

■ Macroeconomics

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The Monetary System: What it Is and How It Works

Presentation Slides



IN THIS CHAPTER, YOU WILL LEARN:

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

$$M = B \cdot m = B \cdot \frac{Cr + 1}{Cr + rr}$$

↓

$$M_1 \text{ (currency + deposits)}$$

4.1 What Is Money?

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*
the common unit by which everyone measures prices and values

Money: Types

1. Fiat money

- has no intrinsic value
- example: the paper currency we use

2. Commodity money

- has intrinsic value
- examples:
gold coins,
cigarettes in P.O.W. camps

NOW YOU TRY

Discussion Question

Which of these are money?

- a. Currency ✓
- b. Checks ✗
- c. Deposits in checking accounts
("demand deposits") M_1 ✓
- d. Credit cards ✗
- e. Certificates of deposit
("time deposits") ✓
 M_2

Money: Examples, part 1

- Currency
 - Yes; U.S. dollar bills, Mexican pesos, and other currencies are all money
- Checks
 - The check itself is not money, but the funds in the checking account are money
- Deposits in checking accounts (“demand deposits”)
 - Yes, the funds in a checking account serve the three purposes

Money: Examples, part 2

- Credit cards
 - No, they are a means of deferred payment
 - For credit card purchases, you agree to pay back your credit card company in the future
- Certificates of deposit (“time deposits”), or CDs
 - Depends on the length of time; they are a store of value and are measured in money units (dollars, for example) but are not easily spent (medium of exchange)
 - There are multiple measures of the money supply

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**.
- The U.S.'s central bank is called the **Federal Reserve** ("the Fed").
- To control the money supply, the Fed uses **open market operations**, the purchase and sale of government bonds.



*The Federal Reserve Building
Washington, DC*

Money supply measures, July 2017

中国M1: 流通中通货+企事业单位长期存款
(个人长期不算M1)

Symbol	Assets Included	Amount in July 2017 (billions of dollars)
C / M0	Currency	\$ 1,486
M1	Currency plus demand deposits, traveler's checks, and other checkable deposits	3,528
M2	M1 plus ^{≤ USD 100,000} retail money market mutual fund balances, saving deposits (including money market deposit accounts), and small time deposits	13,602

4.2 The Role of Banks in the Monetary System

Banks' role in the monetary system

- The money supply equals currency plus demand (checking account) deposits:

$$M = C + D$$

money supply (under M)
currency (under C)
demand deposits (under D)

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

A few preliminaries

⇒ 準備金

- **Reserves** (R): the portion of deposits that banks have not lent.
- A bank's liabilities include deposits; assets include reserves and outstanding loans. *+ Securities*
- **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,
 $D = 0$ and $M = C = \$1,000$.

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 (1 of 3)

- Suppose banks hold 20% of deposits in reserve, making loans with the rest.
- Firstbank will make \$800 in loans.

FIRSTBANK'S balance sheet

Assets	Liabilities
Reserves \$200 Loans \$800	Deposits \$1,000

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

- The money supply now equals \$1,800:
 - Depositor has \$1,000 in demand deposits.
 - Borrower holds \$800 in currency.

Scenario 3: Fractional-reserve banking (2 of 3)

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

SECONDBANK'S balance sheet

Assets	Liabilities
Reserves \$160 Loans \$640	Deposits \$800

- Secondbank will loan 80% of this deposit.

Scenario 3: Fractional-reserve banking (3 of 3)

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

THIRDBANK'S balance sheet

Assets	Liabilities
Reserves \$128 Loans \$512	Deposits \$640

Finding the total amount of money:

贷款创造货币

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

Total money supply = $(1/rr) \times \$1,000$

where rr = ratio of reserves to deposits = $\frac{\text{reserves}}{\text{deposits}}$

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 ^{资本金} capital, leverage, 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)	50

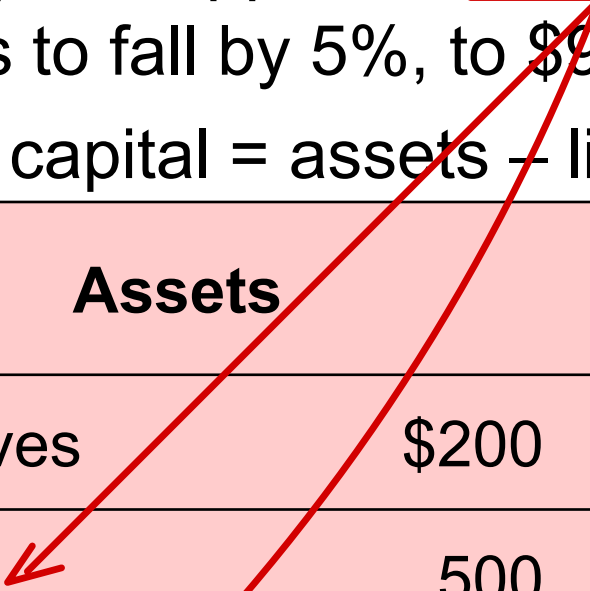
Bank capital, leverage, and capital requirements

- **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 regulators
- 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.

4.3 How Central Banks Influence the Money Supply

A model of the money supply

exogenous variables

- **Monetary base**, $B = C + R$
controlled by the central bank
- **Reserve-deposit ratio**, $rr = R/D$
depends on ~~regulations~~ & bank policies
- **Currency-deposit ratio**, $cr = C/D$
depends on households' ~~preferences~~

Solving for the money supply:

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

where

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

$$m = \frac{M_1}{\text{基础货币}}$$

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

$$m = \frac{C+D}{C+R} = \frac{cr+1}{cr+rr}$$

The money multiplier

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

- If $rr < 1$, then $m > 1$ $rr = \frac{R}{D}$
- If monetary base changes by ΔB , then $\Delta M = m \times \Delta B$
- m is the **money multiplier**, the increase in the money supply resulting from a one-dollar increase in the monetary base.

NOW YOU TRY

The money multiplier

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

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
 $\Delta cr > 0$.

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

$$M = m \cdot B$$

$$m = \frac{cr + 1}{cr + rr}$$

$$M = C + D \quad B = C + R$$

The Fed can change the monetary base using:

- open market operations (the Fed's preferred method of monetary control) $R \uparrow \rightarrow B \uparrow \rightarrow M \uparrow$
 - To increase the base, the Fed could buy government bonds, paying with new dollars.
- the **discount rate**: 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**: 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
 - To reduce the reserve-deposit ratio, the Fed could pay a lower interest rate on reserves.

美国：法定存准率

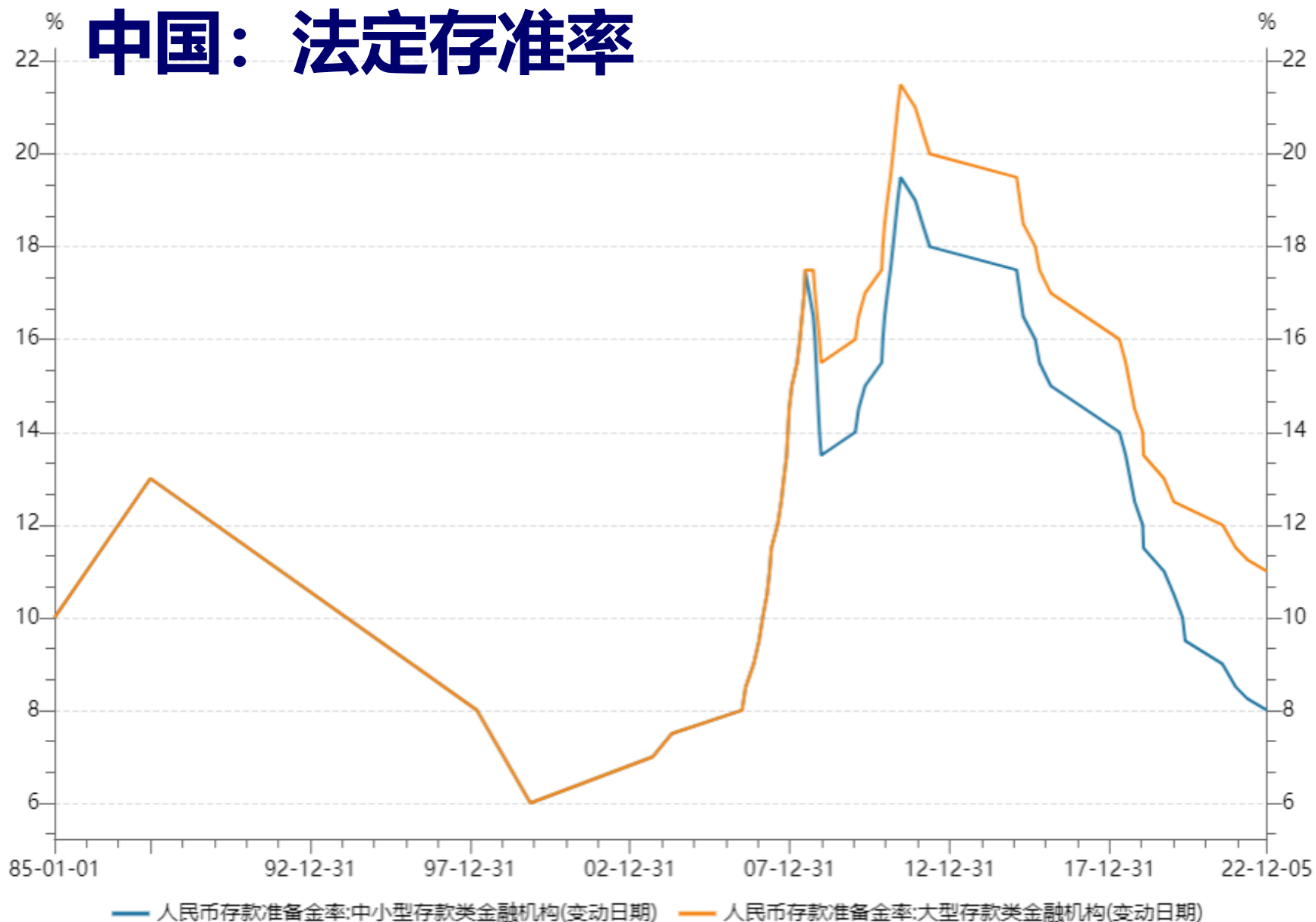
Reserve Requirements

As announced on March 15, 2020, the Board reduced reserve requirement ratios to zero percent effective March 26, 2020. This action eliminated reserve requirements for all depository institutions.



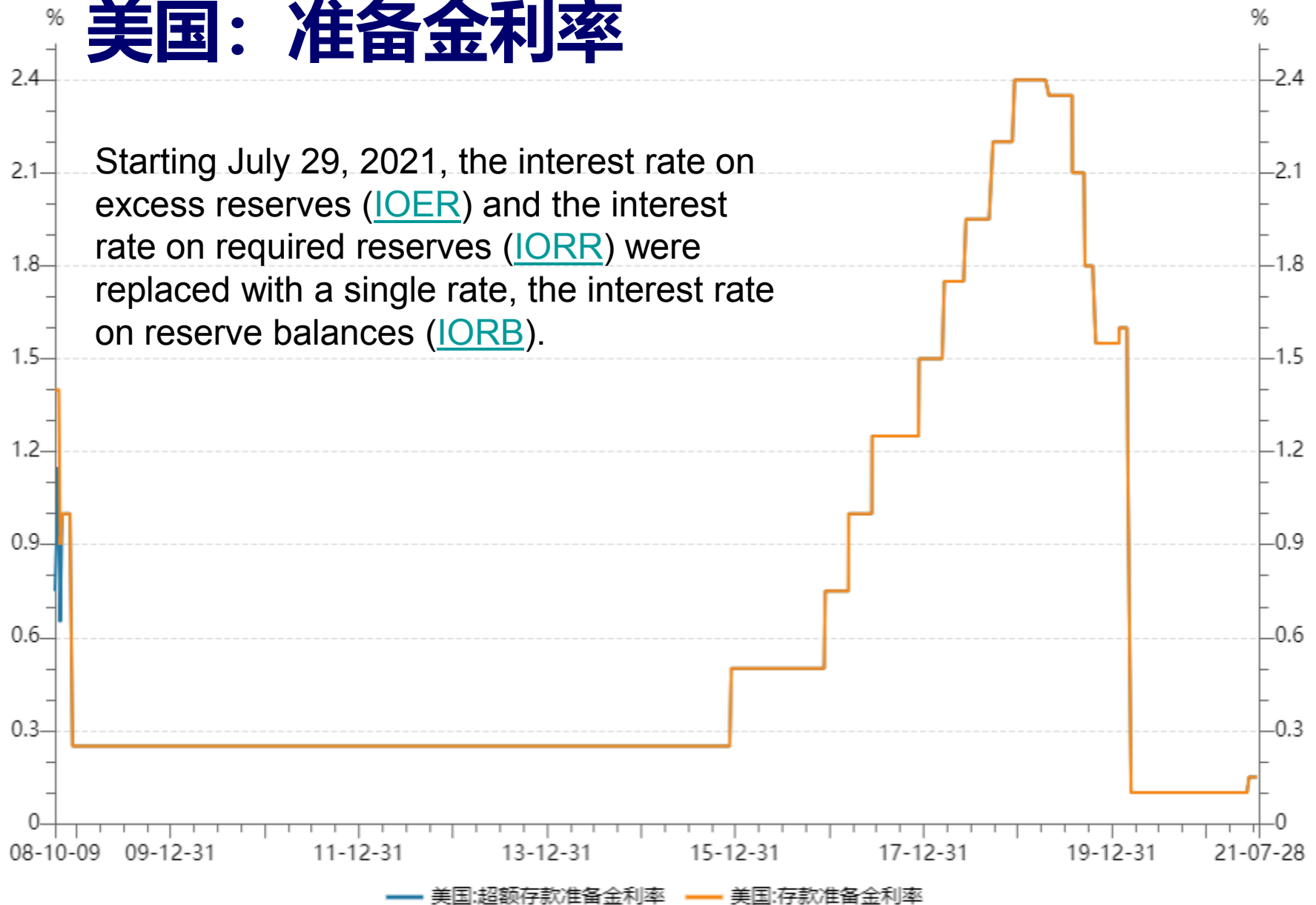
<https://www.federalreserve.gov/monetarypolicy/reservereq.htm>

中国：法定存准率



数据来源：Wind

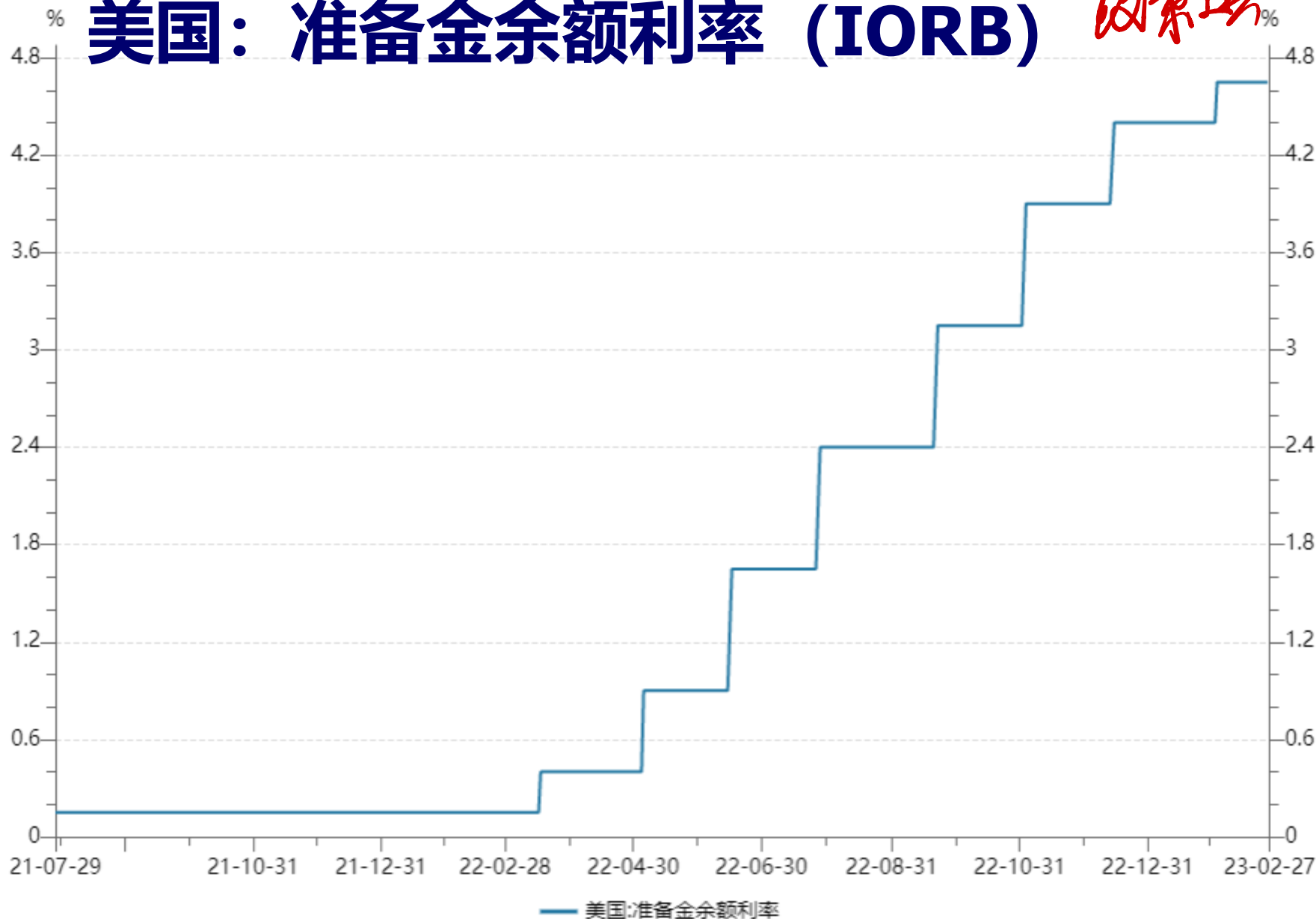
美国：准备金利率



数据来源：Wind

美国：准备金余额利率 (IORB)

政策工具



数据来源：Wind

美国：联邦基金利率

加息

基准利率

☆ Effective Federal Funds Rate (EFFR)

DOWNLOAD

Observation:
2023-02-23: 4.58 (+ more)
Updated: Feb 24, 2023

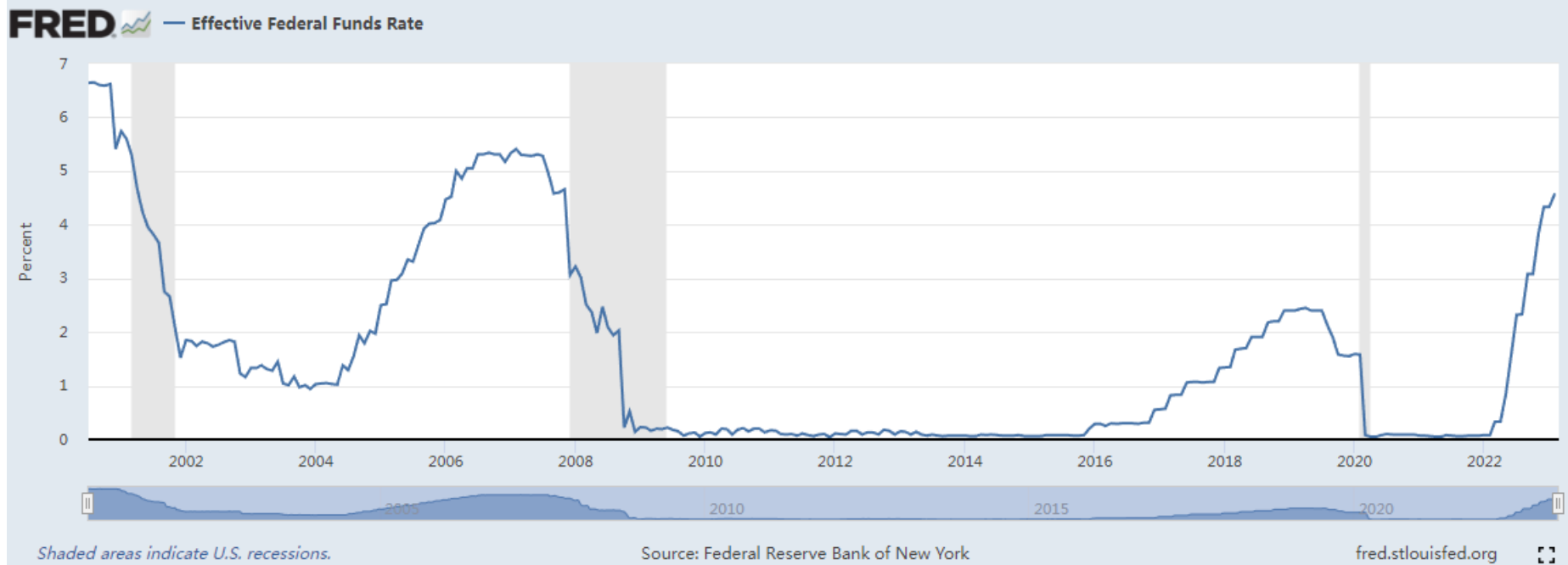
Units:
Percent,
Not Seasonally Adjusted

Frequency:
Daily

1Y | 5Y | 10Y | Max

2000-07-0 to 2023-02-2

EDIT GRAPH



中国：准备金利率

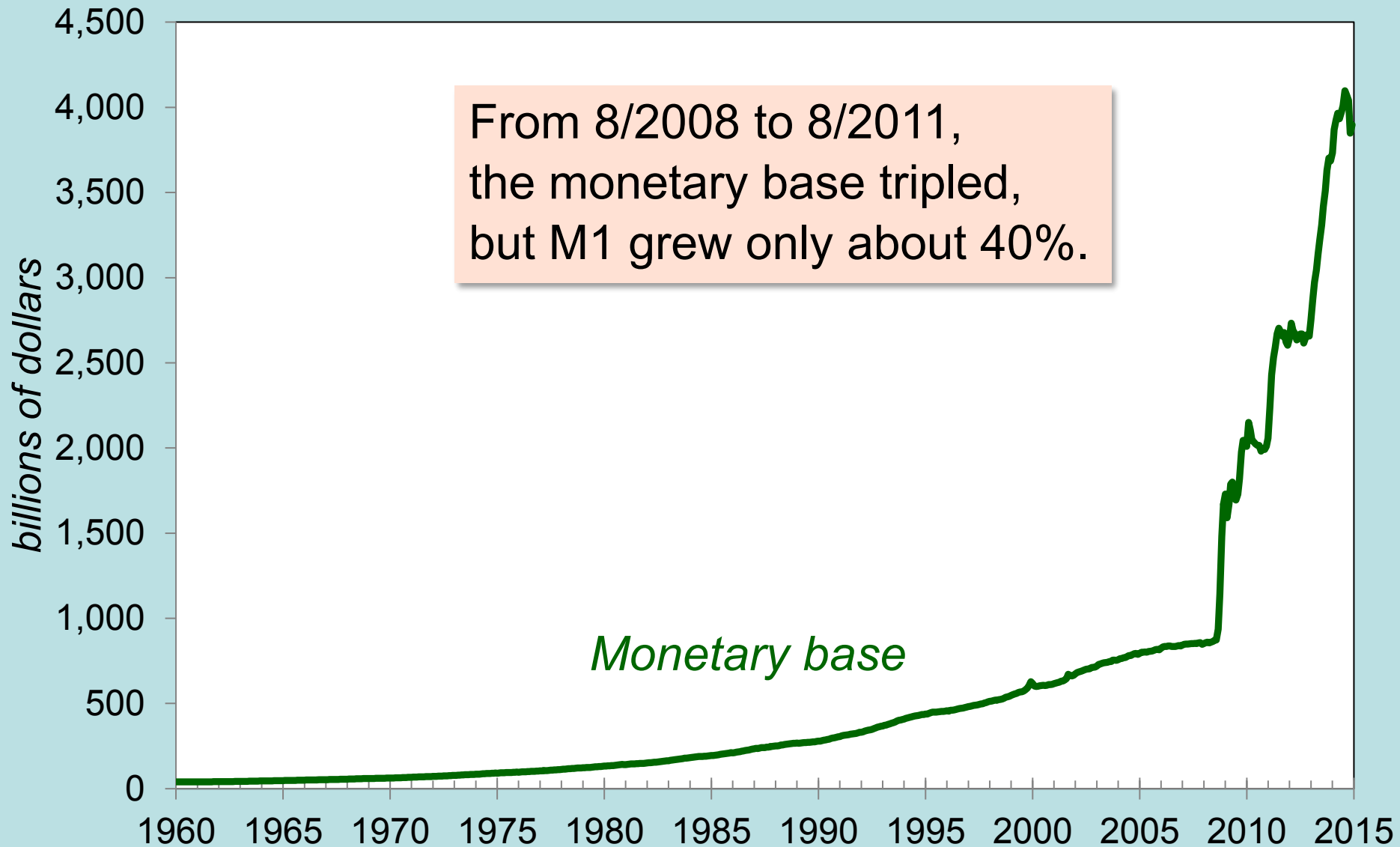
序号	指标名称 ↓	人民银行对金融机构存款利率:法定准备金	人民银行对金融机构存款利率:超额准备金
	频率	日	日
	单位	%	%
	数据来源	中国人民银行	中国人民银行
1	2020-04-07		0.35
2	2008-11-27	1.62	0.72
3	2005-03-17	1.89	0.99
4	2004-03-25	1.89	1.62
5	2003-12-20	1.89	1.62
6	2002-02-21	1.89	1.89
7	2001-09-11	2.07	2.07
8	1999-06-10	2.07	2.07
9	1998-12-07	3.24	3.24
10	1998-07-01	3.51	3.51
11	1998-03-21	5.22	5.22
12	1997-10-23	7.56	7.02
13	1996-08-23	8.28	7.92
14	1996-05-01	8.82	8.82

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** (reserves above the reserve requirement). If banks change their excess reserves, then rr , m , and M change.

CASE STUDY: Quantitative Easing



美国:M1货币乘数

☆ M1 Money Multiplier (DISCONTINUED) (MULT)

[DOWNLOAD](#)**Observation:**

2019-12-04: 1.197 (+ more)

Updated: Dec 12, 2019

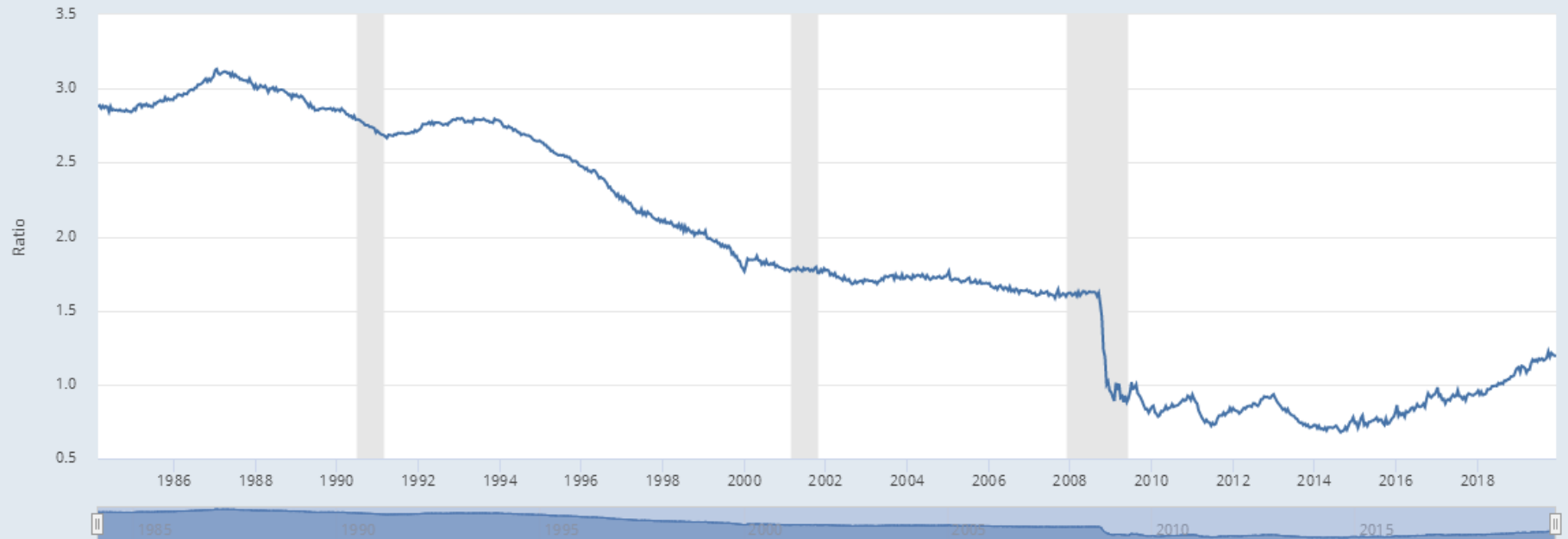
Units:Ratio,
Seasonally Adjusted**Frequency:**Biweekly,
Ending Wednesday

1Y | 5Y | 10Y | Max

1984-02-1! to 2019-12-0!

[EDIT GRAPH](#)

FRED — M1 Money Multiplier (DISCONTINUED)



U.S. recessions are shaded; the most recent end date is undecided.

Source: Federal Reserve Bank of St. Louis

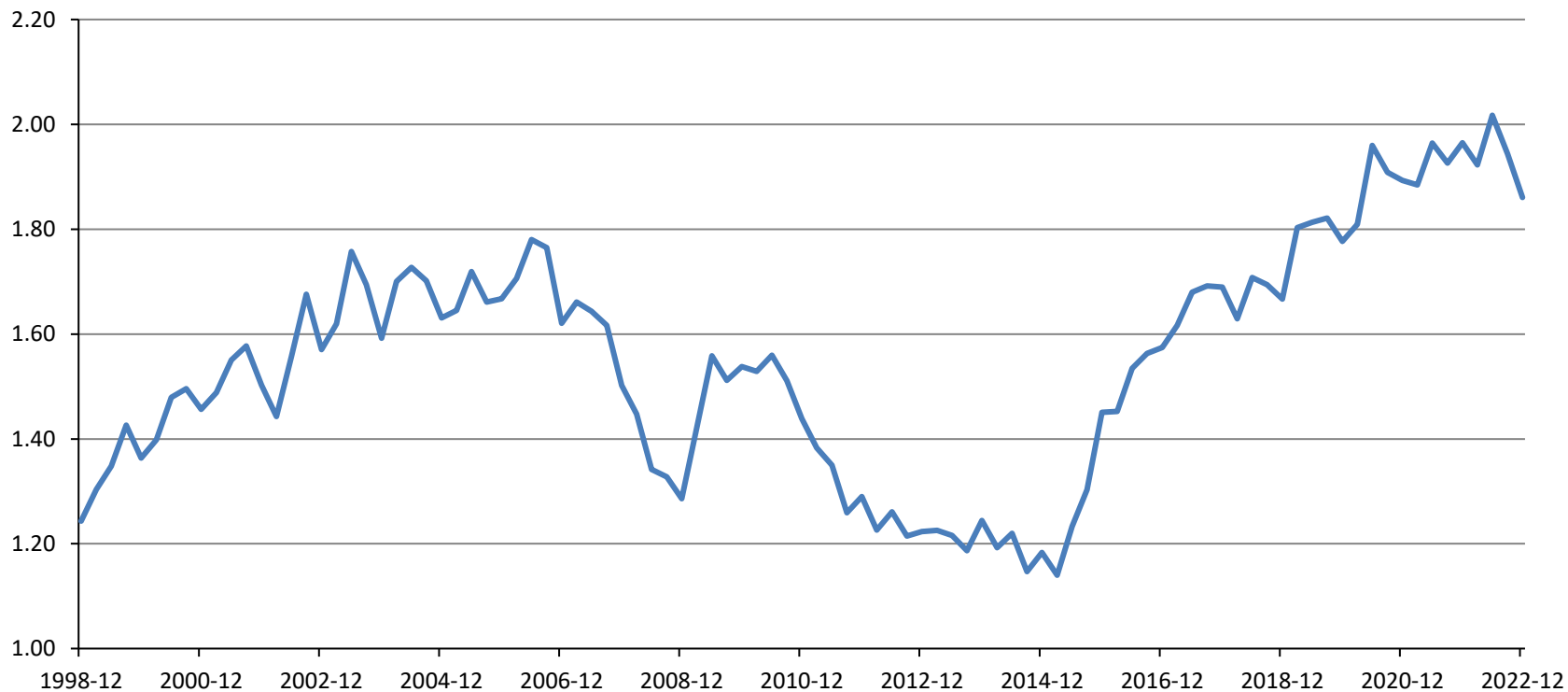
fred.stlouisfed.org



Since Dec 2008, the money multiplier (M1) has been less than 1 for long time.

中国:M1货币乘数

M1乘数



CASE STUDY:

Quantitative Easing

- *Quantitative easing*: the Fed bought long-term govt bonds instead of T-bills to reduce long-term rates.
长期国债 短期国债
- 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

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

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

CASE STUDY:

Bank failures in the 1930s

	<i>August 1929</i>	<i>March 1933</i>	<i>% change</i>
<i>M</i>	26.5	19.0	−28.3%
<i>C</i>	3.9	5.5	41.0
<i>D</i>	22.6	13.5	−40.3
<i>B</i>	7.1	8.4	18.3
<i>C</i>	3.9	5.5	41.0
<i>R</i>	3.2	2.9	−9.4
<i>m</i>	3.7	2.3	−37.8
<i>rr</i>	0.14	0.21	50.0
<i>cr</i>	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.

中国《存款保险条例》于2015年5月1日开始实施。

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.

Exercise

2. Explain how each of the following events affects the ^Bmonetary base, the money ^mmultiplier, and the money ^Msupply.

- a. The Federal Reserve buys bonds in an open market operation.
 $B \uparrow$ m^- $M \uparrow$
- b. The Fed increases the interest rate it pays banks for holding reserves. $(rr \uparrow)$ $B \uparrow$ $m \downarrow$ $M \downarrow$
- c. The Fed reduces its lending to banks through its Term Auction Facility.
 $B \downarrow$ m^- $M \downarrow$
- d. Rumors about a computer virus attack on ATM machines increase the amount of money people hold as currency rather than demand deposits.
 B^- $m \downarrow$ $M \downarrow$
- e. The Fed flies a helicopter over 5th Avenue in New York City and drops newly printed \$100 bills.
 $B \uparrow$ $m_{-or} \downarrow$ $M \uparrow$