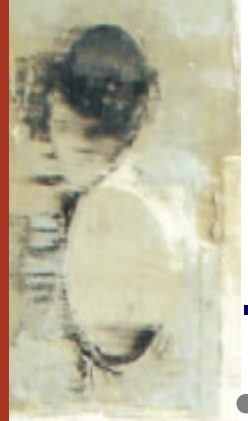
Chapter 4:
The Monetary System:

What It Is And How It Works



IN THIS CHAPTER, YOU WILL LEARN:

- The definition, functions, and types of money
- How banks “create” money
- What a central bank is and how it controls the money supply

Money: Definition

Money is the stock of assets that can be readily used to make transactions.

Money: Functions

- *Medium of exchange*
  we use it to buy stuff
- *Store of value*
  transfers purchasing power from the present to the future
- *Unit of account* （计价单位）
  the common unit by which everyone measures prices and values

Money: Types

1. Fiat money（法定货币）
   - has no intrinsic value
   - example: the paper currency we use
2. Commodity money（商品货币）
   - has intrinsic value
   - examples:
     gold coins,
     cigarettes in P.O.W. camps

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Discussion Question

Which of these are money?

a. Currency
b. Checks
c. Deposits in checking accounts ("demand deposits")
d. Credit cards

Two definitions

- The **money supply** is the quantity of money available in the economy.
- **Monetary policy** is the control over the money supply.

The central bank and monetary control

- Monetary policy is conducted by a country's **central bank**.
- Examples are the European Central Bank (ECB) in the Eurozone, the Bank of England (BoE) in the UK, or the Federal Reserve Bank in the U.S. (FED)
- To control the money supply, the Fed uses **open market operations（公开市场操作）**, the purchase and sale of government bonds.

Money supply measures, March 2015

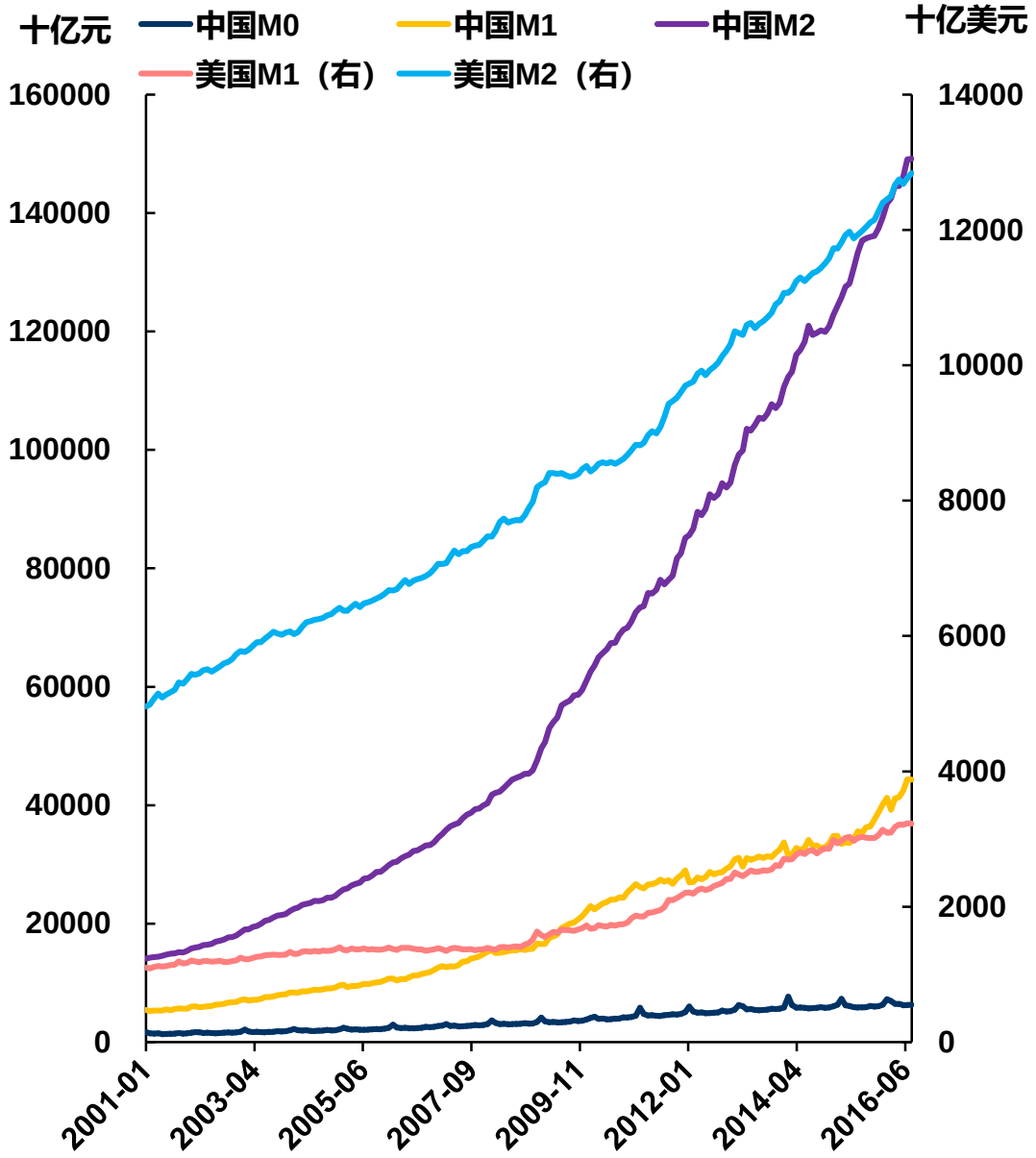
symbol	assets included	amount ($ billions)
C	Currency	1,279
M1	**C** + demand deposits, travelers' checks, other checkable deposits	2,988
M2	**M1** + small time deposits, savings deposits, money market mutual funds, money market deposit accounts	11,846

中国的货币供应

M0=流通中的现金

M1=M0+支票存款（以及转账信用卡存款）

M2=M1+储蓄存款（包括活期和定期储蓄存款）

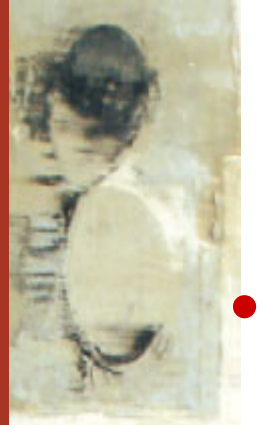


Banks' role in the monetary system

- The money supply equals currency （通货）plus demand (checking account) deposits （活期存款）:

$$M = C + D$$

- Since the money supply includes demand deposits, the banking system plays an important role.



A few preliminaries

- **Reserves** (***R***)（准备金）: the portion of deposits that banks have not lent.
- A bank's liabilities include deposits; assets include reserves and outstanding loans.
- **100-percent-reserve banking**: a system in which banks hold all deposits as reserves.
- **Fractional-reserve banking**: a system in which banks hold a fraction of their deposits as reserves.

Banks' role in the monetary system

- To understand the role of banks, we will consider three scenarios:
  1. No banks
  2. 100-percent-reserve banking (banks hold all deposits as reserves)
  3. Fractional-reserve banking (banks hold a fraction of deposits as reserves, use the rest to make loans)
- In each scenario, we assume C = \$1,000.

SCENARIO 1:
No banks

With no banks,

$$\boldsymbol{D} = 0 \text{ and } \boldsymbol{M} = \boldsymbol{C} = \$1{,}000.$$

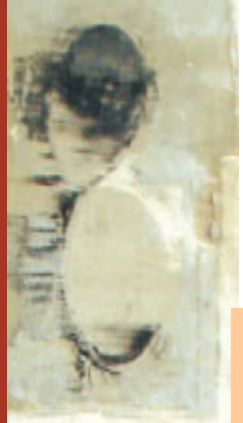
SCENARIO 2:
100-percent-reserve banking

- Initially ***C*** = \$1000, ***D*** = \$0, ***M*** = \$1,000.
- Now suppose households deposit the \$1,000 at "Firstbank."

FIRSTBANK'S balance sheet

Assets	Liabilities
reserves \$1,000	deposits \$1,000

- After the deposit:
  C = \$0,
  D = \$1,000,
  M = \$1,000
- *LESSON:*
  100%-reserve banking has no impact on size of money supply.



SCENARIO 3:
Fractional-reserve banking

LESSON: In a fractional-reserve banking system, banks create money.

FIRSTBANK'S balance sheet

Assets		Liabilities
reserves	$200	deposits $1,000
loans	$800	

The money supply now equals $1,800:

- Depositor has $1,000 in demand deposits.
- Borrower holds $800 in currency.

SCENARIO 3:
Fractional-reserve banking

- Suppose the borrower deposits the $800 in Secondbank.
- Initially, Secondbank's balance sheet is:

SECONDBANK'S balance sheet

Assets		Liabilities
reserves	$160	deposits $800
loans	$640	

- Secondbank will loan 80% of this deposit.

SCENARIO 3:
Fractional-reserve banking

- If this $640 is eventually deposited in Thirdbank,
- Then Thirdbank will keep 20% of it in reserve and loan the rest out:

THIRDBANK'S balance sheet

Assets		Liabilities
reserves	$128	deposits $640
loans	$512	

Finding the total amount of money:

	Original deposit	= $1000
+	Firstbank lending	= $ 800
+	Secondbank lending	= $ 640
+	Thirdbank lending	= $ 512
+	other lending…	

Total money supply = (1/***rr***) × $1,000

where ***rr*** = ratio of reserves to deposits

(存款准备金率)

In our example, ***rr*** = 0.2, so ***M*** = $5,000

Money creation in the banking system

A fractional-reserve banking system creates money, but it doesn't create wealth:

Bank loans give borrowers some new money and an equal amount of new debt.

Bank capital, leverage（杠杆）, and capital requirements

- **Bank capital**: the resources a bank's owners have put into the bank
- A more realistic balance sheet:

Assets		**Liabilities and Owners' Equity**	
Reserves	$200	Deposits	$750
Loans	500	Debt	200
Securities	300	Capital (owners' equity 所有者权益)	50

Bank capital, leverage, and capital requirements

- **Leverage**: the use of borrowed money to supplement existing funds for purposes of investment
- *Leverage ratio* = assets/capital
  = $(200 + 500 + 300)/$50 = **20**

Assets		**Liabilities and Owners' Equity**	
Reserves	$200	Deposits	$750
Loans	500	Debt	200
Securities	300	Capital (owners' equity)	50

Bank capital, leverage, and capital requirements

- Being highly leveraged makes banks vulnerable.
- Example: Suppose a recession causes our bank's assets to fall by 5%, to $950.
- Then, capital = assets – liabilities = 950 – 950 = 0

Assets		**Liabilities and Owners' Equity**	
Reserves	$200	Deposits	$750
Loans	500	Debt	200
Securities	300	Capital (owners' equity)	50

Bank capital, leverage, and capital requirements

Capital requirement:

- minimum amount of capital mandated by regulator
- intended to ensure banks will be able to pay off depositors
- higher for banks that hold more risky assets

2008-2009 financial crisis:

- Losses on mortgages shrank bank capital, slowed lending, exacerbated the recession.
- Govt injected billions of dollars of capital into banks to ease the crisis and encourage more lending.

A model of the money supply

exogenous variables

- **Monetary base（基础货币）**, $B = C + R$

  controlled by the central bank

- **Reserve-deposit ratio（存款准备金率）**,

  $rr = R/D$

  depends on regulations & bank policies

- **Currency-deposit ratio（通货存款比）**,

  $cr = C/D$

  depends on households' preferences

Solving for the money supply:

$$M = C + D = \frac{C + D}{B} \times B = m \times B$$

where

$$m = \frac{C + D}{B}$$

$$= \frac{C + D}{C + R} = \frac{(C/D) + (D/D)}{(C/D) + (R/D)} = \frac{cr + 1}{cr + rr}$$

The money multiplier

$$M = m \times B, \quad \text{where} \quad m = \frac{cr + 1}{cr + rr}$$

- If $rr < 1$, then $m > 1$
- If monetary base changes by ΔB, then $\Delta M = m \times \Delta B$
- m is the **money multiplier（货币乘数）**, the increase in the money supply resulting from a one-dollar increase in the monetary base.

NOW YOU TRY

The money multiplier

$$M = m \times B, \quad \text{where} \quad m = \frac{cr + 1}{cr + rr}$$

Suppose households decide to hold more of their money as currency and less in the form of demand deposits.

1. Determine impact on money supply.
2. Explain the intuition for your result.

SOLUTION

The money multiplier

Impact of an increase in the currency-deposit ratio $\Delta \boldsymbol{cr} > 0$.

1. An increase in ***cr*** increases the denominator of ***m*** proportionally more than the numerator. So ***m*** falls, causing ***M*** to fall.
2. If households deposit less of their money, then banks can't make as many loans, so the banking system won't be able to create as much money.

The instruments of monetary policy

The Fed can change the monetary base using:

- open market operations (the Fed's preferred method of monetary control)
  - To increase the base, the Fed could buy government bonds, paying with new dollars.
- the **discount rate（贴现率）**: the interest rate the Fed charges on loans to banks
  - To increase the base, the Fed could lower the discount rate, encouraging banks to borrow more reserves.

The instruments of monetary policy

The Fed can change the reserve-deposit ratio using:

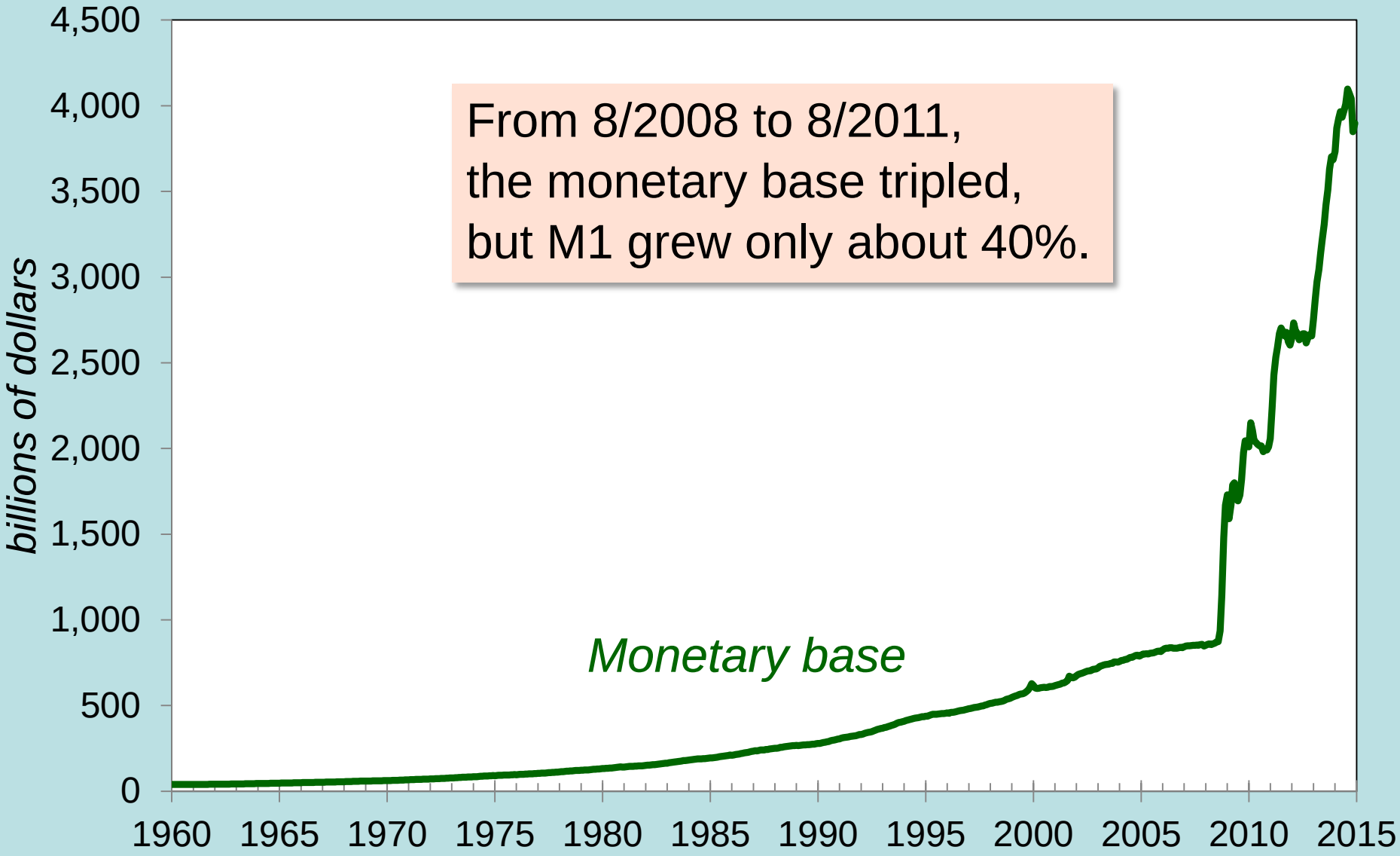
- **reserve requirements（法定准备金率）** Fed regulations that impose a minimum reserve-deposit ratio
  - To reduce the reserve-deposit ratio, the Fed could reduce reserve requirements.
- **interest on reserves**: the Fed pays interest on bank reserves deposited with the Fed

Why the Fed can't precisely control *M*

$$M = m \times B, \quad \text{where} \quad m = \frac{cr + 1}{cr + rr}$$

- Households can change ***cr***, causing ***m*** and ***M*** to change.
- Banks often hold **excess reserves** (超额准备
  (reserves above the reserve requirement).
  If banks change their excess reserves, then ***rr***, ***m***, and ***M*** change.

CASE STUDY:
Quantitative Easing



CASE STUDY:
Quantitative Easing（量化宽松）

- *Quantitative easing*: the Fed bought long-term govt bonds instead of T-bills to reduce long-term rates.
- The Fed also bought mortgage-backed securities to help the housing market.
- But after losses on bad loans, banks tightened lending standards and increased excess reserves, causing money multiplier to fall.
- If banks start lending more as economy recovers, rapid money growth may cause inflation. To prevent, the Fed is considering various “exit strategies.”

CASE STUDY:
Bank failures in the 1930s

- From 1929 to 1933:
  - over 9,000 banks closed
  - money supply fell 28%
- This drop in the money supply may not have caused The Great Depression, but certainly contributed to its severity.

CASE STUDY:

Bank failures in the 1930s

$$M = m \times B, \quad \text{where} \quad m = \frac{cr + 1}{cr + rr}$$

- Loss of confidence in banks: increases ***cr***, reduces ***m***
- Banks became more cautious: increases ***rr***, reduces ***m***

CASE STUDY:
Bank failures in the 1930s

	August 1929	*March 1933*	*% change*
M	26.5	19.0	–28.3%
C	3.9	5.5	41.0
D	22.6	13.5	–40.3
B	7.1	8.4	18.3
C	3.9	5.5	41.0
R	3.2	2.9	–9.4
m	3.7	2.3	–37.8
rr	0.14	0.21	50.0
cr	0.17	0.41	141.2

Could this happen again?

- Many policies have been implemented since the 1930s to prevent such widespread bank failures.
- *E.g.*, Federal Deposit Insurance, to prevent bank runs and large swings in the currency-deposit ratio.

CHAPTER SUMMARY

Money

- Definition: the stock of assets used for transactions
- Functions: medium of exchange, store of value, unit of account
- Types: commodity money (has intrinsic value), fiat money (no intrinsic value)
- Money supply controlled by central bank

CHAPTER SUMMARY

Fractional reserve banking creates money because each dollar of reserves generates many dollars of demand deposits.

The money supply depends on the:

- monetary base
- currency-deposit ratio
- reserve ratio

The Fed can control the money supply with:

- open market operations
- the reserve requirement
- the discount rate
- interest on reserves

CHAPTER SUMMARY

Bank capital, leverage, capital requirements

- Bank capital is the owners' equity in the bank.
- Because banks are highly leveraged, a small decline in the value of bank assets can have a huge impact on bank capital.
- Bank regulators require that banks hold sufficient capital to ensure that depositors can be repaid.