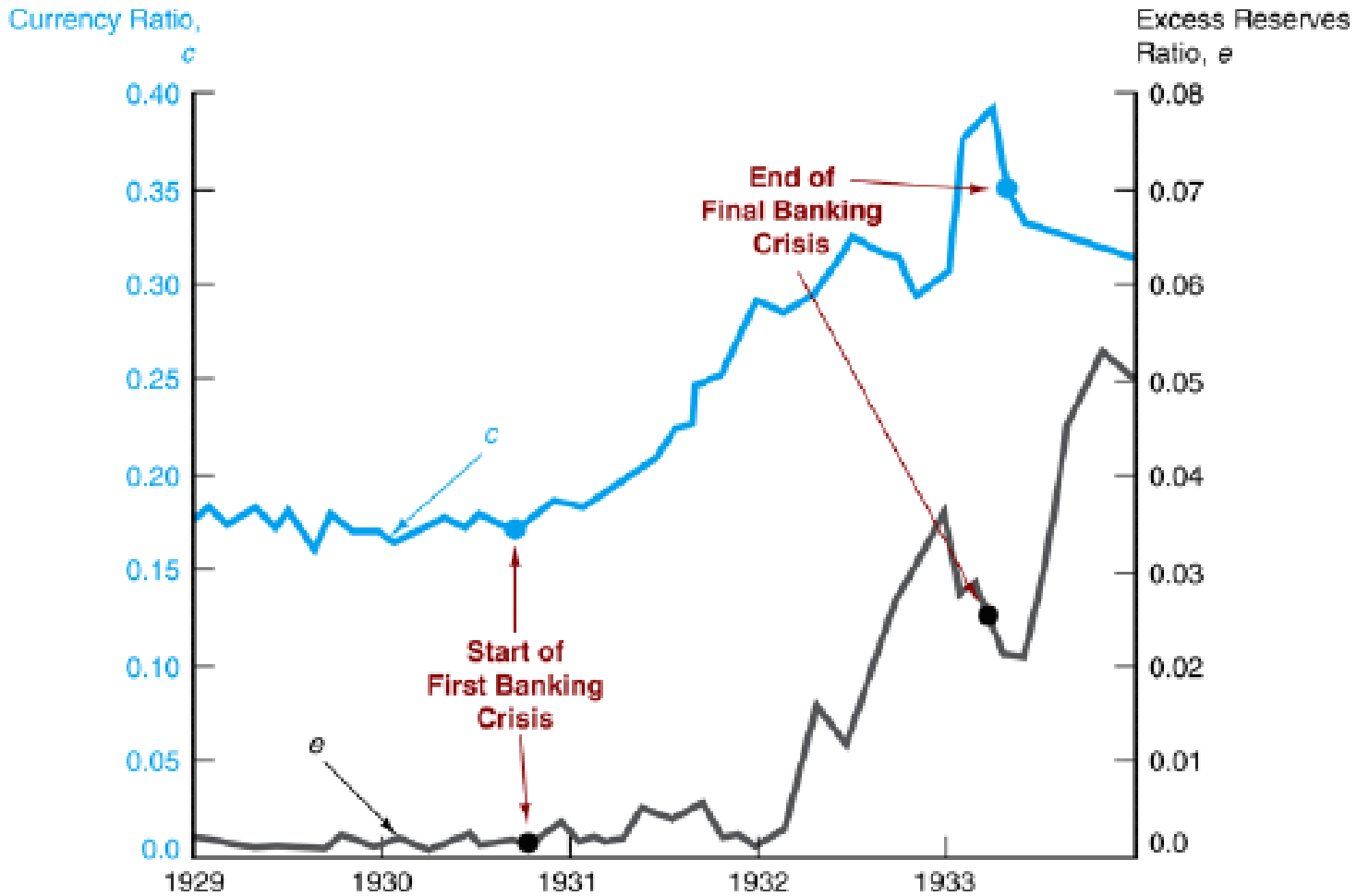
- **Bank failures (and no deposit insurance):**
  - increase in deposit outflows and holding of currency (depositors)
  - an increase in the amount of excess reserves (banks)
  - for a relatively constant MB, the money supply decreased due to the fall of the money multiplier.

Application



Source: Milton Friedman and Anna Jacobson Schwartz, *A Monetary History of the United*

Application



Sources: Federal Reserve *Bulletin*; Milton Friedman and Anna Jacobson Schwartz, *A Monetary History of the United States, 1867–1960* (Princeton, NJ: Princeton University Press, 1963), p. 333.

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