

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*
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

Discussion Question

Which of these are money?

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

The money supply and monetary policy 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.' 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, April 2012

symbol	assets included	amount (\$ billions)
C	Currency	1,035
M1	C + demand deposits, travelers' checks, other checkable deposits	2,248
M2	M1 + small time deposits, savings deposits, money market mutual funds, money market deposit accounts	9,842

Banks' role in the monetary system

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

$$**M = C + D**$$

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

A few preliminaries

- **Reserves (R)**: 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 $C = \$1,000$.

Reserve requirement

Deposit Creation: The Banking System

Bank A				Bank A			
Assets		Liabilities		Assets		Liabilities	
Reserves	+\$100 m	Checkable deposits	+\$100 m	Reserves	+\$10	Checkable deposits	+\$100 m
				Loans	+\$90		

Bank B				Bank B			
Assets		Liabilities		Assets		Liabilities	
Reserves	+\$90	Checkable deposits	+\$90	Reserves	+\$9	Checkable deposits	+\$90
				Loans	+\$81		

Table 1 Creation of Deposits (assuming 10% reserve requirement and a \$100 increase in reserves)

Creation of Deposits (assuming 10% reserve requirement and a \$100 million increase in reserves)			
Bank	Increase in Deposits (\$)	Increase in Loans (\$)	Increase in Reserves (\$)
First National	0.00	100.00 m	0.00
A	100.00 m	90.00 m	10.00 m
B	90.00 m	81.00 m	9.00 m
C	81.00 m	72.90 m	8.10 m
D	72.90 m	65.61 m	7.29 m
E	65.61 m	59.05 m	6.56 m
F	59.05 m	53.14 m	5.91 m
.	.	.	.
.	.	.	.
.	.	.	.
Total for all banks	1,000.00 m	1,000.00 m	100.00 m

Deriving The Formula for Multiple Deposit Creation

Assuming banks do not hold excess reserves

Required Reserves (RR) = Total Reserves (R)

RR = Required Reserve Ratio (r) times the total amount of checkable deposits (D)

Substituting

$$r \times D = R$$

Dividing both sides by r

$$D = \frac{1}{r} \times R$$

Taking the change in both sides yields

$$\Delta D = \frac{1}{r} \times \Delta R$$

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.

How Central Banks affect the Money Supply

- Open market operations
- Discount rate
- Reserve requirements

Bank capital, leverage, and capital requirements

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

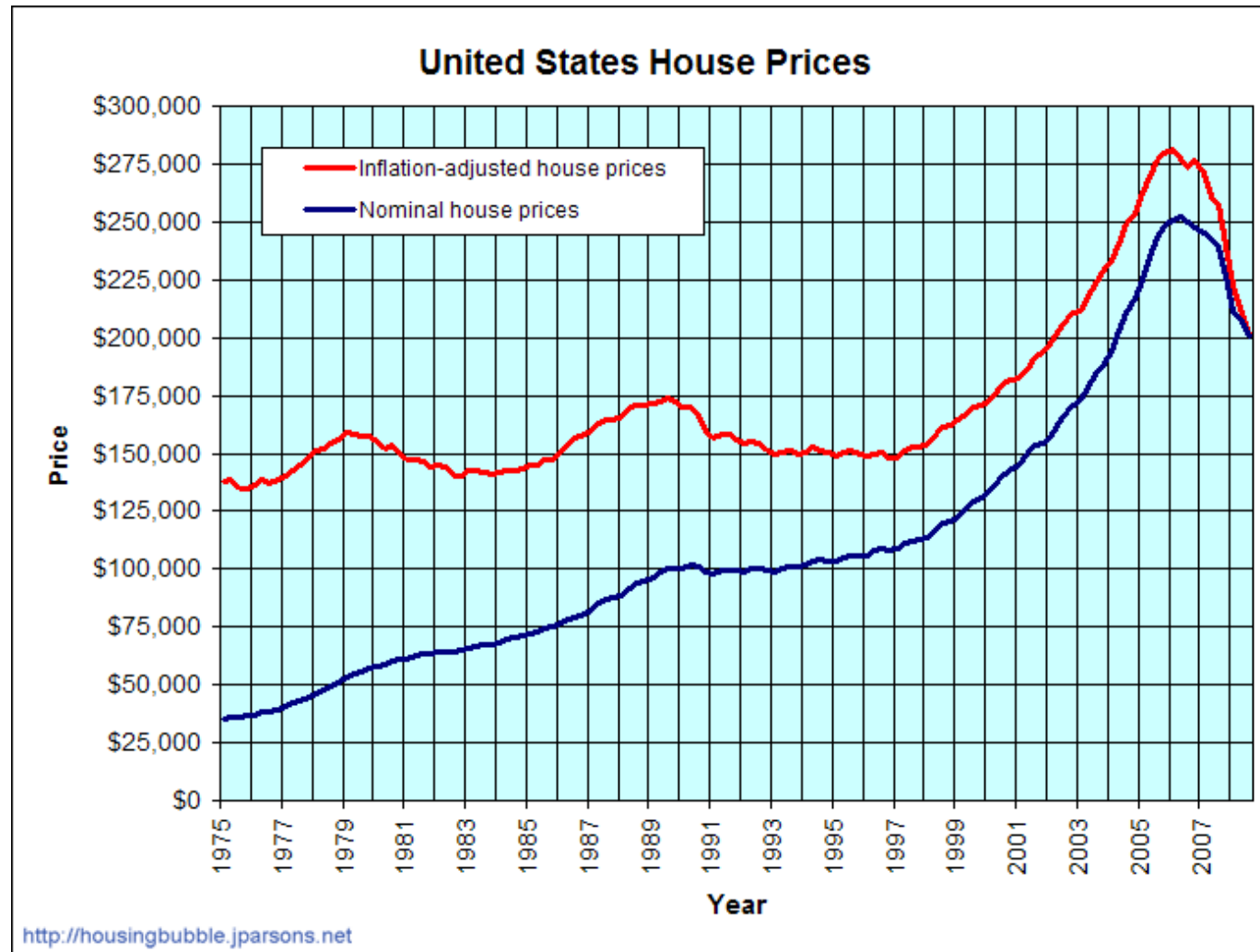
Assets		Liabilities and Owners' Equity	
Reserves	\$200	Deposits	\$750
Loans	500	Debt	200
Securities	300	Capital (owners' equity)	50

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

The danger of high leverage ratio



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

How about if total assets drop 10%?

Consequences of insolvency

- Assets < liabilities
- Owners' equity < 0
- Owners aren't liable for the shortage
 - Limited liability for corporate owners

Bank Failures

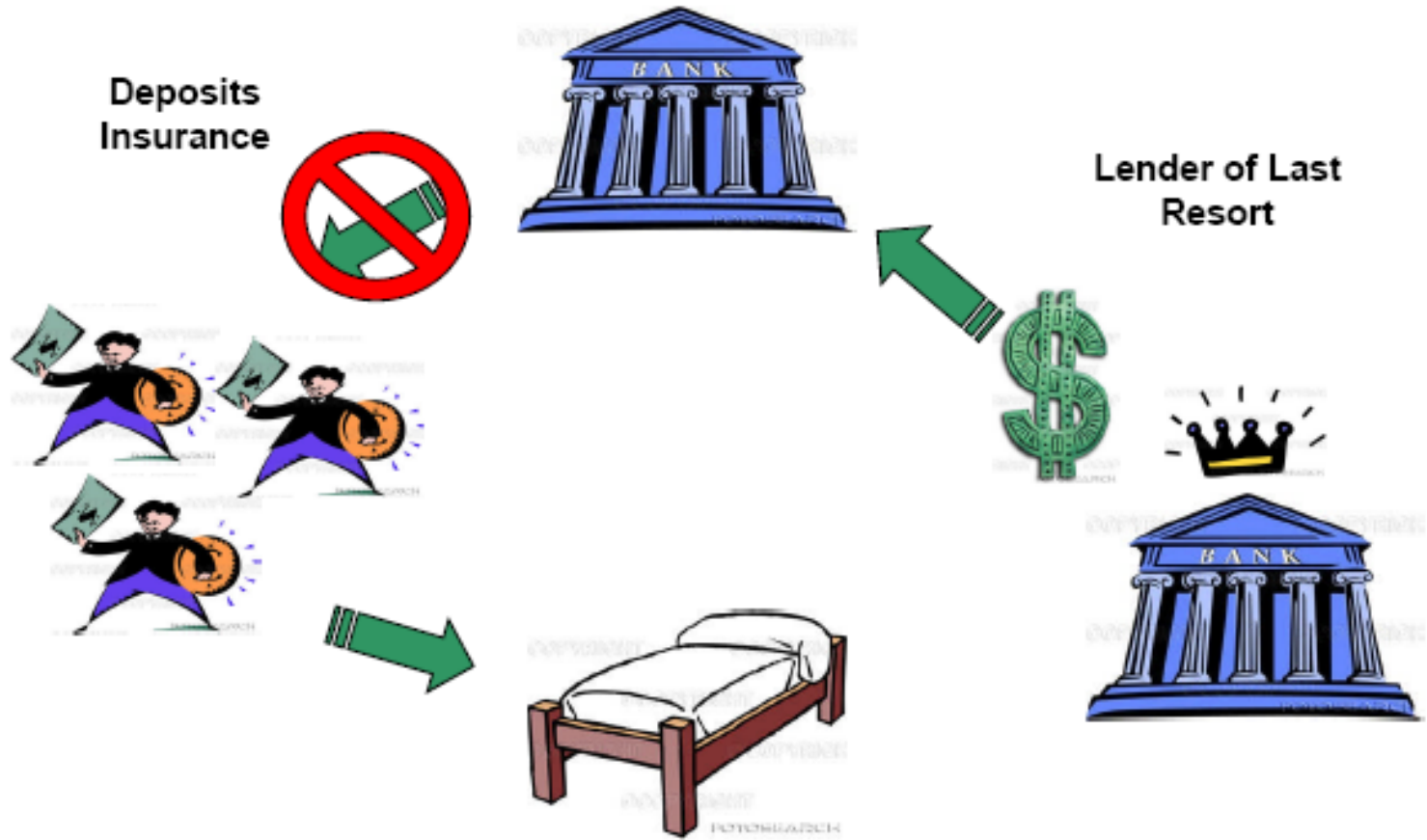
- In 2005 and 2006, # of bank failure = 0.
- In 2007, # of bank failures = 3.
- In 2008, # of bank failures = 25
- In 2009, # of bank failures = 140
- In 2010, # of bank failures = 157
- In 2011, # of bank failures = 92
- In 2012, # of bank failures = 51

- These numbers do not include investment banks.

Fear of insolvency

- Creditors' fears of insolvencies can lead to
 - Runs
 - Refusals to lend

Classic Bank Run



Refusal to lend

- Financial institutions become more reluctant to make
 - * not only mortgage loans,
 - * but other types of loans:

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 capital into banks to ease the crisis and encourage more lending.

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: Now, want to show the M supply in terms of these three exogenous Variables.

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

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

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

- If $\mathbf{rr} < 1$, then $\mathbf{m} > 1$
- If monetary base changes by $\Delta\mathbf{B}$, then $\Delta\mathbf{M} = \mathbf{m} \times \Delta\mathbf{B}$
- \mathbf{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

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

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.

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.

An Example: Case A:

- B: is also called high power money,
- Suppose $B=500$ billion. And c_r is 0.4 and r_r is 0.1.
- What is the money multiplier?
- What is the total money supply?

An Example: Case B

- B: is also called high power money,
- Suppose $B=500$ billion. Now due to financial crisis, cr suddenly become 0.8 and rr remains at 0.1 .
- What is the money multiplier?
- What is the total money supply?

An Example: Case C

- B: is also called high power money,
- Suppose $B=500$ billion. If c_r remains at 0.4 and banks become more reluctant to lend and keep a lot of reserves in the bank and r is 0.4.
- What is the money multiplier?
- What is the total money supply?

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**: 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

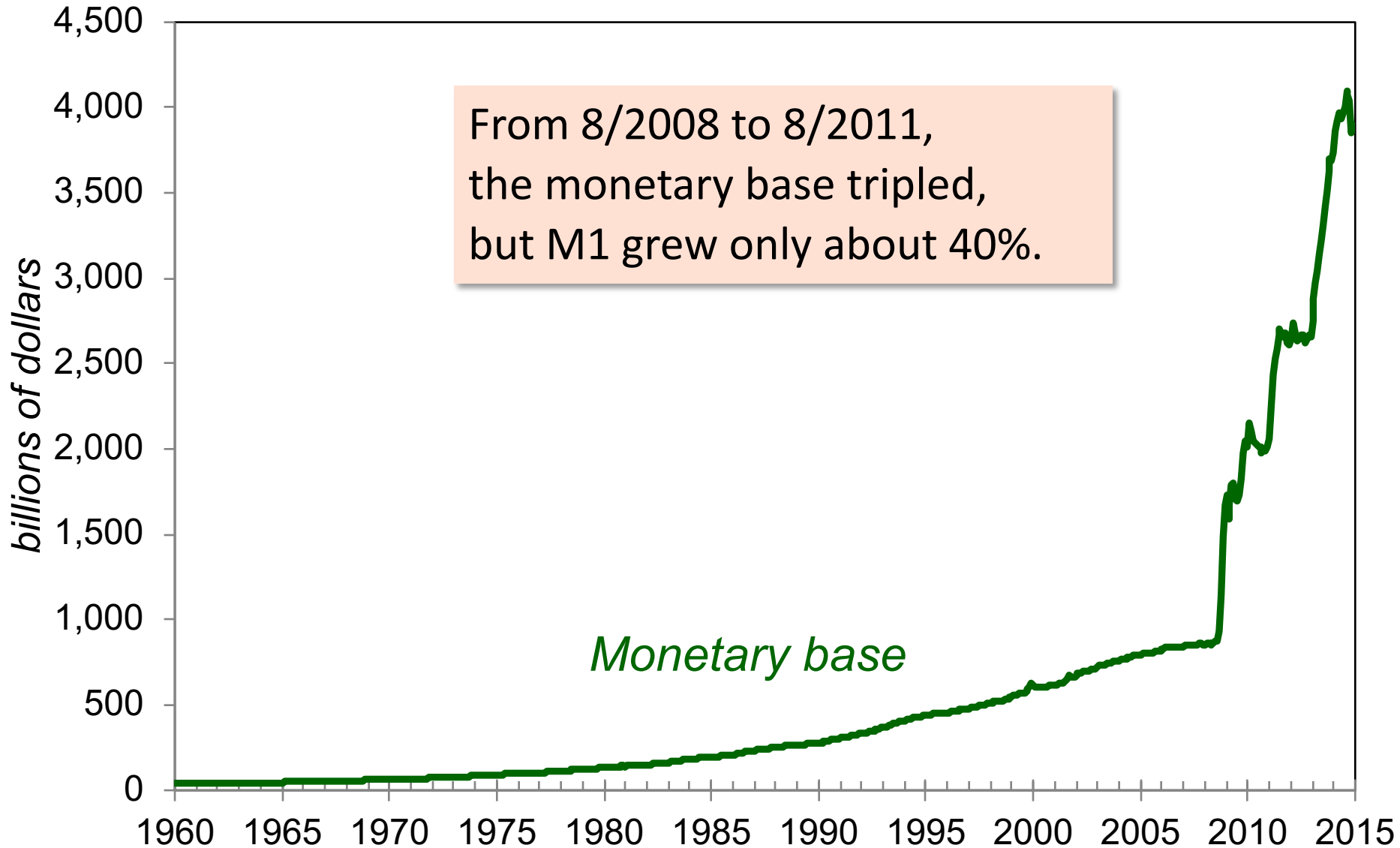
- **reserve requirements**: Fed regulations that impose a minimum reserve-deposit ratio
 - To reduce the reserve-deposit ratio, the Fed could reduce reserve requirements
- **interest on reserves**: the Fed pays interest on bank reserves deposited with the Fed
 - To reduce the reserve-deposit ratio, the Fed could pay a lower interest rate on reserves

Why the Fed can't precisely control M

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

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

CASE STUDY: Quantitative Easing



CASE STUDY:

Quantitative Easing

- *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

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

- Loss of confidence in banks
 $\Rightarrow \uparrow \mathbf{cr} \Rightarrow \downarrow \mathbf{m}$
- Banks became more cautious
 $\Rightarrow \uparrow \mathbf{rr} \Rightarrow \downarrow \mathbf{m}$

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.

CHAPTER SUMMARY

Money

- def: 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.