

# EE432 Monetary Theory and Policy



Final Exam Recap I  
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# Chapter 17



## The Central Bank Balance Sheet and the Money Supply Process

# The Central Bank's Balance Sheet

**Figure 17.1**

The Central Bank's Balance Sheet

	<b>Assets</b>	<b>Liabilities</b>
Government's bank	Securities Foreign exchange reserves	Currency Government's account
Bankers' bank	Loans	Accounts of the commercial banks (reserves)

# The Monetary Base

- Together, **currency in the hands of the public** and **reserves in the banking system** make up the **monetary base**.
  - This is the privately held **liabilities of the central bank**.
  - It is also called **high-powered money**.
- The central bank can **control** the **size** of the **monetary base**.

# Changing the Size and Composition of the Balance Sheet

- The *central bank can simply **buy things** and then **create liabilities to pay for them**, which **increase the size** of its balance sheet as much as it wants.*

## 1. Open Market Operation

- *Buying or selling a security initiated by the central bank.*

## 2. Foreign Exchange Intervention

- *Buy or sell foreign exchange reserves initiated by the central bank.*

## 3. Extend a discount loan, initiated by commercial banks.

## 4. Decision by an individual to **withdraw cash** from their banks

# Open Market Operations

- When the central bank buys or sells securities in financial markets, it engages in **open market operations**.

Figure 17.2

Balance Sheet Changes after the Federal Reserve Purchases a U.S. Treasury Bond

## A. Federal Reserve's Balance Sheet

Assets		Liabilities	
Securities (U.S. Treasury bond)	+\$1 billion	Reserves	+\$1 billion

## B. Banking System's Balance Sheet

Assets		Liabilities	
Reserves	+\$1 billion		
Securities (U.S. Treasury bond)	-\$1 billion		

# Foreign Exchange Intervention

- If the **central bank** *buy German government bonds (securities)* from **commercial banks**.
- The **payment** is *credited directly* to the **reserve account** of the *commercial bank* from which the bonds were bought.

**Figure 17.3**

Balance Sheet Changes after the Federal Reserve Purchases a German Government Bond

A. Federal Reserve's Balance Sheet		B. Banking System's Balance Sheet	
Assets	Liabilities	Assets	Liabilities
Foreign exchange reserves +\$1 billion (German government bonds in euros)	Reserves +\$1 billion	Reserves +\$1 billion Securities -\$1 billion (German government bonds)	

# Discount Loans

- Commercial banks *ask for loans*

Figure 17.4

Balance Sheet Changes after the Federal Reserve Makes a Discount Loan

A. Federal Reserve's Balance Sheet				B. Banking System's Balance Sheet			
Assets		Liabilities		Assets		Liabilities	
Discount loans	+\$100 million	Reserves	+\$100 million	Reserves	+\$100 million	Discount loans	+\$100 million

- For the commercial bank, it is a **liability** *matched by an increase in* the level of its **reserve account**.
- For the central bank, the **loan** is an **asset** that is created in exchange for *a credit to the commercial bank reserve account*, and **expands the monetary base**.

# Cash Withdrawal

- When **individual** *takes cash from an ATM*, it **changes the central bank's balance sheet**.
  - **shift** from **reserves** to **currency** on the central bank's balance sheet.

# Cash Withdrawal

Figure 17.5

Balance Sheet Changes after a Private Person Withdraws Cash from His or Her Bank Account

## A. Nonbank Public's Balance Sheet

Assets		Liabilities	
Currency	+\$100		
Checkable deposits	-\$100		

## B. Federal Reserve's Balance Sheet

Assets		Liabilities	
		Currency	+\$100
		Reserves	-\$100

## C. Banking System's Balance Sheet

Assets		Liabilities	
Reserves	-\$100	Checkable deposits	-\$100

- **Individual assets** *shift* from checkable deposits to cash. For the **central bank**, the *change* comes in the *composition of liabilities*.
- By *withdrawing cash* from **commercial bank**, individual decreased the banking system's **reserves**.

# The Deposit Expansion Multiplier

- **Central bank liabilities** form the base on which the **supplies of money and credit** are built.
  - This is why they are called the **monetary base**.
  - The central bank **controls** the **monetary base**.
- Our primary interest, however, is in the **broader measure of money** which are *multiples of the monetary base*.
  - M1.
  - M2.

# Deposit Expansion in a System of Banks

- We start with the following assumptions:
  - **Banks** hold *no excess reserves*.
  - The **reserve requirement ratio** is **10%**.
  - **Currency holding** does not change when deposits and loans change.
  - *When a borrower writes a check, none* of the recipients of the funds **deposit them back in the bank** that *initially made the loan*.

# Deposit Expansion in a System of Banks

- Suppose OBI company pays \$100,000 to American Steel.
- **American Steel** deposits \$100,000 into **Second Bank**.
- **Second Bank's** reserve account at the Fed is *credited with \$100,000*.
- Second Bank will **make a loan** of its *now excess reserves minus the 10% they are required to hold*.
- The **new loan** is *deposited into Third Bank* and the process continues.

# Deposit Expansion in a System of Banks

**Figure 17.7**

Changes in Balance Sheets

## A. Second Bank after American Steel's Deposit

Assets		Liabilities	
Reserves	+\$100,000	American Steel's checking account	+\$100,000

## B. Second Bank after Extension of a Loan

Assets		Liabilities	
Reserves	+\$10,000	American Steel's checking account	+\$100,000
Loan	+\$90,000		

## C. Third Bank after Deposit and Extension of a Loan

Assets		Liabilities	
Reserves	+\$ 9,000	Checking account	+\$90,000
Loan	+\$81,000		

# Deposit Expansion in a System of Banks

**Table 17.3**

Multiple Deposit Expansion following a \$100,000 Open Market Purchase  
Assuming a 10% Reserve Requirement

Bank	Increase in Deposits	Increase in Loans	Increase in Reserves
First Bank	\$ 0	\$ 100,000	\$ 0
Second Bank	\$ 100,000	\$ 90,000	\$ 10,000
Third Bank	\$ 90,000	\$ 81,000	\$ 9,000
Fourth Bank	\$ 81,000	\$ 72,900	\$ 8,100
Fifth Bank	\$ 72,900	\$ 65,610	\$ 7,290
Sixth Bank	\$ 65,610	\$ 59,049	\$ 6,561
.	.	.	.
.	.	.	.
.	.	.	.
The Banking System	\$1,000,000	\$1,000,000	\$100,000

# Deposit Expansion in a System of Banks

- We can *derive* a formula for the **deposit expansion multiplier**
- Let's begin by *assuming* there is *only one bank and everyone must use it*.
- The **level of reserves**, then, is just the **required reserve ratio**  $r_D$  *times* its **deposits**.
- If **required reserves** are RR and **deposits** are D, then the **level of reserves** can be *expressed as*:

$$RR = r_D D.$$

# Deposit Expansion in a System of Banks

- Any **change in deposits** creates a corresponding **change in reserves**:

$$\Delta RR = r_D \Delta D$$

- The **change in deposits** is:

$$\Delta D = \frac{1}{r_D} \Delta RR$$

- For *each dollar increase in reserves, deposits increase by  $(1/r_D)$ .*

# The Arithmetic of the Money Multiplier

- The *money multiplier* shows how the **quantity of money** is *related to the monetary base*.
- If we label the **quantity of money**  $M$  and the **monetary base**  $MB$ , the **money multiplier**  $m$  is defined as:

$$M = m \times MB$$

# The Arithmetic of the Money Multiplier

- We will start with the following relationships:
  - **Money** equals **currency,  $C$ , plus checkable deposits,  $D$ ,**
  - **The monetary base  $MB$  equals **currency plus reserves in the banking system  $R$ , and****
  - **Reserves equal **required reserves  $RR$  plus excess reserves  $ER$ .****

$$M = C + D$$

$$MB = C + R$$

$$R = RR + ER$$

# The Arithmetic of the Money Multiplier

- We know that **banks** holdings of *required reserves* depends on the **required reserve ratio**  $r_D$ .
- The amount of excess reserve a bank holds depends on the *costs and benefits of holding them*.
  - The *higher the interest rate* on loans, the *lower banks' excess reserves*, and
  - The *greater banks' concern* over the *possibility of deposit withdrawals*, the *higher their excess reserves*.

# The Arithmetic of the Money Multiplier

- Labeling the **excess reserve-to-deposit ratio**  $\{ER/D\}$ , we can rewrite the reserve equation as:

$$\begin{aligned}R &= RR + ER \\ &= r_D D + \{ER/D\}D \\ &= (r_D + \{ER/D\})D\end{aligned}$$

- Banks ***hold reserves*** as a ***proportion of their deposits***.

# The Arithmetic of the Money Multiplier

- The **currency-to-deposit ratio**,  $\{C/D\}$ , is the *fraction of deposits that people hold as currency*.

$$C = \{C/D\}D$$

- The **decision of how much currency to hold** depends on the costs and benefits as well.
  - The **cost of currency** is the *interest it would earn on deposit*.
  - The **benefit** is its *lower risk and greater liquidity*.

# The Arithmetic of the Money Multiplier

- Putting this all together, we can see to following.

$$\begin{aligned} MB &= C + R \\ &= \{C/D\}D + (r_D + \{ER/D\})D \\ &= (\{C/D\} + r_D + \{ER/D\})D \end{aligned}$$

- The **monetary base** has three uses:
  - **Required reserves**
  - **Excess Reserves**
  - **Cash in the hands** of the nonbank public

# The Arithmetic of the Money Multiplier

- We can do the same with the **equation for money**.

$$\begin{aligned}M &= C + D \\ &= \{C/D\}D + D \\ &= (\{C/D\} + 1)D\end{aligned}$$

# The Arithmetic of the Money Multiplier

- We can use the **equation for  $MB$**  to ***solve for deposits***:

$$D = \frac{1}{\{C/D\} + r_D + \{ER/D\}} \times MB$$

- And **substituting  $D$**  into the **money equation**:

$$M = \frac{\{C/D\} + 1}{\{C/D\} + r_D + \{ER/D\}} \times MB$$

# The Arithmetic of the Money Multiplier

The **quantity of money** in the economy *depends on*:

1. The **monetary base**, which is controlled by Fed,
2. The **reserve requirement**,
3. The ***bank's desire to hold excess reserves***, and
4. The nonbank **public's demand for currency**.

# The Limits on the Central Bank's Ability to Control the Quantity of Money

- The **various factors** *affecting the quantity of money change over time.*
  - **Market interest rates** affect the *cost of holding both excess reserves and currency.*
  - **As interest rates increase**, we expect to see **{ER/D}** and **{C/D}** fall.
    - This **increases the money multiplier** and **the quantity of money.**

# The Limits on the Central Bank's Ability to Control the Quantity of Money

- If these changes in the money multiplier were predictable, the *central bank might choose to exploit this link in its policymaking.*
- Although this made sense in the U.S. in the 1930s, **it no longer does.**
- In a financial crisis, **other balance-sheet tools** help address *liquidity needs and market disruptions more directly.*

# Chapter 18



## Monetary Policy: Stabilizing the Domestic Economy

# Introduction

- Between September 2007 and December 2008, the **FOMC lowered its target for the federal funds rate 10 times**.
- This was the first time since the 1930s that the **nominal federal funds rate hit zero**.
  - **Zero lower bound**: the idea that a *nominal interest rate cannot fall below zero*
  - **Effective lower bound**: the *nominal interest rate level below which intermediaries and their customers will switch from bank deposits to holding cash*.

# Introduction

- To steady the financial system and the economy *after the crisis*, the **Fed** *utilized* its three of its **conventional policy tools**:
  - The *target range* for the **federal funds rate**
  - The **interest rate on excess reserves (IOER rate)**
  - The *rate* for **discount window lending**
- Policymakers then proceeded to develop and use a variety of **unconventional policy tools** including:
  - **Massive purchases of risky assets** in fragile markets
  - **Communicating its intent to keep interest rates low over an extended period**

# The Federal Reserve's Conventional Policy Toolbox

The Fed has **four** leading *conventional monetary policy tools*, also known as *policy instruments*:

1. The **target federal funds rate range**
2. The **interest rate on excess reserves (IOER rate)**
3. The **discount rate**
4. The **reserve requirement**

# The Federal Reserve's Conventional Policy Toolbox

- An important **supplementary tool** for monetary policy used by the Fed: ***overnight reverse repo (ON RRP) rate***.
  - Serves to ***keep the market federal funds rate close to the IOER rate***
  - Can be **used to set a floor under the market federal funds rate**

# The Target Federal Fund Rate

- Prior to the financial crisis, the **target federal fund rate** was the *FOMC's primary policy instrument*.
- The **federal funds rate** is the *rate at which banks lend reserves to each other overnight*.
  - It is *determined in the market* and not controlled by the Fed.
- The target federal funds rate are set by the **FOMC**, and the **market federal funds rate**, at which transactions between banks take place.

# The Interest on Excess Reserves

- *Discrepancies between **actual** and **desired reserves** gave rise to a market for reserves.*
  - Some banks can *lend out excess reserves*.
  - Some banks will *borrow to cover a shortfall*.
- *Without this market, banks would need to **hold substantial** quantities of **excess reserves** as insurance against shortfalls.*

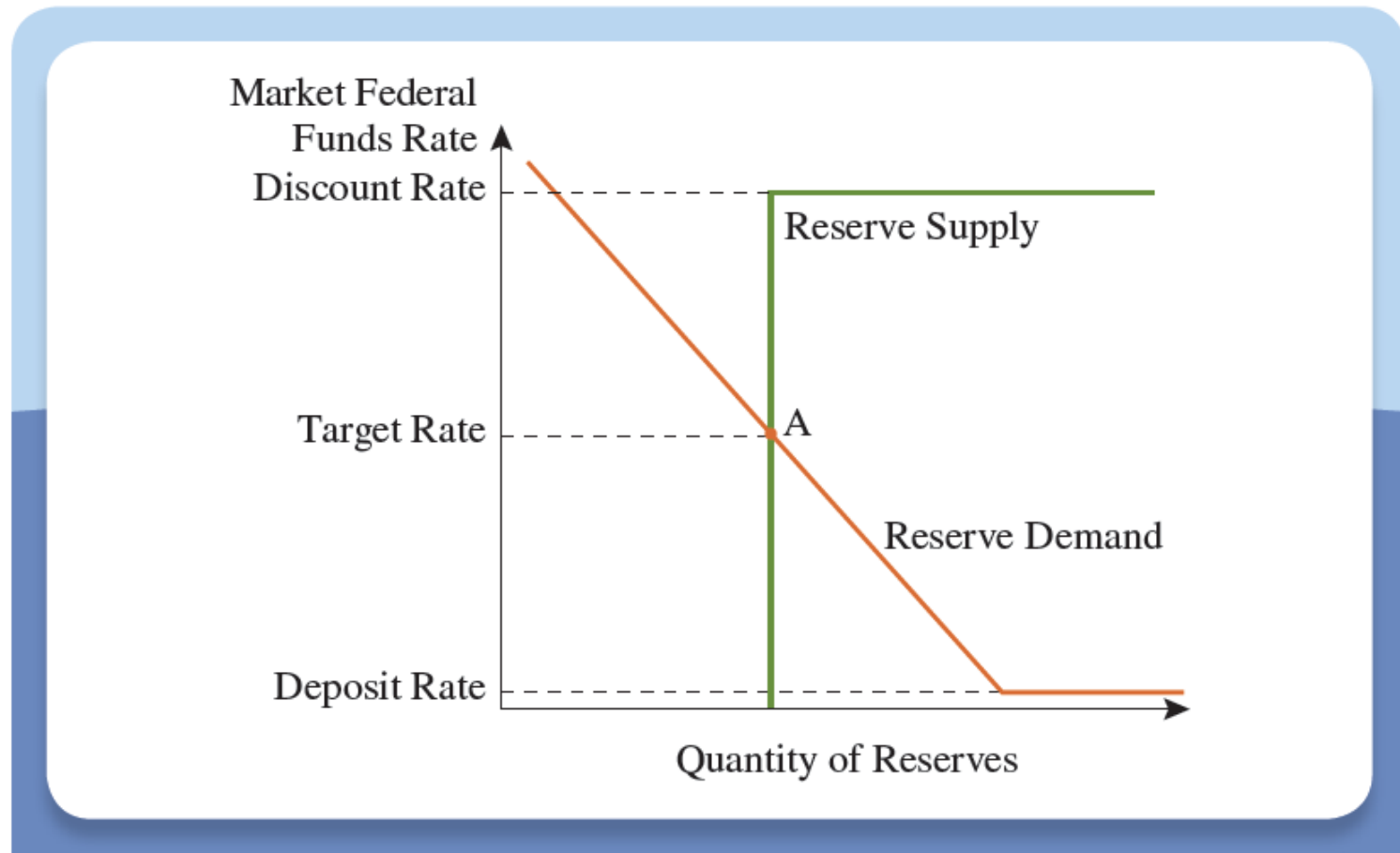
# The Target Federal Fund Rate and the Interest on Excess Reserves

- As the market *federal funds rate rises*, banks demand *fewer reserves*
- The **Fed** continues to be the *monopoly supplier of aggregate bank reserves*.
- By **buying or selling securities** in the market through an *open market operation (OMO)*, the Fed could *increase or decrease the supply of reserves* in order to *lower or raise the market federal funds rate*.

# The Target Federal Fund Rate and the Interest on Excess Reserves

Figure 18.2

The Market for Bank Reserves prior to September 2008



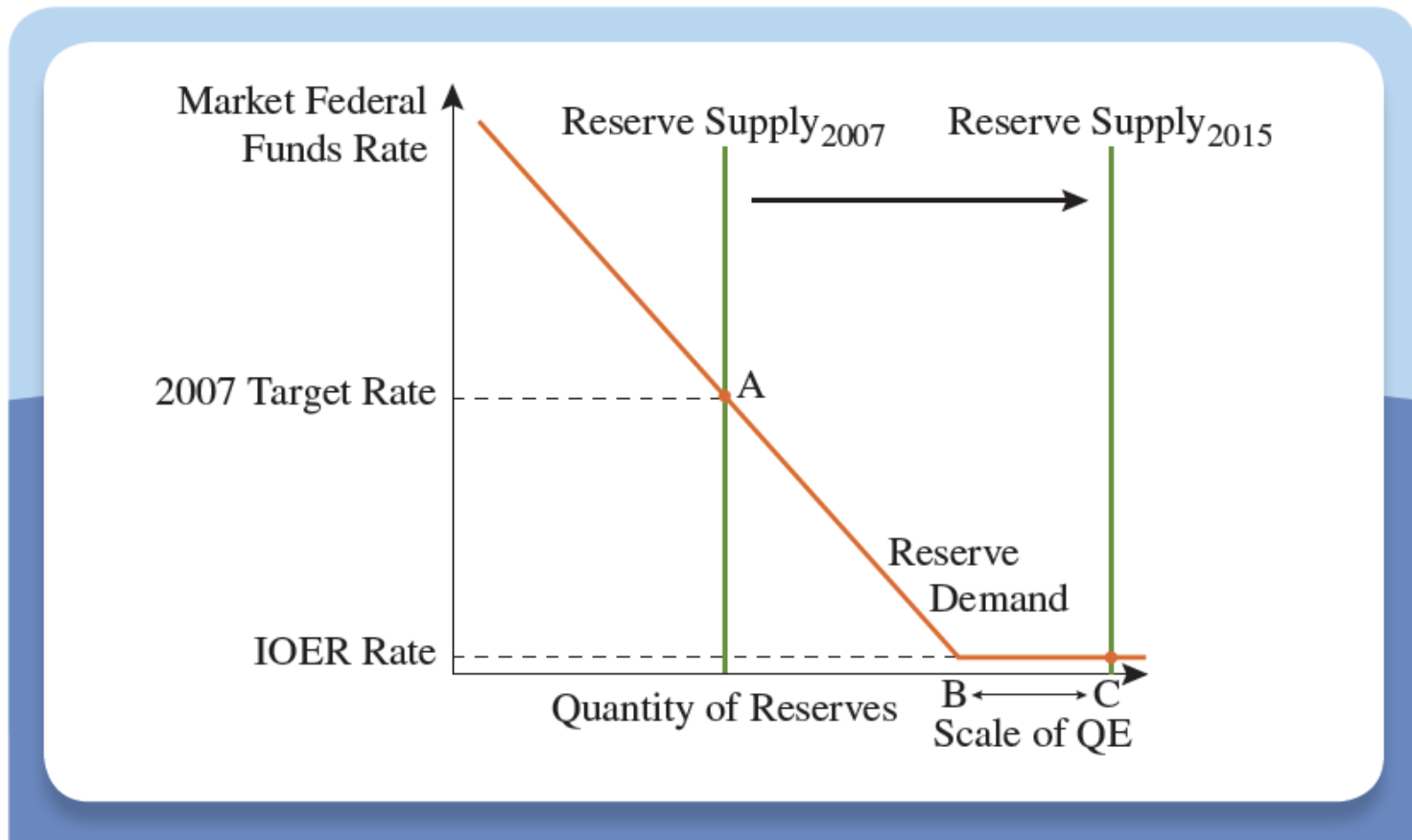
# The Target Federal Fund Rate and the Interest on Excess Reserves

- *During the financial crisis, the Fed lowered its policy target close to zero, and engaged in **quantitative easing** making large-scale asset purchases to increase the supply of reserves far beyond the level needed to **keep the federal funds rate near zero**.*
  - Policymakers began specifying a target range, *instead of a target level for the federal funds rate*
  - The **IOER rate** forms the upper limit of the target of the target range

# The Target Federal Fund Rate and the Interest on Excess Reserves

Figure 18.3

The Market for Reserves with Quantitative Easing (QE) after September 2008



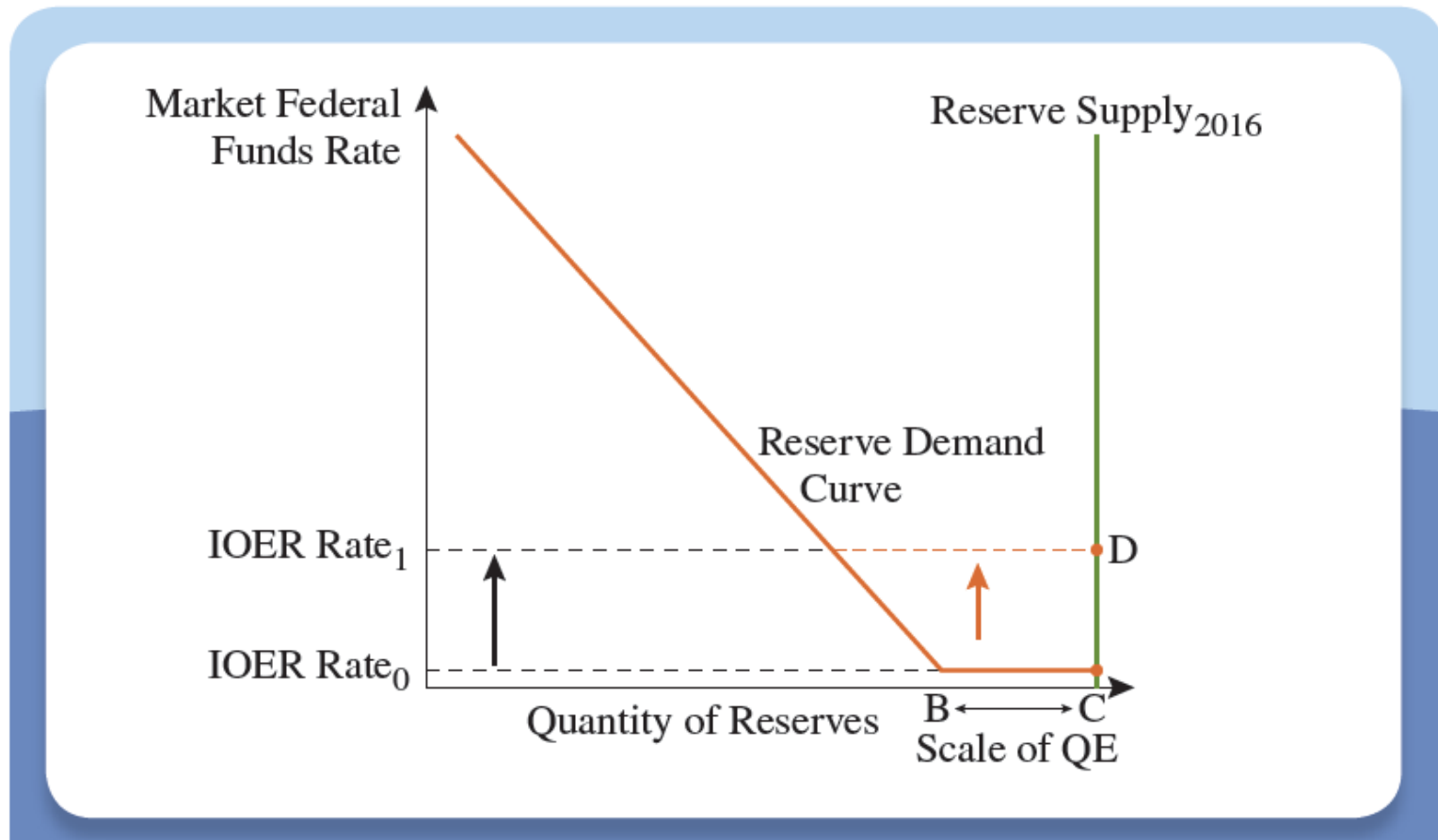
# The Target Federal Fund Rate and the Interest on Excess Reserves

- **Tightening monetary policy** through the **IOER rate**
  - If there is an **increase** in the target range for the federal funds rate, the Fed will **raise the IOER rate**; **raising the minimum rate** at which banks are **willing to lend**
  - Allows the FOMC to **raise interest rates**, **tightening financial conditions**, **without** altering the supply of reserves

# The Target Federal Funds Rate and the Interest on Excess Reserves

Figure 18.4

Tightening Monetary Policy by Increasing the IOER Rate



# Discount Lending, the Lender of Last Resort, and Crisis Management

- By ***controlling*** the **quantity of loans** it makes, a *central bank can control*:
  - The **size of reserves**
  - The **size of the monetary base**
  - **Interest rates**
- *Today, lending* by the Federal Reserve Banks **to commercial banks**, called **discount lending**, is *usually small* aside from crisis periods.

# Discount Lending, the Lender of Last Resort, and Crisis Management

- **Discount lending** is the Fed's primary tool for:
  - Ensuring **short-term financial stability**
  - **Eliminating bank panics**
  - **Preventing the sudden collapse** of institutions that are experiencing financial difficulties
- The central bank is the **lender of last resort**:
  - *Making loans to banks when no one else will or can.*

# Discount Lending, the Lender of Last Resort, and Crisis Management

The **Fed** makes *three types of loans*:

1. **Primary credit**
  2. **Secondary credit**
  3. **Seasonal credit**
- The **Fed** controls the **interest rate** on these loans, **not** the quantity of credit extended.
  - The **banks** decide how much to borrow.

# Reserve Requirements

- The Federal Reserve Board has had the authority to set the ***reserve requirements***.
  - These are the **minimum level of reserves** *banks must hold* either as *vault cash* or on *deposit at the Fed*.
- *Changes in the reserve requirement* affect the ***money multiplier*** and the ***quantity of money and credit circulating*** in the economy.
- In the U.S., the *reserve requirement turns out not to be very useful*.

# Linking Tools to Objectives: Making Choices

- **Monetary policymakers' goals are:**
  - *Low and stable inflation*
  - *High and stable growth*
  - *A stable financial system*
  - *Stable interest and exchange rates*

# Linking Tools to Objectives: Making Choices

A consensus has developed among monetary policy experts that:

1. The **reserve requirement** is *not useful as an operational instrument*,
2. **Central bank lending** is *necessary* to ensure **financial stability**, and
3. **Short-term interest rates** are the *conventional tool* to use to *stabilize short-term fluctuations in prices and output*.

# Desirable Features of a Policy Instrument

A good monetary policy instrument has *three features*:

1. It is easily observable by everyone.
  - Ensures *transparency* in policymaking, which enhances *accountability*.
2. It is controllable and quickly changed.
  - An instrument that can be *adjusted quickly* in the face of a *sudden change* in economic conditions is clearly more useful
3. It is **tightly linked to the policymakers' objectives**.
  - The *more predictable* the impact of an instrument, the *easier* it will be for policymakers *to meet their objectives*

# Inflation Targeting

- **Inflation targeting** focuses on the objective of *low and stable inflation*
- It is a monetary policy strategy that involves *public announcement* of a numerical inflation target and underscores the central bank's commitment to price stability.
- When the *target is credible, inflation will be low*

# Inflation Targeting

- Long-term expectations of *low inflation* act to anchor low long-term *interest rates* and *promote economic growth*.
- **Hierarchical mandate** in which **price stability comes first** and everything else comes second
  - The ECB, Australia, Chile, South Africa, United Kingdom, and dozens of other countries
- **Dual mandate** in which the **goal of price stability and maximum employment are equal**
  - The Fed

# Inflation Targeting

- *Increases policymakers **accountability** and helps establish their **credibility***
- *The result is not just lower and **more stable inflation**, but usually *higher and more stable economic growth**

# A Guide to Central Bank Interest Rates: The Taylor Rule

- The FOMC sets a **target range** for the federal funds rate and the **day** on which to make the changes.
- The **Taylor Rule** *tracks the actual behavior of the target federal funds rate and relates it to the real interest rate, inflation, and output.*

**Target fed funds rate =**

**Natural rate of interest + Current inflation +  $\frac{1}{2}$   
(Inflation gap) +  $\frac{1}{2}$  (Output gap)**

# A Guide to Central Bank Interest Rates: The Taylor Rule

- The **natural rate of interest** is the *real short-term interest rate that prevails when the economy is using resources normally*.
  - Taylor **originally used 2 percent**, which is *close to the average real short-term rate*

# A Guide to Central Bank Interest Rates: The Taylor Rule

- The **inflation gap** is *current inflation* minus an *inflation target* (both measured as percentages)
  - When *inflation* exceeds the target level, the **inflation gap** is *positive*
- The **output gap** is the percentage deviation of *current output (real GDP)* from *potential output*
  - When *current output* is above potential output, the **output gap** is *positive*

# A Guide to Central Bank Interest Rates: The Taylor Rule

- When **inflation rises above its target level**,
  - The response is to *raise interest rates*.
- When **output falls below the target level**,
  - The response is to *lower interest rates*.
- If *inflation is currently on target* and there is *no output gap*,
  - The *target federal funds rate* should be set at the **natural rate of interest plus target inflation**.

# A Guide to Central Bank Interest Rates: The Taylor Rule

- The Taylor rule has some interesting properties.
  - The increase in current inflation feeds *one for one* into the ***target federal funds rate***; however,
  - The increase in the inflation gap is halved.
- A **1 percentage point increase in the inflation rate** raises the **target federal funds rate 1½ percentage points**.

# Unconventional Policy Tools

- There are two circumstances when **unconventional policy** tools can *play a useful stabilization role*:
  1. When **lowering the target interest-rate to zero** is **not sufficient** to *stimulate the economy*
  2. When an **impaired financial system** prevents *conventional interest-rate policy* from supporting economic growth

# Unconventional Policy Tools

There are *three categories of unconventional policy* approaches:

## 1. **Forward guidance**

- This is when the *central bank communicates intentions* regarding the *future path of monetary policy*.

## 2. **Quantitative easing (QE)**

- When the *central bank supplies aggregate reserves beyond the quantity needed to lower the policy rate to its target*, usually zero or lower.

# Unconventional Policy Tools

## 3. Targeted asset purchases (TAP)

- When the central bank alters the *mix of assets it holds on its balance sheet* in order to change their relative prices in a way that *stimulates economic activity*.

# Forward Guidance

- The *simplest unconventional approach* is for the *central bank to provide forward guidance - guidance today about **policy target rates in the future***
- They might express the *intent to keep the policy target low for an extended period of time.*
  - This could have a *specific termination date*, or *duration* could be dependent on some future change in economic conditions.

# Forward Guidance

- To **stimulate economic activity**, *forward guidance* aims at **lowering the long-term interest rates** that affect private spending.
- To be effective, forward guidance *needs to be credible and time consistent*

# Forward Guidance

- *Although forward guidance can be effective, it is **difficult to anticipate** and difficult to **reach consensus on the desirable policy path** and to *communicate these policy intentions simply**
- The potential for disturbing side effects, including **asset price bubbles**

# Quantitative Easing

- **QE** occurs when the central bank *expands the supply of aggregate reserves beyond* the level that would be *needed to maintain its policy rate target*.
  - The central bank **buys assets**, thereby **expanding its overall balance sheet**.
- At a market federal funds rate equal to the *interest on excess reserves*, an **addition to aggregate reserves** no longer reduces the funds rate
  - The Fed can **add limitlessly to reserves** without affecting the market federal funds rate.

# Quantitative Easing

- It is difficult to predict the effects of QE.
- Fed policymakers argue their *balance sheet expansion helped to lower long-term interest rates*, but there is *disagreement on the impacts*.
- An *increase in the supply of reserves (QE)* may simply lead banks to **hold more** of them *rather than provide additional loans*.

# Quantitative Easing

- One mechanism is that *QE can add credibility to a policymaker's promise to keep interest rates low.*
- Announcements of an expansion of aggregate reserves (QE) could ***lower bond yields*** by *extending the time horizon* over which **bondholders expect a zero policy rate.**
  - QE may reinforce the impact of ***forward guidance***

# Quantitative Easing

- A problem with QE is that *central banks do not know how much is needed to be effective*.
- QE can be *powerful tool for central bankers to prevent a sustained deflation*, especially *when conventional policy tools have been exhausted*.

# Targeted Asset Purchases

- ***Targeted asset purchases (TAP)*** shift the *composition of the balance sheet* **toward selected assets** in order to **boost their relative price and stimulate economic activity**.
- In the absence of private demand for the risky asset, the **central bank's purchase** makes credit available where none existed.

# Making an Effective Exit

- What happens **when QE and TAP have vastly expanded the amount of reserves and assets** on the central bank's balance sheet?
  - The central bank *may need to sell a large volume of assets to reduce reserve supply sufficiently to raise the policy rate target.*
- ***But, QE and TAP assets are typically more difficult to sell.***
- A central bank *may be unable to sell assets and withdraw reserves from the banking system rapidly enough to hike the policy interest rate* when it desires.