After studying this chapter, you will be able to:

- Define money and describe its functions
- Explain the economic functions of banks and other depository institutions
- Describe the structure and functions of the Federal Reserve System (the Fed)
- Explain how the banking system creates money
- Explain what determines the demand for money, the supply of money, and the nominal interest rate
- Explain how the quantity of money influences the price level and the inflation rate in the long run

8

MONEY, THE PRICE LEVEL, AND INFLATION

Money, like fire and the wheel, has been around for a long time, and it has taken many forms. Money was wampum (beads made from shells) for North American Indians, whale's teeth for Fijians, and tobacco for early American colonists. Cakes of salt served as money in Ethiopia and Tibet. Today, when we want to buy something, we use coins or dollar bills, write a check, or swipe a debit card or a credit card. Soon, we'll be using a "smart card" or even a cell phone to make payments. Are all these things money?

The quantity of money in our economy is regulated by the Federal Reserve—the Fed. How does the Fed influence the quantity of money? And what happens if the Fed creates too much money or too little money?

In this chapter, we study the functions of money, the banks that create it, the Federal Reserve and its influence on the quantity of money, and the long-run consequences of changes in the quantity of money. In *Reading Between the Lines* at the end of the chapter, we look at the extraordinary actions taken by the Fed during the recent financial crisis.

What Is Money?

What do wampum, tobacco, and nickels and dimes have in common? They are all examples of **money**, which is defined as any commodity or token that is generally acceptable as a means of payment. A **means of payment** is a method of settling a debt. When a payment has been made, there is no remaining obligation between the parties to a transaction. So what wampum, tobacco, and nickels and dimes have in common is that they have served (or still do serve) as the means of payment. Money serves three other functions:

- Medium of exchange
- Unit of account
- Store of value

Medium of Exchange

A *medium of exchange* is any object that is generally accepted in exchange for goods and services. Without a medium of exchange, goods and services must be exchanged directly for other goods and services—an exchange called *barter*. Barter requires a *double coincidence of wants*, a situation that rarely occurs. For example, if you want a hamburger, you might offer a CD in exchange for it. But you must find someone who is selling hamburgers and wants your CD.

A medium of exchange overcomes the need for a double coincidence of wants. Money acts as a medium of exchange because people with something to sell will always accept money in exchange for it. But money isn't the only medium of exchange. You can buy with a credit card, but a credit card isn't money. It doesn't make a final payment, and the debt it creates must eventually be settled by using money.

Unit of Account

A *unit of account* is an agreed measure for stating the prices of goods and services. To get the most out of your budget, you have to figure out whether seeing one more movie is worth its opportunity cost. But that cost is not dollars and cents. It is the number of ice-cream cones, sodas, or cups of coffee that you must give up. It's easy to do such calculations when all these goods have prices in terms of dollars and cents (see Table 8.1). If the price of a movie is $8 and the price of a cappuccino is $4, you know right away that seeing one movie costs you 2 cappuccinos.

TABLE 8.1 The Unit of Account Function of Money Simplifies Price Comparisons

Good	Price in money units	Price in units of another good
Movie	$8.00 each	2 cappuccinos
Cappuccino	$4.00 each	2 ice-cream cones
Ice cream	$2 per cone	2 packs of jelly beans
Jelly beans	$1 per pack	2 sticks of gum
Gum	$0.50 per stick	

Money as a unit of account: The price of a movie is $8 and the price of a stick of gum is 50¢, so the opportunity cost of a movie is 16 sticks of gum ($8.00 ÷ 50¢ = 16).

No unit of account: You go to a movie theater and learn that the cost of seeing a movie is 2 cappuccinos. You go to a grocery store and learn that a pack of jelly beans costs 2 sticks of gum. But how many sticks of gum does seeing a movie cost you? To answer that question, you go to the coffee shop and find that a cappuccino costs 2 ice-cream cones. Now you head for the ice-cream shop, where an ice-cream cone costs 2 packs of jelly beans. Now you get out your pocket calculator: 1 movie costs 2 cappuccinos, or 4 ice-cream cones, or 8 packs of jelly beans, or 16 sticks of gum!

If jelly beans are $1 a pack, one movie costs 8 packs of jelly beans. You need only one calculation to figure out the opportunity cost of any pair of goods and services.

Imagine how troublesome it would be if your local movie theater posted its price as 2 cappuccinos, the coffee shop posted the price of a cappuccino as 2 ice-cream cones, the ice-cream shop posted the price of an ice-cream cone as 2 packs of jelly beans, and the grocery store priced a pack of jelly beans as 2 sticks of gum! Now how much running around and calculating will you have to do to find out how much that movie is going to cost you in terms of the cappuccinos, ice cream cones, jelly beans, or gum that you must give up to see it? You get the answer for cappuccinos right away from the sign posted on the movie theater. But for all the other goods, you're going to

have to visit many different stores to establish the price of each good in terms of another and then calculate the prices in units that are relevant for your own decision. The hassle of doing all this research might be enough to make a person swear off movies! You can see how much simpler it is if all the prices are expressed in dollars and cents.

Store of Value

Money is a *store of value* in the sense that it can be held and exchanged later for goods and services. If money were not a store of value, it could not serve as a means of payment.

Money is not alone in acting as a store of value. A house, a car, and a work of art are other examples.

The more stable the value of a commodity or token, the better it can act as a store of value and the more useful it is as money. No store of value has a completely stable value. The value of a house, a car, or a work of art fluctuates over time. The value of the commodities and tokens that are used as money also fluctuate over time.

Inflation lowers the value of money and the values of other commodities and tokens that are used as money. To make money as useful as possible as a store of value, a low inflation rate is needed.

Money in the United States Today

In the United States today, money consists of

- Currency
- Deposits at banks and other depository institutions

Currency The notes and coins held by individuals and businesses are known as **currency**. Notes are money because the government declares them so with the words "This note is legal tender for all debts, public and private." You can see these words on every dollar bill. Notes and coins *inside* banks are not counted as currency because they are not held by individuals and businesses.

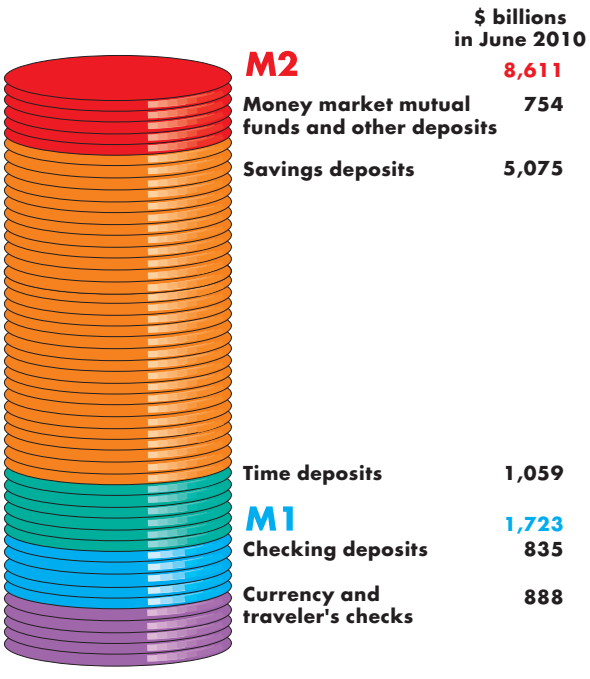
Deposits Deposits of individuals and businesses at banks and other depository institutions, such as savings and loan associations, are also counted as money. Deposits are money because the owners of the deposits can use them to make payments.

Official Measures of Money Two official measures of money in the United States today are known as M1 and M2. **M1** consists of currency and traveler's checks plus checking deposits owned by individuals and businesses. M1 does *not* include currency held by banks, and it does not include currency and checking deposits owned by the U.S. government. **M2** consists of M1 plus time deposits, savings deposits, and money market mutual funds and other deposits.

Economics in Action

Official Measures of U.S. Money

The figure shows the relative magnitudes of the items that make up M1 and M2. Notice that M2 is almost five times as large as M1 and that currency is a small part of our money.



Two Measures of Money

M1
- Currency and traveler's checks
- Checking deposits at commercial banks, savings and loan associations, savings banks, and credit unions

M2
- M1
- Time deposits
- Savings deposits
- Money market mutual funds and other deposits

Source of data: The Federal Reserve Board. The data are for June 2010.

Are M1 and M2 Really Money? Money is the means of payment. So the test of whether an asset is money is whether it serves as a means of payment. Currency passes the test. But what about deposits? Checking deposits are money because they can be transferred from one person to another by writing a check or using a debit card. Such a transfer of ownership is equivalent to handing over currency. Because M1 consists of currency plus checking deposits and each of these is a means of payment, *M1 is money*.

But what about M2? Some of the savings deposits in M2 are just as much a means of payment as the checking deposits in M1. You can use an ATM to get funds from your savings account to pay for your purchase at the grocery store or the gas station. But some savings deposits are not means of payment. These deposits are known as liquid assets. *Liquidity* is the property of being easily convertible into a means of payment without loss in value. Because the deposits in M2 that are not means of payment are quickly and easily converted into a means of payment—into currency or checking deposits—they are counted as money.

Deposits Are Money but Checks Are Not In defining money, we include, along with currency, deposits at banks and other depository institutions. But we do not count the checks that people write as money. Why are deposits money and checks not?

To see why deposits are money but checks are not, think about what happens when Colleen buys some roller-blades for $100 from Rocky's Rollers. When Colleen goes to Rocky's shop, she has $500 in her deposit account at the Laser Bank. Rocky has $1,000 in his deposit account—at the same bank, as it happens. The total deposits of these two people are $1,500. Colleen writes a check for $100. Rocky takes the check to the bank right away and deposits it. Rocky's bank balance rises from $1,000 to $1,100, and Colleen's balance falls from $500 to $400. The total deposits of Colleen and Rocky are still the same as before: $1,500. Rocky now has $100 more than before, and Colleen has $100 less.

This transaction has transferred money from Colleen to Rocky, but the check itself was never money. There wasn't an extra $100 of money while the check was in circulation. The check instructs the bank to transfer money from Colleen to Rocky.

If Colleen and Rocky use different banks, there is an extra step. Rocky's bank credits $100 to Rocky's account and then takes the check to a check-clearing center. The check is then sent to Colleen's bank, which pays Rocky's bank $100 and then debits Colleen's account $100. This process can take a few days, but the principles are the same as when two people use the same bank.

Credit Cards Are Not Money You've just seen that checks are not money. What about credit cards? Isn't having a credit card in your wallet and presenting the card to pay for your roller-blades the same thing as using money? Why aren't credit cards somehow valued and counted as part of the quantity of money?

When you pay by check, you are frequently asked to prove your identity by showing your driver's license. It would never occur to you to think of your driver's license as money. It's just an ID card. A credit card is also an ID card, but one that lets you take out a loan at the instant you buy something. When you sign a credit card sales slip, you are saying, "I agree to pay for these goods when the credit card company bills me." Once you get your statement from the credit card company, you must make at least the minimum payment due. To make that payment, you need money—you need to have currency or a checking deposit to pay the credit card company. So although you use a credit card when you buy something, the credit card is not the *means of payment* and it is not money.

REVIEW QUIZ

1. What makes something money? What functions does money perform? Why do you think packs of chewing gum don't serve as money?
2. What are the problems that arise when a commodity is used as money?
3. What are the main components of money in the United States today?
4. What are the official measures of money? Are all the measures really money?
5. Why are checks and credit cards not money?

You can work these questions in Study Plan 8.1 and get instant feedback. myeconlab

We've seen that the main component of money in the United States is deposits at banks and other depository institutions. Let's take a closer look at these institutions.

Depository Institutions

A **depository institution** is a financial firm that takes deposits from households and firms. These deposits are components of M1 and M2. You will learn what these institutions are, what they do, the economic benefits they bring, how they are regulated, and how they have innovated to create new financial products.

Types of Depository Institutions

The deposits of three types of financial firms make up the nation's money. They are

- Commercial banks
- Thrift institutions
- Money market mutual funds

Commercial Banks A *commercial bank* is a firm that is licensed to receive deposits and make loans. In 2010, about 7,000 commercial banks operated in the United States but mergers make this number fall each year as small banks disappear and big banks expand.

A few very large commercial banks offer a wide range of banking services and have extensive international operations. The largest of these banks are Bank of America, Wells Fargo, JPMorgan Chase, and Citigroup. Most commercial banks are small and serve their regional and local communities.

The deposits of commercial banks represent 40 percent of M1 and 65 percent of M2.

Thrift Institutions Savings and loan associations, savings banks, and credit unions are *thrift institutions*.

Savings and Loan Association A *savings and loan association* (S&L) is a depository institution that receives deposits and makes personal, commercial, and home-purchase loans.

Savings Bank A *savings bank* is a depository institution that accepts savings deposits and makes mostly home-purchase loans.

Credit Union A *credit union* is a depository institution owned by a social or economic group, such as a firm's employees, that accepts savings deposits and makes mostly personal loans.

The deposits of the thrift institutions represent 9 percent of M1 and 16 percent of M2.

Money Market Mutual Funds A *money market mutual fund* is a fund operated by a financial institution that sells shares in the fund and holds assets such as U.S. Treasury bills and short-term commercial bills.

Money market mutual fund shares act like bank deposits. Shareholders can write checks on their money market mutual fund accounts, but there are restrictions on most of these accounts. For example, the minimum deposit accepted might be $2,500, and the smallest check a depositor is permitted to write might be $500.

Money market mutual funds do not feature in M1 and represent 9 percent of M2.

What Depository Institutions Do

Depository institutions provide services such as check clearing, account management, credit cards, and Internet banking, all of which provide an income from service fees.

But depository institutions earn most of their income by using the funds they receive from depositors to make loans and to buy securities that earn a higher interest rate than that paid to depositors. In this activity, a depository institution must perform a balancing act weighing return against risk. To see this balancing act, we'll focus on the commercial banks.

A commercial bank puts the funds it receives from depositors and other funds that it borrows into four types of assets:

1. A bank's **reserves** are notes and coins in the bank's vault or in a deposit account at the Federal Reserve. (We'll study the Federal Reserve later in this chapter.) These funds are used to meet depositors' currency withdrawals and to make payments to other banks. In normal times, a bank keeps about a half of one percent of deposits as reserves. (You'll see in Table 8.2 on the next page that 2010 is not a normal time.)
2. *Liquid assets* are overnight loans to other banks, U.S. government Treasury bills, and commercial bills. These assets are the banks' first line of defense if they need reserves. Liquid assets can be sold and instantly converted into reserves with virtually no risk of loss. Because they have a low risk, they earn a low interest rate.

   The interest rate on overnight loans to other banks, called the **federal funds rate**, is targeted by the Fed. We explain how and why on pp. 350–351.

3. *Securities* are U.S. government bonds and other bonds such as mortgage-backed securities. These assets can be sold and converted into reserves but at prices that fluctuate, so they are riskier than liquid assets and have a higher interest rate.
4. *Loans* are funds committed for an agreed-upon period of time to corporations to finance investment and to households to finance the purchase of homes, cars, and other durable goods. The outstanding balances on credit card accounts are also bank loans. Loans are a bank's riskiest and highest-earning assets: They can't be converted into reserves until they are due to be repaid, and some borrowers default and never repay.

Table 8.2 provides a snapshot of the sources and uses of funds of all the commercial banks in June 2010 that serves as a summary of the above account.

Economic Benefits Provided by Depository Institutions

You've seen that a depository institution earns part of its profit because it pays a lower interest rate on deposits than what it earns on loans. What benefits do these institutions provide that make depositors willing to put up with a low interest rate and borrowers willing to pay a higher one?

TABLE 8.2 Commercial Banks: Sources and Uses of Funds

	Funds (billions of dollars)	Percentage of deposits
Total funds	11,096	144.3
Sources		
Deposits	7,694	100.0
Borrowing	1,997	26.0
Own capital and other sources	1,405	18.3
Uses		
Reserves	1,097	14.3
Liquid assets	98	1.3
Securities and other assets	3,040	39.5
Loans	6,861	89.2

Commercial banks get most of their funds from depositors and use most of them to make loans. In normal times banks hold about 0.5 percent of deposits as reserves. But in 2010, at a time of great financial uncertainty, they held an unusually large 14.3 percent as reserves.

Source of data: The Federal Reserve Board. The data are for June, 2010.

Depository institutions provide four benefits:

- Create liquidity
- Pool risk
- Lower the cost of borrowing
- Lower the cost of monitoring borrowers

Create Liquidity Depository institutions create liquidity by *borrowing short and lending long*—taking deposits and standing ready to repay them on short notice or on demand and making loan commitments that run for terms of many years.

Pool Risk A loan might not be repaid—a default. If you lend to one person who defaults, you lose the entire amount loaned. If you lend to 1,000 people (through a bank) and one person defaults, you lose almost nothing. Depository institutions pool risk.

Lower the Cost of Borrowing Imagine there are no depository institutions and a firm is looking for $1 million to buy a new factory. It hunts around for several dozen people from whom to borrow the funds. Depository institutions lower the cost of this search. The firm gets its $1 million from a single institution that gets deposits from a large number of people but spreads the cost of this activity over many borrowers.

Lower the Cost of Monitoring Borrowers By monitoring borrowers, a lender can encourage good decisions that prevent defaults. But this activity is costly. Imagine how costly it would be if each household that lent money to a firm incurred the costs of monitoring that firm directly. Depository institutions can perform this task at a much lower cost.

How Depository Institutions Are Regulated

Depository institutions are engaged in a risky business, and a failure, especially of a large bank, would have damaging effects on the entire financial system and economy. To make the risk of failure small, depository institutions are required to hold levels of reserves and owners' capital that equal or surpass ratios laid down by regulation. If a depository institution fails, its deposits are guaranteed up to $250,000 per depositor per bank by the *Federal Deposit Insurance Corporation* or FDIC. The FDIC can take over management of a bank that appears to be heading toward failure.

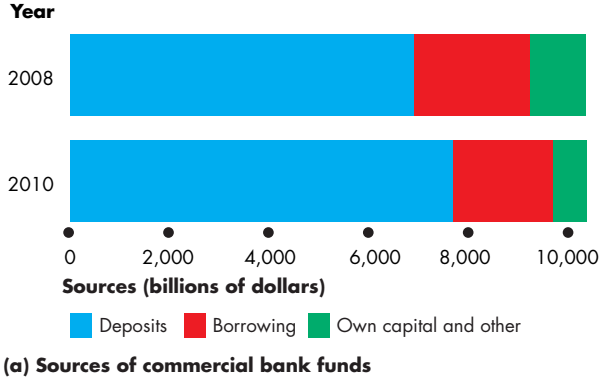
Economics in Action

Commercial Banks Flush with Reserves

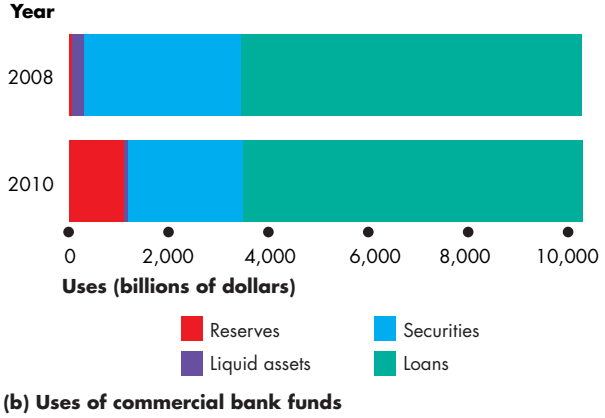
When Lehman Brothers (a New York investment bank) failed in October 2008, panic spread through financial markets. Banks that are normally happy to lend to each other overnight for an interest rate barely above the rate they can earn on safe Treasury bills lost confidence and the interest rate in this market shot up to 3 percentage points above the Treasury bill rate. Banks wanted to be safe and to hold cash. The Fed created and the banks willingly held reserves at the unheard of level of $1 trillion or 14 percent of deposits.

Throughout 2009 and 2010, bank reserves remained at this extraordinary level. And despite having plenty of funds to lend, the level of bank loans barely changed over 2009 and 2010.

The figure compares the commercial banks' sources and uses of funds (sources are liabilities and uses are assets) in 2008 with those in 2010.



(a) Sources of commercial bank funds



(b) Uses of commercial bank funds

Changes in the Sources and Uses of Commercial Bank Funds

Source of data: The Federal Reserve Board.

Financial Innovation

In the pursuit of larger profit, depository institutions are constantly seeking ways to improve their products in a process called *financial innovation*.

During the late 1970s, a high inflation rate sent the interest rate on home-purchase loans to 15 percent a year. Traditional fixed interest rate mortgages became unprofitable and variable interest rate mortgages were introduced.

During the 2000s, when interest rates were low and depository institutions were flush with funds, sub-prime mortgages were developed. To avoid the risk of carrying these mortgages, mortgage-backed securities were developed. The original lending institution sold these securities, lowered their own exposure to risk, and obtained funds to make more loans.

The development of low-cost computing and communication brought financial innovations such as credit cards and daily interest deposit accounts.

Financial innovation has brought changes in the composition of money. Checking deposits at thrift institutions have become an increasing percentage of M1 while checking deposits at commercial banks have become a decreasing percentage. Savings deposits have decreased as a percentage of M2, while time deposits and money market mutual funds have expanded. Surprisingly, the use of currency has not fallen much.

REVIEW QUIZ

1. What are depository institutions?
2. What are the functions of depository institutions?
3. How do depository institutions balance risk and return?
4. How do depository institutions create liquidity, pool risks, and lower the cost of borrowing?
5. How have depository institutions made innovations that have influenced the composition of money?

You can work these questions in Study Plan 8.2 and get instant feedback.

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You now know what money is. Your next task is to learn about the Federal Reserve System and the ways in which it can influence the quantity of money.

The Federal Reserve System

The **Federal Reserve System** (usually called the **Fed**) is the central bank of the United States. A **central bank** is a bank's bank and a public authority that regulates a nation's depository institutions and conducts *monetary policy,* which means that it adjusts the quantity of money in circulation and influences interest rates.

We begin by describing the structure of the Fed.

The Structure of the Fed

Three key elements of the Fed's structure are

- The Board of Governors
- The regional Federal Reserve banks
- The Federal Open Market Committee

The Board of Governors A seven-member board appointed by the President of the United States and confirmed by the Senate governs the Fed. Members have 14-year (staggered) terms and one seat on the board becomes vacant every two years. The President appoints one board member as chairman for a 4-year renewable term—currently Ben Bernanke, a former economics professor at Princeton University.

The Federal Reserve Banks The nation is divided into 12 Federal Reserve districts (shown in Fig. 8.1). Each district has a Federal Reserve Bank that provides check-clearing services to commercial banks and issues bank notes.

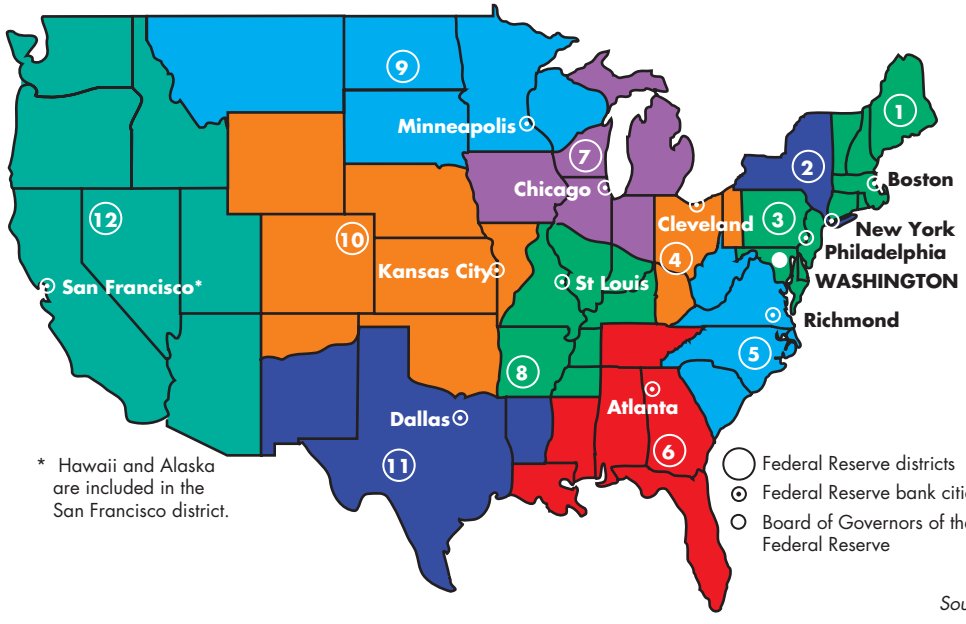
The Federal Reserve Bank of New York (known as the New York Fed), occupies a special place in the Federal Reserve System because it implements the Fed's policy decisions in the financial markets.

The Federal Open Market Committee The **Federal Open Market Committee** (FOMC) is the main policy-making organ of the Federal Reserve System. The FOMC consists of the following voting members:

- The chairman and the other six members of the Board of Governors
- The president of the Federal Reserve Bank of New York
- The presidents of the other regional Federal Reserve banks (of whom, on a yearly rotating basis, only four vote)

The FOMC meets approximately every six weeks to review the state of the economy and to decide the actions to be carried out by the New York Fed.

FIGURE 8.1 The Federal Reserve System



The nation is divided into 12 Federal Reserve districts, each having a Federal Reserve bank. (Some of the larger districts also have branch banks.) The Board of Governors of the Federal Reserve System is located in Washington, D.C.

Source: Federal Reserve Bulletin.

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The Fed's Balance Sheet

The Fed influences the economy through the size and composition of its balance sheet—the assets that the Fed owns and the liabilities that it owes.

The Fed's Assets The Fed has two main assets:

1. U.S. government securities
2. Loans to depository institutions

The Fed holds U.S. securities—Treasury bills and Treasury bonds—that it buys in the bond market. When the Fed buys or sells bonds, it participates in the *loanable funds market* (see pp. 164–170).

The Fed makes loans to depository institutions. When these institutions in aggregate are short of reserves, they can borrow from the Fed. In normal times this item is small, but during 2007 and 2008, it grew as the Fed provided increasing amounts of relief from the financial crisis. By October 2008, loans to depository institutions exceeded government securities in the Fed's balance sheet.

The Fed's Liabilities The Fed has two liabilities:

1. Federal Reserve notes
2. Depository institution deposits

Federal Reserve notes are the dollar bills that we use in our daily transactions. Some of these notes are held by individuals and businesses; others are in the tills and vaults of banks and other depository institutions.

Depository institution deposits at the Fed are part of the reserves of these institutions (see p. 187).

The Monetary Base The Fed's liabilities together with coins issued by the Treasury (coins are not liabilities of the Fed) make up the monetary base. That is, the **monetary base** is the sum of currency (Federal Reserve notes and coins) and depository institution deposits at the Fed.

The Fed's assets are the sources of the monetary base. They are also called the backing for the monetary base. The Fed's liabilities are the uses of the monetary base as currency and bank reserves. Table 8.3 provides a snapshot of the sources and uses of the monetary base in June 2010.

When the Fed changes the monetary base, the quantity of money and interest rate change. You're going to see how these changes come about later in this chapter. First, we'll look at the Fed's tools that enable it to influence money and interest rates.

TABLE 8.3 The Sources and Uses of the Monetary Base

Sources (billions of dollars)		Uses (billions of dollars)	
U.S. government securities	777	Currency	900
Loans to depository institutions	70	Reserves of depository institutions	1,099
Other items (net)	1,152		
Monetary base	1,999	Monetary base	1,999

Source of data: Federal Reserve Board. The data are for June, 2010.

The Fed's Policy Tools

The Fed influences the quantity of money and interest rates by adjusting the quantity of reserves available to the banks and the reserves the banks must hold. To do this, the Fed manipulates three tools:

- Open market operations
- Last resort loans
- Required reserve ratio

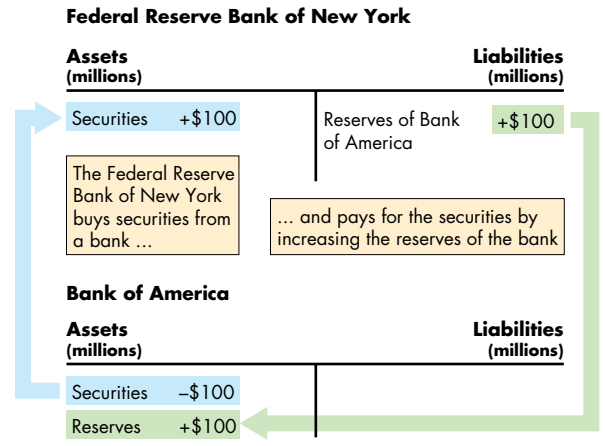
Open Market Operations An **open market operation** is the purchase or sale of securities by the Fed in the *loanable funds market*. When the Fed buys securities, it pays for them with newly created bank reserves. When the Fed sells securities, the Fed is paid with reserves held by banks. So open market operations directly influence the reserves of banks. By changing the quantity of bank reserves, the Fed changes the quantity of monetary base, which influences the quantity of money.

An Open Market Purchase To see how an open market operation changes bank reserves, suppose the Fed buys $100 million of government securities from the Bank of America. When the Fed makes this transaction, two things happen:

1. The Bank of America has $100 million less securities, and the Fed has $100 million more securities.
2. The Fed pays for the securities by placing $100 million in the Bank of America's deposit account at the Fed.

Figure 8.2 shows the effects of these actions on the balance sheets of the Fed and the Bank of America. Ownership of the securities passes from the Bank of

FIGURE 8.2 The Fed Buys Securities in the Open Market



When the Fed buys securities in the open market, it creates bank reserves. The Fed's assets and liabilities increase, and the Bank of America exchanges securities for reserves.

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America to the Fed, so the Bank of America's assets decrease by $100 million and the Fed's assets increase by $100 million, as shown by the blue arrow running from the Bank of America to the Fed.

The Fed pays for the securities by placing $100 million in the Bank of America's reserve account at the Fed, as shown by the green arrow running from the Fed to the Bank of America.

The Fed's assets and liabilities increase by $100 million. The Bank of America's total assets are unchanged: It sold securities to increase its reserves.

An Open Market Sale If the Fed sells $100 million of government securities to the Bank of America in the open market:

1. The Bank of America has $100 million more securities, and the Fed has $100 million less securities.
2. The Bank of America pays for the securities by using $100 million of its reserve deposit at the Fed.

You can follow the effects of these actions on the balance sheets of the Fed and the Bank of America by reversing the arrows and the plus and minus signs in Fig. 8.2. Ownership of the securities passes from the Fed to the Bank of America, so the Fed's assets decrease by $100 million and the Bank of America's assets increase by $100 million.

Economics in Action

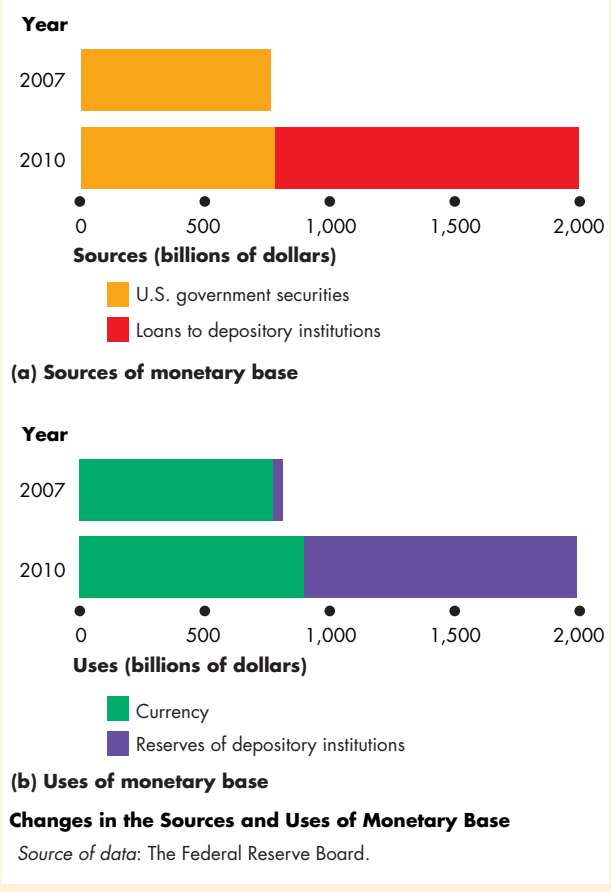
The Fed's Balance Sheet Explodes

The Fed's balance sheet underwent some remarkable changes during the financial crisis of 2007–2008 and the recession that the crisis triggered. The figure shows the effects of these changes on the size and composition of the monetary base by comparing the situation in 2010 with that before the financial crisis began in late 2007.

In a normal year, 2007, the Fed's holding of U.S. government securities is almost as large as the monetary base and the monetary base is composed of almost all currency.

But between 2007 and 2010 the Fed made huge loans to banks and other financial institutions that more than doubled the monetary base. Almost all of this increase was composed of bank reserves.

When, and how quickly, to unwind the large increase in the monetary base and bank reserves was a source of disagreement at the Fed in 2010.



Changes in the Sources and Uses of Monetary Base

Source of data: The Federal Reserve Board.

The Bank of America uses $100 million of its reserves to pay for the securities.

Both the Fed's assets and liabilities decrease by $100 million. The Bank of America's total assets are unchanged: It has used reserves to buy securities.

The New York Fed conducts these open-market transactions on directions from the FOMC.

Last Resort Loans The Fed is the **lender of last resort**, which means that if a bank is short of reserves, it can borrow from the Fed. But the Fed sets the interest rate on last resort loans and this interest rate is called the *discount rate*.

During the period since August 2007 when the first effects of the financial crisis started to be felt, the Fed has been especially active as lender of last resort and, with the U.S. Treasury, has created a number of new lending facilities and initiatives to prevent banks from failing.

Required Reserve Ratio The **required reserve ratio** is the minimum percentage of deposits that depository institutions are required to hold as reserves. In 2010, required reserves were 3 percent of checking deposits between $10.7 million and $55.2 million and 10 percent of checking deposits in excess of $55.2 million. If the Fed requires the banks to hold more reserves, they must cut their lending.

REVIEW QUIZ

1. What is the central bank of the United States and what functions does it perform?
2. What is the monetary base and how does it relate to the Fed's balance sheet?
3. What are the Fed's three policy tools?
4. What is the Federal Open Market Committee and what are its main functions?
5. How does an open market operation change the monetary base?

You can work these questions in Study Plan 8.3 and get instant feedback. myeconlab

Next, we're going to see how the banking system—the banks and the Fed—creates money and how the quantity of money changes when the Fed changes the monetary base.

How Banks Create Money

Banks create money. But this doesn't mean that they have smoke-filled back rooms in which counterfeiters are busily working. Remember, money is both currency and bank deposits. What banks create is deposits, and they do so by making loans.

Creating Deposits by Making Loans

The easiest way to see that banks create deposits is to think about what happens when Andy, who has a Visa card issued by Citibank, uses his card to buy a tank of gas from Chevron. When Andy signs the card sales slip, he takes a loan from Citibank and obligates himself to repay the loan at a later date. At the end of the business day, a Chevron clerk takes a pile of signed credit card sales slips, including Andy's, to Chevron's bank. For now, let's assume that Chevron also banks at Citibank. The bank immediately credits Chevron's account with the value of the slips (minus the bank's commission).

You can see that these transactions have created a bank deposit and a loan. Andy has increased the size of his loan (his credit card balance), and Chevron has increased the size of its bank deposit. Because bank deposits are money, Citibank has created money.

If, as we've just assumed, Andy and Chevron use the same bank, no further transactions take place. But the outcome is essentially the same when two banks are involved. If Chevron's bank is Bank of America, then Citibank uses its reserves to pay Bank of America. Citibank has an increase in loans and a decrease in reserves; Bank of America has an increase in reserves and an increase in deposits. The banking system as a whole has an increase in loans and deposits but no change in reserves.

If Andy had swiped his card at an automatic payment pump, all these transactions would have occurred at the time he filled his tank, and the quantity of money would have increased by the amount of his purchase (minus the bank's commission for conducting the transactions).

Three factors limit the quantity of loans and deposits that the banking system can create through transactions like Andy's. They are:

- The monetary base
- Desired reserves
- Desired currency holding

The Monetary Base You've seen that the *monetary base* is the sum of Federal Reserve notes, coins, and banks' deposits at the Fed. The size of the monetary base limits the total quantity of money that the banking system can create. The reason is that banks have a desired level of reserves, households and firms have a desired holding of currency, and both of these desired holdings of the monetary base depend on the quantity of deposits.

Desired Reserves A bank's *desired reserves* are the reserves that it *plans* to hold. They contrast with a bank's *required reserves*, which is the minimum quantity of reserves that a bank *must* hold.

The quantity of desired reserves depends on the level of deposits and is determined by the **desired reserve ratio**—the ratio of reserves to deposits that the banks *plan* to hold. The *desired* reserve ratio exceeds the *required* reserve ratio by an amount that the banks determine to be prudent on the basis of their daily business requirements and in the light of the current outlook in financial markets.

Desired Currency Holding The proportions of money held as currency and bank deposits—the ratio of currency to deposits— depend on how households and firms choose to make payments: Whether they plan to use currency or debit cards and checks.

Choices about how to make payments change slowly so the ratio of desired currency to deposits also changes slowly, and at any given time this ratio is fixed. If bank deposits increase, desired currency holding also increases. For this reason, when banks make loans that increase deposits, some currency leaves the banks—the banking system leaks reserves. We call the leakage of bank reserves into currency the *currency drain*, and we call the ratio of currency to deposits the **currency drain ratio**.

We've sketched the way that a loan creates a deposit and described the three factors that limit the amount of loans and deposits that can be created. We're now going to examine the money creation process more closely and discover a money multiplier.

The Money Creation Process

The money creation process begins with an increase in the monetary base, which occurs if the Fed conducts an open market operation in which it buys securities from banks and other institutions. The Fed pays for the securities it buys with newly created bank reserves.

When the Fed buys securities from a bank, the bank's reserves increase but its deposits don't change. So the bank has excess reserves. A bank's **excess reserves** are its actual reserves minus its desired reserves.

When a bank has excess reserves, it makes loans and creates deposits. When the entire banking system has excess reserves, total loans and deposits increase and the quantity of money increases.

One bank can make a loan and get rid of excess reserves. But the banking system as a whole can't get rid of excess reserves so easily. When the banks make loans and create deposits, the extra deposits lower excess reserves for two reasons. First, the increase in deposits increases desired reserves. Second, a currency drain decreases total reserves. But excess reserves don't completely disappear. So the banks lend some more and the process repeats.

As the process of making loans and increasing deposits repeats, desired reserves increase, total reserves decrease through the currency drain, and eventually enough new deposits have been created to use all the new monetary base.

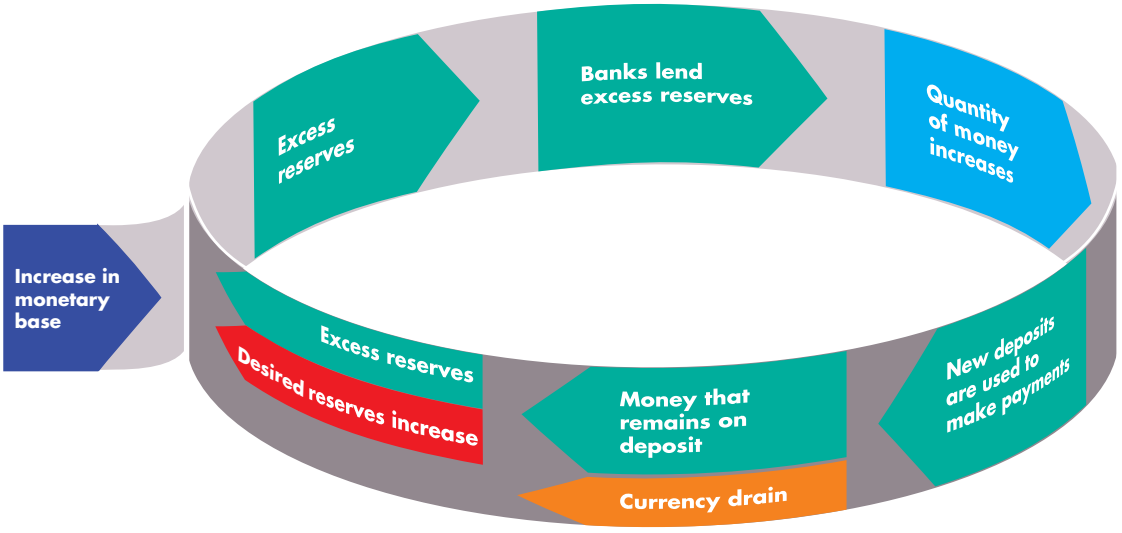
Figure 8.3 summarizes one round in the process we've just described. The sequence has the following eight steps:

1. Banks have excess reserves.
2. Banks lend excess reserves.
3. The quantity of money increases.
4. New money is used to make payments.
5. Some of the new money remains on deposit.
6. Some of the new money is a *currency drain*.
7. Desired reserves increase because deposits have increased.
8. Excess reserves decrease.

If the Fed *sells* securities in an open market operation, then banks have negative excess reserves—they are short of reserves. When the banks are short of reserves, loans and deposits decrease and the process we've described above works in a downward direction until desired reserves plus desired currency holding has decreased by an amount equal to the decrease in monetary base.

A money multiplier determines the change in the quantity of money that results from a change in the monetary base.

FIGURE 8.3 How the Banking System Creates Money by Making Loans



The Federal Reserve increases the monetary base, which increases bank reserves and creates excess reserves. Banks lend the excess reserves, which creates new deposits. The quantity of money increases. New deposits are used to make payments. Some of the new money remains on deposit at banks and some leaves the banks in a currency drain. The increase in bank deposits increases banks' desired reserves. But the banks still have excess reserves, though less than before. The process repeats until excess reserves have been eliminated.

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The Money Multiplier

The **money multiplier** is the ratio of the change in the quantity of money to the change in monetary base. For example, if a $1 million increase in the monetary base increases the quantity of money by $2.5 million, then the money multiplier is 2.5.

The smaller the banks' desired reserve ratio and the smaller the currency drain ratio, the larger is the money multiplier. (See the Mathematical Note on pp. 204–205 for details on the money multiplier).

REVIEW QUIZ

1. How do banks create money?
2. What limits the quantity of money that the banking system can create?
3. A bank manager tells you that she doesn't create money. She just lends the money that people deposit. Explain why she's wrong.

You can work these questions in Study Plan 8.4 and get instant feedback. myeconlab

Economics in Action

The Variable Money Multipliers

We can measure the money multiplier, other things remaining the same, as the ratio of the quantity of money (M1 or M2) to the monetary base. In normal times, these ratios (and the money multipliers) change slowly.

In the early 1990s, the M1 multiplier—the ratio of M1 to the monetary base—was about 3 and the M2 multiplier—the ratio of M2 to the monetary base—was about 12. Through the 1990s and 2000s, the currency drain ratio gradually increased and the money multipliers decreased. By 2007 the M1 multiplier was 2 and the M2 multiplier was 9.

Then, in 2008 and 2009 when the Fed increased the monetary base by an unprecedented $1 trillion, almost all of the newly created reserves were willingly held by the banks. In an environment of enormous uncertainty, desired reserves increased by an amount similar to the increase in actual reserves. The quantity of money barely changed.

The Money Market

There is no limit to the amount of money we would like to *receive* in payment for our labor or as interest on our savings. But there *is* a limit to how big an inventory of money we would like to *hold* and neither spend nor use to buy assets that generate an income. The *quantity of money demanded* is the inventory of money that people plan to hold on any given day. It is the quantity of money in our wallets and in our deposit accounts at banks. The quantity of money held must equal the quantity supplied, and the forces that bring about this equality in the money market have powerful effects on the economy, as you will see in the rest of this chapter.

But first, we need to explain what determines the amount of money that people plan to hold.

The Influences on Money Holding

The quantity of money that people plan to hold depends on four main factors:

- The price level
- The *nominal* interest rate
- Real GDP
- Financial innovation

The Price Level The quantity of money measured in dollars is *nominal money*. The quantity of nominal money demanded is proportional to the price level, other things remaining the same. If the price level rises by 10 percent, people hold 10 percent more nominal money than before, other things remaining the same. If you hold $20 to buy your weekly movies and soda, you will increase your money holding to $22 if the prices of movies and soda—and your wage rate—increase by 10 percent.

The quantity of money measured in constant dollars (for example, in 2005 dollars) is real money. *Real money* is equal to nominal money divided by the price level and is the quantity of money measured in terms of what it will buy. In the above example, when the price level rises by 10 percent and you increase your money holding by 10 percent, your *real* money holding is constant. Your $22 at the new price level buys the same quantity of goods and is the same quantity of *real money* as your $20 at the original price level. The quantity of real money demanded is independent of the price level.

The *Nominal* Interest Rate A fundamental principle of economics is that as the opportunity cost of something increases, people try to find substitutes for it. Money is no exception. The higher the opportunity cost of holding money, other things remaining the same, the smaller is the quantity of real money demanded. The nominal interest rate on other assets minus the nominal interest rate on money is the opportunity cost of holding money.

The interest rate that you earn on currency and checking deposits is zero. So the opportunity cost of holding these items is the nominal interest rate on other assets such as a savings bond or Treasury bill. By holding money instead, you forgo the interest that you otherwise would have received.

Money loses value because of inflation, so why isn't the inflation rate part of the cost of holding money? It is. Other things remaining the same, the higher the expected inflation rate, the higher is the nominal interest rate.

Real GDP The quantity of money that households and firms plan to hold depends on the amount they are spending. The quantity of money demanded in the economy as a whole depends on aggregate expenditure—real GDP.

Again, suppose that you hold an average of $20 to finance your weekly purchases of movies and soda. Now imagine that the prices of these goods and of all other goods remain constant but that your income increases. As a consequence, you now buy more goods and services and you also keep a larger amount of money on hand to finance your higher volume of expenditure.

Financial Innovation Technological change and the arrival of new financial products influence the quantity of money held. Financial innovations include

1. Daily interest checking deposits
2. Automatic transfers between checking and saving deposits
3. Automatic teller machines
4. Credit cards and debit cards
5. Internet banking and bill paying

These innovations have occurred because of the development of computing power that has lowered the cost of calculations and record keeping.

We summarize the effects of the influences on money holding by using a demand for money curve.

The Demand for Money

The **demand for money** is the relationship between the quantity of real money demanded and the nominal interest rate when all other influences on the amount of money that people wish to hold remain the same.

Figure 8.4 shows a demand for money curve, *MD*. When the interest rate rises, other things remaining the same, the opportunity cost of holding money rises and the quantity of real money demanded decreases—there is a movement up along the demand for money curve. Similarly, when the interest rate falls, the opportunity cost of holding money falls, and the quantity of real money demanded increases—there is a movement down along the demand for money curve.

When any influence on money holding other than the interest rate changes, there is a change in the demand for money and the demand for money curve shifts. Let's study these shifts.

Shifts in the Demand for Money Curve

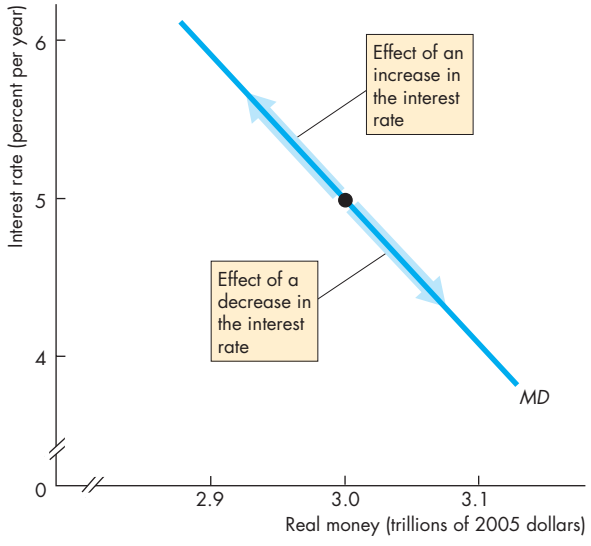
A change in real GDP or financial innovation changes the demand for money and shifts the demand for money curve.

Figure 8.5 illustrates the change in the demand for money. A decrease in real GDP decreases the demand for money and shifts the demand for money curve leftward from MD_0 to MD_1. An increase in real GDP has the opposite effect: It increases the demand for money and shifts the demand for money curve rightward from MD_0 to MD_2.

The influence of financial innovation on the demand for money curve is more complicated. It decreases the demand for currency and might increase the demand for some types of deposits and decrease the demand for others. But generally, financial innovation decreases the demand for money.

Changes in real GDP and financial innovation have brought large shifts in the demand for money in the United States.

FIGURE 8.4 The Demand for Money



The demand for money curve, *MD*, shows the relationship between the quantity of real money that people plan to hold and the nominal interest rate, other things remaining the same. The interest rate is the opportunity cost of holding money. A change in the interest rate brings a movement along the demand for money curve.

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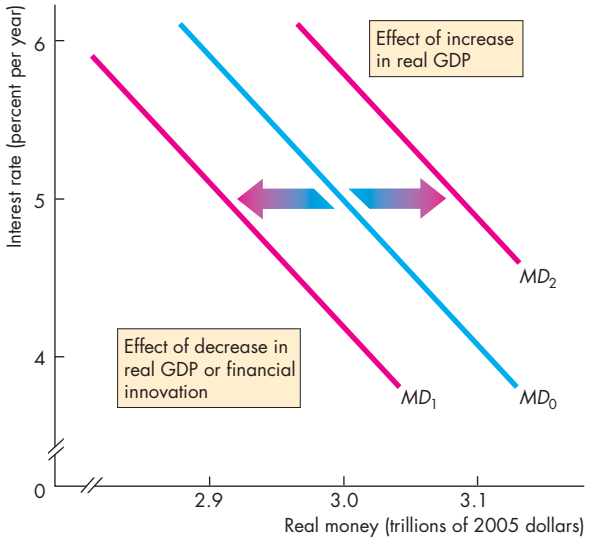
FIGURE 8.5 Changes in the Demand for Money



A decrease in real GDP decreases the demand for money. The demand for money curve shifts leftward from MD_0 to MD_1. An increase in real GDP increases the demand for money. The demand for money curve shifts rightward from MD_0 to MD_2. Financial innovation generally decreases the demand for money.

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Money Market Equilibrium

You now know what determines the demand for money, and you've seen how the banking system creates money. Let's now see how the money market reaches an equilibrium.

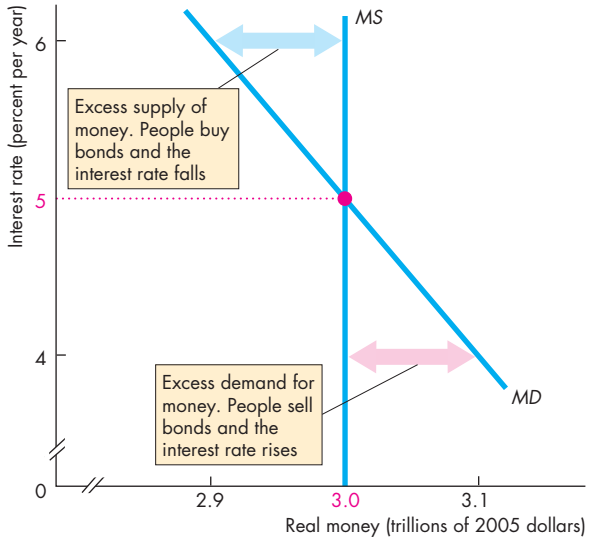
Money market equilibrium occurs when the quantity of money demanded equals the quantity of money supplied. The adjustments that occur to bring money market equilibrium are fundamentally different in the short run and the long run.

Short-Run Equilibrium The quantity of money supplied is determined by the actions of the banks and the Fed. As the Fed adjusts the quantity of money, the interest rate changes.

In Fig. 8.6, the Fed uses open market operations to make the quantity of real money supplied $3.0 trillion and the supply of money curve *MS*. With demand for money curve *MD*, the equilibrium interest rate is 5 percent a year.

If the interest rate were 4 percent a year, people would want to hold more money than is available.

FIGURE 8.6 Money Market Equilibrium



Money market equilibrium occurs when the quantity of money demanded equals the quantity supplied. In the short run, real GDP determines the demand for money curve, *MD*, and the Fed determines the quantity of real money supplied and the supply of money curve, *MS*. The interest rate adjusts to achieve equilibrium, here 5 percent a year.

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They would sell bonds, bid down their price, and the interest rate would rise. If the interest rate were 6 percent a year, people would want to hold less money than is available. They would buy bonds, bid up their price, and the interest rate would fall.

The Short-Run Effect of a Change in the Supply of Money Starting from a short-run equilibrium, if the Fed increases the quantity of money, people find themselves holding more money than the quantity demanded. With a surplus of money holding, people enter the loanable funds market and buy bonds. The increase in demand for bonds raises the price of a bond and lowers the interest rate (refresh your memory by looking at Chapter 7, p. 164).

If the Fed decreases the quantity of money, people find themselves holding less money than the quantity demanded. They now enter the loanable funds market to sell bonds. The decrease in the demand for bonds lowers their price and raises the interest rate.

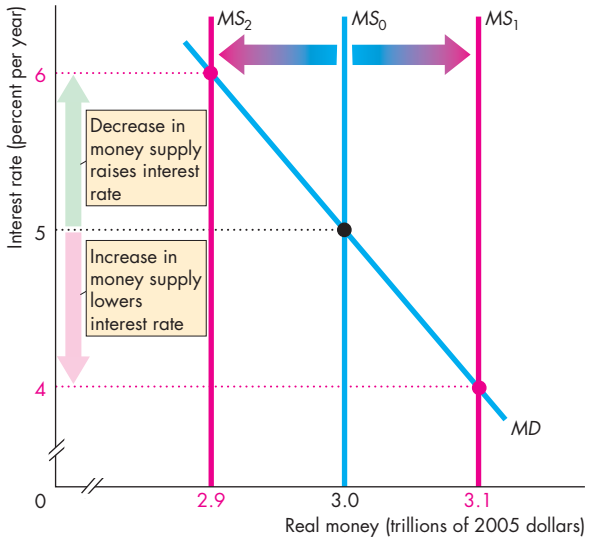
Figure 8.7 illustrates the effects of the changes in the quantity of money that we've just described. When the supply of money curve shifts rightward from MS_0 to MS_1, the interest rate falls to 4 percent a year; when the supply of money curve shifts leftward to MS_2, the interest rate rises to 6 percent a year.

Long-Run Equilibrium You've just seen how the nominal interest rate is determined in the money market at the level that makes the quantity of money demanded equal the quantity supplied by the Fed. You learned in Chapter 7 (on p. 168) that the real interest rate is determined in the loanable funds market at the level that makes the quantity of loanable funds demanded equal the quantity of loanable funds supplied. You also learned in Chapter 7 (on p. 165) that the real interest rate equals the nominal interest rate minus the inflation rate.

When the inflation rate equals the expected (or forecasted) inflation rate and when real GDP equals potential GDP, the money market, the loanable funds market, the goods market, and the labor market are in long-run equilibrium—the economy is in long-run equilibrium.

If in long-run equilibrium, the Fed increases the quantity of money, eventually a new long-run equilibrium is reached in which nothing real has changed. Real GDP, employment, the real quantity of money, and the real interest rate all return to their original levels. But something does change: the price level. The price level rises by the same percentage as the rise

FIGURE 8.7 A Change in the Supply of Money



An increase in the supply of money shifts the supply of money curve from MS_0 to MS_1 and the interest rate falls. A decrease in the supply of money shifts the supply of money curve from MS_0 to MS_2 and the interest rate rises.

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in the quantity of money. Why does this outcome occur in the long run?

The reason is that real GDP and employment are determined by the demand for labor, the supply of labor, and the production function—the real forces described in Chapter 6 (pp. 139–141); and the real interest rate is determined by the demand for and supply of (real) loanable funds—the real forces described in Chapter 7 (pp. 166–168). The only variable that is free to respond to a change in the supply of money in the long run is the price level. The price level adjusts to make the quantity of real money supplied equal to the quantity demanded.

So when the Fed changes the nominal quantity of money, in the long run the price level changes by a percentage equal to the percentage change in the quantity of nominal money. In the long run, the change in the price level is proportional to the change in the quantity of money.

The Transition from the Short Run to the Long Run

How does the economy move from the first short-run response to an increase in the quantity of money to the long-run response?

The adjustment process is lengthy and complex. Here, we'll only provide a sketch of the process. A more thorough account must wait until you've studied Chapter 9.

We start out in long-run equilibrium and the Fed increases the quantity of money by 10 percent. Here are the steps in what happens next.

First, the nominal interest rate falls (just like you saw on p. 198 and in Fig. 8.6). The real interest rate falls too, as people try to get rid of their excess money holdings and buy bonds.

With a lower real interest rate, people want to borrow and spend more. Firms want to borrow to invest and households want to borrow to invest in bigger homes or to buy more consumer goods.

The increase in the demand for goods cannot be met by an increase in supply because the economy is already at full employment. So there is a general shortage of all kinds of goods and services.

The shortage of goods and services forces the price level to rise.

As the price level rises, the real quantity of money decreases. The decrease in the quantity of real money raises the nominal interest rate and the real interest rate. As the interest rate rises, spending plans are cut back, and eventually the original full-employment equilibrium is restored. At the new long-run equilibrium, the price level has risen by 10 percent and nothing real has changed.

REVIEW QUIZ

1. What are the main influences on the quantity of real money that people and businesses plan to hold?
2. Show the effects of a change in the nominal interest rate and a change in real GDP using the demand for money curve.
3. How is money market equilibrium determined in the short run?
4. How does a change in the supply of money change the interest rate in the short run?
5. How does a change in the supply of money change the interest rate in the long run?

You can work these questions in Study Plan 8.5 and get instant feedback. myeconlab

Let's explore the long-run link between money and the price level a bit further.

The Quantity Theory of Money

In the long run, the price level adjusts to make the quantity of real money demanded equal the quantity supplied. A special theory of the price level and inflation—the quantity theory of money—explains this long-run adjustment of the price level.

The **quantity theory of money** is the proposition that in the long run, an increase in the quantity of money brings an equal percentage increase in the price level. To explain the quantity theory of money, we first need to define *the velocity of circulation*.

The **velocity of circulation** is the average number of times a dollar of money is used annually to buy the goods and services that make up GDP. But GDP equals the price level (P) multiplied by *real* GDP (Y). That is,

$$GDP = PY.$$

Call the quantity of money M. The velocity of circulation, V, is determined by the equation

$$V = PY/M.$$

For example, if GDP is $1,000 billion ($PY$ = $1,000 billion) and the quantity of money is $250 billion, then the velocity of circulation is 4.

From the definition of the velocity of circulation, the *equation of exchange* tells us how M, V, P, and Y are connected. This equation is

$$MV = PY.$$

Given the definition of the velocity of circulation, the equation of exchange is always true—it is true by definition. It becomes the quantity theory of money if the quantity of money does not influence the velocity of circulation or real GDP. In this case, the equation of exchange tells us that in the long run, the price level is determined by the quantity of money. That is,

$$P = M(V/Y),$$

where (V/Y) is independent of M. So a change in M brings a proportional change in P.

We can also express the equation of exchange in growth rates,[1] in which form it states that

$$\text{Money growth rate} + \text{Rate of velocity change} = \text{Inflation rate} + \text{Real GDP growth rate}$$

Economics in Action

Does the Quantity Theory Work?

On average, as predicted by the quantity theory of money, the inflation rate fluctuates in line with fluctuations in the money growth rate minus the real GDP growth rate. Figure 1 shows the relationship between money growth (M2 definition) and inflation in the United States. You can see a clear relationship between the two variables.

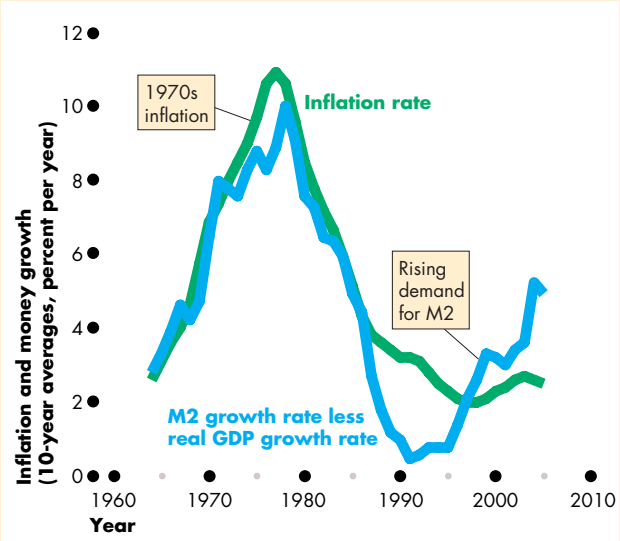

Figure 1 U.S. Money Growth and Inflation

Sources of data: Federal Reserve and Bureau of Labor Statistics.

Solving this equation for the inflation rate gives

$$\text{Inflation rate} = \text{Money growth rate} + \text{Rate of velocity change} - \text{Real GDP growth rate}$$

In the long run, the rate of velocity change is not influenced by the money growth rate. More strongly, in the long run, the rate of velocity change is approxi-

[1] To obtain this equation, begin with

$$MV = PY.$$

Then changes in these variables are related by the equation

$$\Delta MV + M\Delta V = \Delta PY + P\Delta Y.$$

Divide this equation by the equation of exchange to obtain

$$\Delta M/M + \Delta V/V = \Delta P/P + \Delta Y/Y.$$

The term $\Delta M/M$ is the money growth rate, $\Delta V/V$ is the rate of velocity change, $\Delta P/P$ is the inflation rate, and $\Delta Y/Y$ is the real GDP growth rate.

International data also support the quantity theory. Figure 2 shows a scatter diagram of the inflation rate and the money growth rate in 134 countries and Fig. 3 shows the inflation rate and money growth rate in countries with inflation rates below 20 percent a year. You can see a general tendency for money growth and inflation to be correlated, but the quantity theory (the red line) does not predict inflation precisely.

The correlation between money growth and inflation isn't perfect, and the correlation does not tell us that money growth *causes* inflation. Money growth might cause inflation; inflation might cause money growth; or some third variable might cause both inflation and money growth. Other evidence does confirm, though, that causation runs from money growth to inflation.

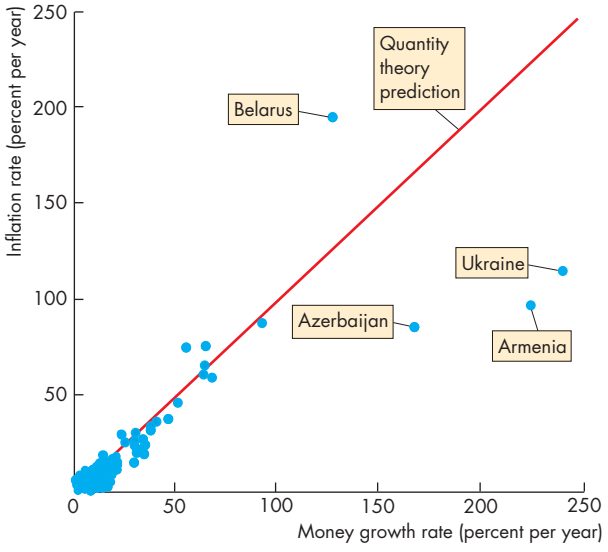

Figure 2 134 Countries: 1990–2005

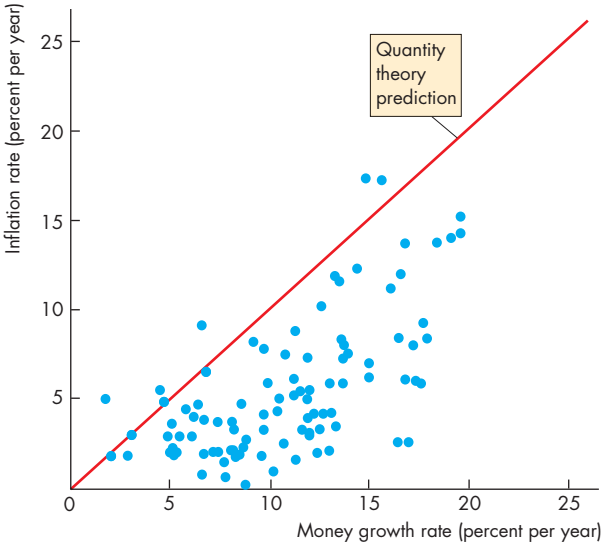

Figure 3 Lower-Inflation Countries: 1990–2005

Sources of data: International Financial Statistics Yearbook, 2008 and International Monetary Fund, *World Economic Outlook*, October, 2008.

mately zero. With this assumption, the inflation rate in the long run is determined as

$$\text{Inflation rate} = \text{Money growth rate} - \text{Real GDP growth rate}.$$

In the long run, fluctuations in the money growth rate minus the real GDP growth rate bring equal fluctuations in the inflation rate.

Also, in the long run, with the economy at full employment, real GDP equals potential GDP, so the real GDP growth rate equals the potential GDP growth rate. This growth rate might be influenced by inflation, but the influence is most likely small and the quantity theory assumes that it is zero. So the real GDP growth rate is given and doesn't change when the money growth rate changes—inflation is correlated with money growth.

REVIEW QUIZ

1 What is the quantity theory of money?
2 How is the velocity of circulation calculated?
3 What is the equation of exchange?
4 Does the quantity theory correctly predict the effects of money growth on inflation?

You can work these questions in Study Plan 8.6 and get instant feedback. myeconlab

You now know what money is, how the banks create it, and how the quantity of money influences the nominal interest rate in the short run and the price level in the long run. *Reading Between the Lines* on pp. 202–203 looks at the Fed's incredible actions in the recent financial crisis.