

Chapter
16

The Monetary System

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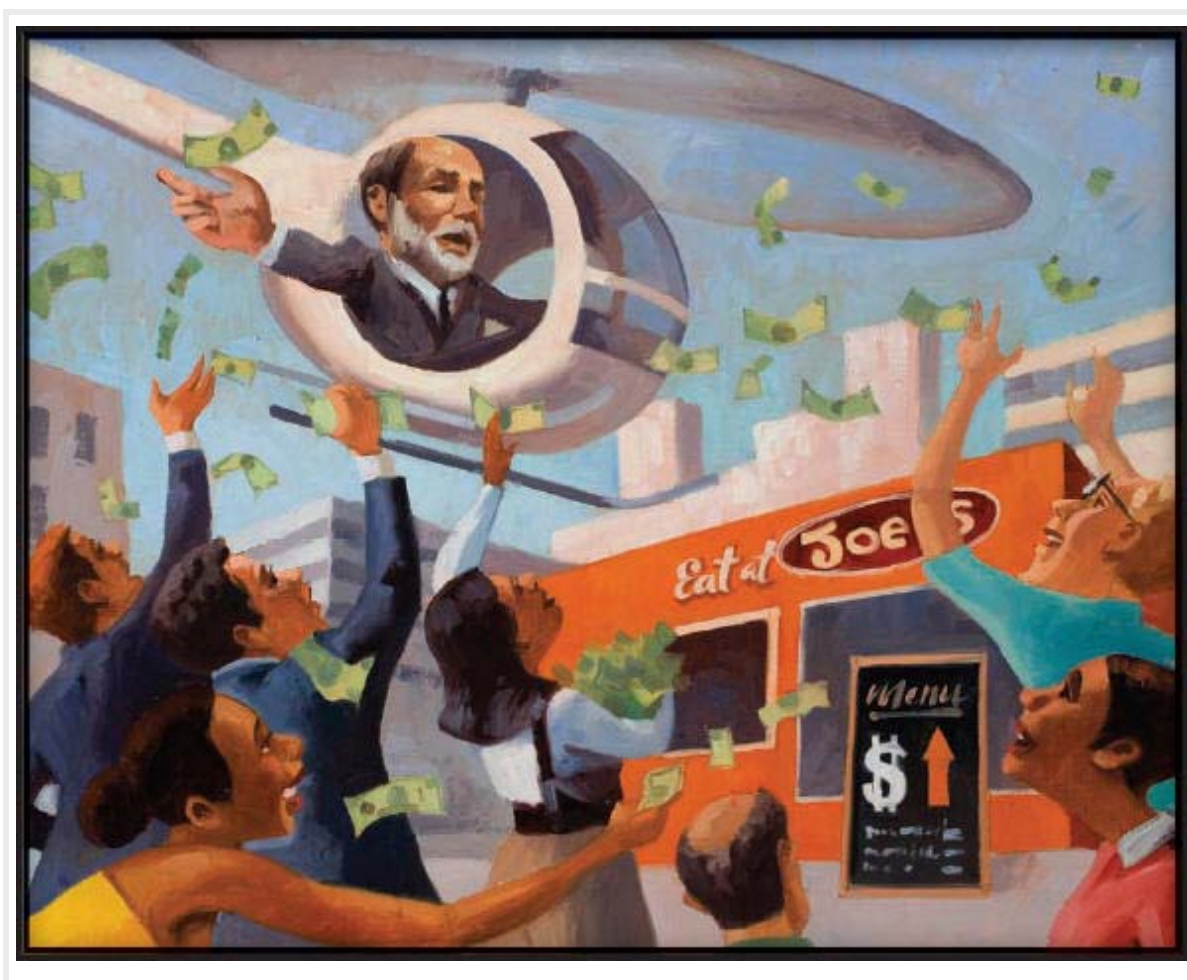
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Chapter Recap

Chapter Introduction



When you walk into a restaurant to buy a meal, you get something of value—a full stomach. To pay for this service, you might hand the restaurateur several worn-out pieces of greenish paper decorated with strange symbols, government buildings, and the portraits of famous dead Americans. Or you might hand him a single piece of paper with the name of a bank and your signature. Whether you pay by cash or check, the restaurateur is happy to work hard to satisfy your gastronomical desires in exchange for these pieces of paper which, in and of themselves, are worthless.

To anyone who has lived in a modern economy, this social custom is not at all odd. Even though paper money has no intrinsic value, the restaurateur is confident that, in the future, some third person will accept it in exchange for something that the restaurateur does value. And that third person is confident that some fourth person will accept the money, with the knowledge that yet a fifth person will accept the money . . . and so on. To the restaurateur and to other people in our society, your cash or check represents a claim to goods and services in the future.

The social custom of using money for transactions is extraordinarily useful in a large, complex society. Imagine, for a moment, that there was no item in the economy widely accepted in exchange for goods and services. People would have to rely on *barter*—the exchange of one good or service for another—to obtain the things they need. To get your restaurant meal, for instance, you would have to offer the restaurateur something of immediate value. You could offer to wash some dishes, clean his car, or give him your family's secret recipe for meat loaf. An economy that relies on barter will have trouble allocating its scarce resources efficiently. In such an economy, trade is said to require the *double coincidence of wants*—the unlikely occurrence that two people each have a good or service that the other wants.

The existence of money makes trade easier. The restaurateur does not care whether you can produce a valuable good or service for him. He is happy to accept your money, knowing that other people will do the same for him. Such a convention allows trade to be roundabout. The restaurateur accepts your money and uses it to pay his chef; the chef uses her paycheck to send her child to day care; the day care center uses this tuition to pay a teacher; and the teacher hires you to mow his lawn. As money flows from person to person in the economy, it facilitates production and trade, thereby allowing each person to specialize in what he or she does best and raising everyone's standard of living.

In this chapter, we begin to examine the role of money in the economy. We discuss what money is, the various forms that money takes, how

the banking system helps create money, and how the government controls the quantity of money in circulation. Because money is so important in the economy, we devote much effort in the rest of this book to learning how changes in the quantity of money affect various economic variables, including inflation, interest rates, production, and employment. Consistent with our long-run focus in the previous four chapters, in the next chapter we examine the long-run effects of changes in the quantity of money. The short-run effects of monetary changes are a more complex topic, which we take up later in the book. This chapter provides the background for all of this further analysis.

16-1 The Meaning of Money

What is money? This might seem like an odd question. When you read that billionaire Bill Gates has a lot of money, you know what that means: He is so rich that he can buy almost anything he wants. In this sense, the term *money* is used to mean *wealth*.

Economists, however, use the word in a more specific sense: **Money** is the set of assets in the economy that people regularly use to buy goods and services from each other. The cash in your wallet is money because you can use it to buy a meal at a restaurant or a shirt at a clothing store. By contrast, if you happened to own a large share of Microsoft Corporation, as Bill Gates does, you would be wealthy, but this asset is not considered a form of money. You could not buy a meal or a shirt with this wealth without first obtaining some cash. According to the economist's definition, money includes only those few types of wealth that are regularly accepted by sellers in exchange for goods and services.

16-1a The Functions of Money

Money has three functions in the economy: It is a *medium of exchange*, a *unit of account*, and a *store of value*. These three functions together distinguish money from other assets in the economy, such as stocks, bonds, real estate, art, and even baseball cards. Let's examine each of these functions of money in turn.

A **medium of exchange** is an item that buyers give to sellers when they purchase goods and services. When you buy a shirt at a clothing store, the store gives you the shirt, and you give the store your money. This transfer of money from buyer to seller allows the transaction to take place. When you walk into a store, you are confident that the store will accept your money for the items it is selling because money is the commonly accepted medium of exchange.

A **unit of account** is the yardstick people use to post prices and record debts. When you go shopping, you might observe that a shirt costs \$30 and a hamburger costs \$3. Even though it would be accurate to say that the price of a shirt is 10 hamburgers and the price of a hamburger is 1/10 of a shirt, prices are never quoted in this way. Similarly, if you take out a loan from a bank, the size of your future loan repayments will be measured in dollars, not in a quantity of goods and services. When we want to measure and record economic value, we use money as the unit of account.

A **store of value** is an item that people can use to transfer purchasing power from the present to the future. When a seller accepts money today in exchange for a good or service, that seller can hold the money and become a buyer of another good or service at another time. Money is not the only store of value in the economy: A person can also transfer purchasing power from the present to the future by holding nonmonetary assets such as stocks and bonds. The term *wealth* is used to refer to the total of all stores of value, including both money and nonmonetary assets.

Economists use the term **liquidity** to describe the ease with which an asset can be converted into the economy's medium of exchange. Because money is the economy's medium of exchange, it is the most liquid asset available. Other assets vary widely in their liquidity. Most stocks and bonds can be sold easily with small cost, so they are relatively liquid assets. By contrast, selling a house, a Rembrandt painting, or a 1948 Joe DiMaggio baseball card requires more time and effort, so these assets are less liquid.

When people decide in what form to hold their wealth, they have to balance the liquidity of each possible asset against the asset's usefulness as a store of value. Money is the most liquid asset, but it is far from perfect as a store of value. When prices rise, the value of money falls. In other words, when goods and services become more expensive, each dollar in your wallet can buy less. This link between the price level and the value of money is key to understanding how money affects the economy, a topic we start to explore in the next chapter.

16-1b The Kinds of Money

When money takes the form of a commodity with intrinsic value, it is called **commodity money**. The term *intrinsic value* means that the item would have value even if it were not used as money. One example of commodity money is gold. Gold has intrinsic value because it is used in industry and in the making of jewelry. Although today we no longer use gold as money, historically gold has been a common form of money because it is relatively easy to carry, measure, and verify for impurities. When an economy uses gold as money (or uses paper money that is convertible into gold on demand), it is said to be operating under a *gold standard*.

Another example of commodity money is cigarettes. In prisoner-of-war camps during World War II, prisoners traded goods and services with one another using cigarettes as the store of value, unit of account, and medium of exchange. Similarly, as the Soviet Union was breaking up in the late 1980s, cigarettes started replacing the ruble as the preferred currency in Moscow. In both cases, even non-smokers were happy to accept cigarettes in an exchange, knowing that they could use the cigarettes to buy other goods and services.

Money without intrinsic value is called **fiat money**. A *fiat* is an order or decree, and fiat money is established as money by government decree. For example, compare the paper dollars in your wallet (printed by the U.S. government) and the paper dollars from a game of Monopoly (printed by the Parker Brothers game company). Why can you use the first to pay your bill at a restaurant but not the second? The answer is that the U.S. government has decreed its dollars to be valid money. Each paper dollar in your wallet reads: "This note is legal tender for all debts, public and private."

Although the government is central to establishing and regulating a system of fiat money (by prosecuting counterfeiters, for example), other factors are also required for the success of such a monetary system. To a large extent, the acceptance of fiat money depends as much on expectations and social convention as on government decree. The Soviet government in the 1980s never abandoned the ruble as the official currency. Yet the people of Moscow preferred to accept cigarettes (or even American dollars) in exchange for goods and services because they were more confident that these alternative monies would be accepted by others in the future.

In the News: Mackerel Economics

Money evolves naturally to facilitate exchange, even in prisons.

Packs of Fish Catch on as Currency

By Justin Scheck

When Larry Levine helped prepare divorce papers for a client a few years ago, he got paid in mackerel. Once the case ended, he says, "I had a stack of macks."

Mr. Levine and his client were prisoners in California's Lompoc Federal Correctional Complex. Like other federal inmates around the country, they found a can of mackerel—the "mack" in prison lingo—was the standard currency.

"It's the coin of the realm," says Mark Bailey, who paid Mr. Levine in fish. Mr. Bailey was serving a two-year tax-fraud sentence in connection with a chain of strip clubs he owned. Mr. Levine was serving a nine-year term for drug dealing. Mr. Levine says he used his macks to get his beard trimmed, his clothes pressed and his shoes shined by other prisoners. "A haircut is two macks," he says, as an expected tip for inmates who work in the prison barber shop.

There's been a mackerel economy in federal prisons since about 2004, former inmates and some prison consultants say. That's when federal prisons prohibited smoking and, by default, the cigarette pack, which was the earlier gold standard.

Prisoners need a proxy for the dollar because they're not allowed to possess cash. Money they get from prison jobs (which pay a maximum of 40 cents an hour, according to the Federal Bureau of Prisons) or family members goes into commissary accounts that let them buy things such as food and toiletries. After the smokes disappeared, inmates turned to other items on the commissary menu to use as currency.

Books of stamps were one easy alternative. "It was like half a book for a piece of fruit," says Tony Serra, a well-known San Francisco criminal-defense attorney who last year finished nine months in Lompoc on tax charges. Elsewhere in the West, prisoners use PowerBars or cans of tuna, says Ed Bales, a consultant who advises people who are headed to prison. But in much of the federal prison system, he says, mackerel has become the currency of choice.

Mackerel supplier Global Source Marketing Inc. says demand from prisons has grown since 2004. In recent years, demand has switched from cans—which wardens don't like because inmates can turn them into makeshift knives—to plastic-and-foil pouches of mackerel fillets, says Jon Linder, a vice president at supplier Power Commissary Inc., in Bohemia, N.Y.

Mackerel is hot in prisons in the U.S., but not so much anywhere else, says Mark Muntz, president of Global Source, which imports fillets of the oily, dark-fleshed fish from Asian canneries. Mr. Muntz says he's tried marketing mackerel to discount retailers. "We've even tried 99-cent stores," he says. "It never has done very well at all, regardless of the retailer, but it's very popular in the prisons."

Mr. Muntz says he sold more than \$1 million of mackerel for federal prison commissaries last year. It accounted for about half his commissary sales, he says, outstripping the canned tuna, crab, chicken and oysters he offers.

Unlike those more expensive delicacies, former prisoners say, the mack is a good stand-in for the greenback because each can (or pouch) costs about \$1 and few—other than weight-lifters craving protein—want to eat it.

So inmates stash macks in lockers provided by the prison and use them to buy goods, including illicit ones such as stolen food and home-brewed "prison hooch," as well as services, such as shoeshines and cell cleaning.

"When I grow up, I am going to be a medium of exchange, unit of account, and store of value."



The Wall Street Journal, October 2, 2008.

16-1c Money in the U.S. Economy

As we will see, the quantity of money circulating in the economy, called the *money stock*, has a powerful influence on many economic variables. But before we consider why that is true, we need to ask a preliminary question: What is the quantity of money? In particular, suppose you were given the task of measuring how much money there is in the U.S. economy. What would you include in your measure?

The most obvious asset to include is **currency**—the paper bills and coins in the hands of the public. Currency is clearly the most widely accepted medium of exchange in our economy. There is no doubt that it is part of the money stock.

Yet currency is not the only asset that you can use to buy goods and services. Many stores also accept personal checks. Wealth held in your checking account is almost as convenient for buying things as wealth held in your wallet. To measure the money stock, therefore, you might want to include **demand deposits**—balances in bank accounts that depositors can access on demand simply by writing a check or swiping a debit card at a store.

Once you start to consider balances in checking accounts as part of the money stock, you are led to consider the large variety of other accounts that people hold at banks and other financial institutions. Bank depositors usually cannot write checks against the balances in their savings accounts, but they can easily transfer funds from savings into checking accounts. In addition, depositors in money market mutual funds can often write checks against their balances. Thus, these other accounts should plausibly be part of the U.S. money stock.

FYI: Why Credit Cards Aren't Money

It might seem natural to include credit cards as part of the economy's stock of money. After all, people use credit cards to make many of their purchases. Aren't credit cards, therefore, a medium of exchange?

At first this argument may seem persuasive, but credit cards are excluded from all measures of the quantity of money. The reason is that credit cards are not really a method of payment but a method of *deferring* payment. When you buy a meal with a credit card, the bank that issued the card pays the restaurant what it is due. At a later date, you will have to repay the bank (perhaps with interest). When the time comes to pay your credit card bill, you will probably do so by writing a check against your checking account. The balance in this checking account is part of the economy's stock of money.

Notice that credit cards are very different from debit cards, which automatically withdraw funds from a bank account to pay for items bought. Rather than allowing the user to postpone payment for a purchase, a debit card allows the user immediate access to deposits in a bank

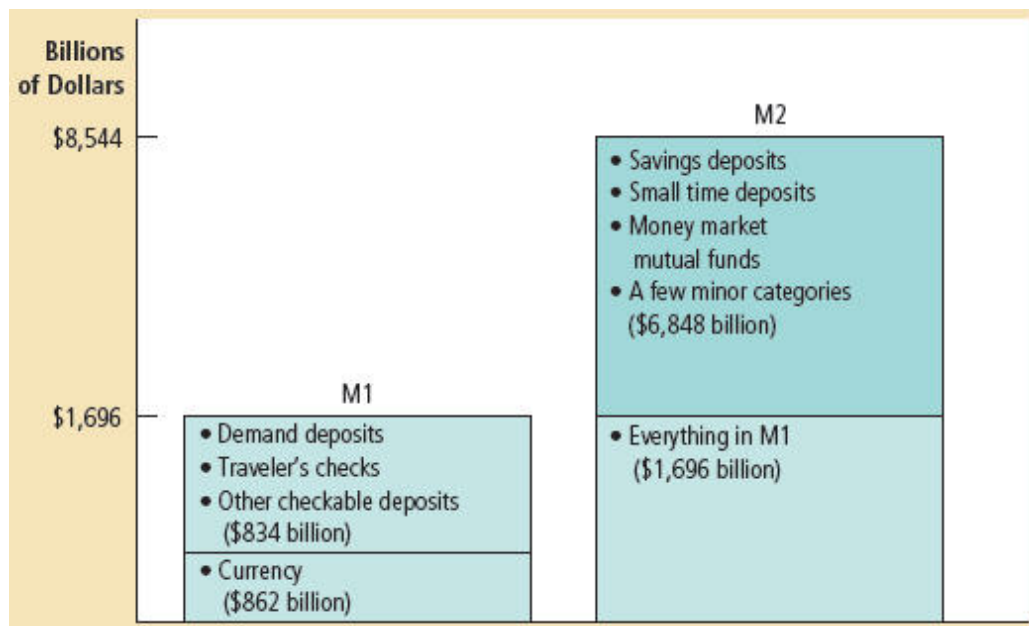
account. In this sense, a debit card is more similar to a check than to a credit card. The account balances that lie behind debit cards are included in measures of the quantity of money.

Even though credit cards are not considered a form of money, they are nonetheless important for analyzing the monetary system. People who have credit cards can pay many of their bills together at the end of the month, rather than sporadically as they make purchases. As a result, people who have credit cards probably hold less money on average than people who do not have credit cards. Thus, the introduction and increased popularity of credit cards may reduce the amount of money that people choose to hold.

In a complex economy such as ours, it is not easy to draw a line between assets that can be called "money" and assets that cannot. The coins in your pocket clearly are part of the money stock, and the Empire State Building clearly is not, but there are many assets in between these extremes for which the choice is less clear. Because different analysts can reasonably disagree about where to draw the dividing line between monetary and nonmonetary assets, various measures of the money stock are available for the U.S. economy. Figure 1 shows the two most commonly used, designated M1 and M2. M2 includes more assets in its measure of money than does M1.

Figure 1. Two Measures of the Money Stock for the U.S. Economy

The two most widely followed measures of the money stock are M1 and M2. This figure shows the size of each measure in 2009.



For our purposes in this book, we need not dwell on the differences between the various measures of money. None of our discussion will hinge on the distinction between M1 and M2. The important point is that the money stock for the U.S. economy includes not just currency but also deposits in banks and other financial institutions that can be readily accessed and used to buy goods and services.

Case Study: Where Is All the Currency?

One puzzle about the money stock of the U.S. economy concerns the amount of currency. At the end of 2009, there was \$862 billion of currency outstanding. To put this number in perspective, we can divide it by 236 million, the number of adults (age 16 and older) in the United States. This calculation implies that the average adult holds about \$3,653 of currency. Most people are surprised to learn that our economy has so much currency because they carry far less than this in their wallets.

Who is holding all this currency? No one knows for sure, but there are two plausible explanations.

The first explanation is that much of the currency is held abroad. In foreign countries without a stable monetary system, people often prefer

U.S. dollars to domestic assets. It is, in fact, not unusual to see U.S. dollars used overseas as the medium of exchange, unit of account, and store of value.

The second explanation is that much of the currency is held by drug dealers, tax evaders, and other criminals. For most people in the U.S. economy, currency is not a particularly good way to hold wealth. Not only can currency be lost or stolen, but it also does not earn interest, whereas a bank deposit does. Thus, most people hold only small amounts of currency. By contrast, criminals may avoid putting their wealth in banks because a bank deposit gives police a paper trail they can use to trace illegal activities. For criminals, currency may be the best store of value available.

QUICK QUIZ

List and describe the three functions of money.

16-2 The Federal Reserve System

BBC Video: Indymac

Whenever an economy uses a system of fiat money, as the U.S. economy does, some agency must be responsible for regulating the system. In the United States, that agency is the **Federal Reserve**, often simply called the **Fed**. If you look at the top of a dollar bill, you will see that it is called a "Federal Reserve Note." The Fed is an example of a **central bank**—an institution designed to oversee the banking system and regulate the quantity of money in the economy. Other major central banks around the world include the Bank of England, the Bank of Japan, and the European Central Bank.

16-2a The Fed's Organization

The Federal Reserve was created in 1913 after a series of bank failures in 1907 convinced Congress that the United States needed a central bank to ensure the health of the nation's banking system. Today, the Fed is run by its board of governors, which has seven members appointed by the president and confirmed by the Senate. The governors have fourteen-year terms. Just as federal judges are given lifetime appointments to insulate them from politics, Fed governors are given long terms to give them independence from short-term political pressures when they formulate monetary policy.

Among the seven members of the board of governors, the most important is the chairman. The chairman directs the Fed staff, presides over board meetings, and testifies regularly about Fed policy in front of congressional committees. The president appoints the chairman to a four-year term. As this book was going to press, the chairman of the Fed was Ben Bernanke, a former economics professor who was appointed to the Fed job by President George W. Bush in 2005 and reappointed by President Barack Obama in 2009.

The Federal Reserve System is made up of the Federal Reserve Board in Washington, D.C., and twelve regional Federal Reserve Banks located in major cities around the country. The presidents of the regional banks are chosen by each bank's board of directors, whose members are typically drawn from the region's banking and business community.

The Fed has two related jobs. The first is to regulate banks and ensure the health of the banking system. This task is largely the responsibility of the regional Federal Reserve Banks. In particular, the Fed monitors each bank's financial condition and facilitates bank transactions by clearing checks. It also acts as a bank's bank. That is, the Fed makes loans to banks when banks themselves want to borrow. When financially troubled banks find themselves short of cash, the Fed acts as a *lender of last resort*—a lender to those who cannot borrow anywhere else—to maintain stability in the overall banking system.

The Fed's second and more important job is to control the quantity of money that is made available in the economy, called the **money supply**. Decisions by policymakers concerning the money supply constitute **monetary policy**. At the Federal Reserve, monetary policy is made by the Federal Open Market Committee (FOMC). The FOMC meets about every six weeks in Washington, D.C., to discuss the condition of the economy and consider changes in monetary policy.

16-2b The Federal Open Market Committee

The Federal Open Market Committee is made up of the seven members of the board of governors and five of the twelve regional bank

presidents. All twelve regional presidents attend each FOMC meeting, but only five get to vote. The five with voting rights rotate among the twelve regional presidents over time. The president of the New York Fed always gets a vote, however, because New York is the traditional financial center of the U.S. economy and because all Fed purchases and sales of government bonds are conducted at the New York Fed's trading desk.

Through the decisions of the FOMC, the Fed has the power to increase or decrease the number of dollars in the economy. In simple metaphorical terms, you can imagine the Fed printing dollar bills and dropping them around the country by helicopter. Similarly, you can imagine the Fed using a giant vacuum cleaner to suck dollar bills out of people's wallets. Although in practice the Fed's methods for changing the money supply are more complex and subtle than this, the helicopter-vacuum metaphor is a good first step to understanding the meaning of monetary policy.

Later in this chapter, we discuss how the Fed actually changes the money supply, but it is worth noting here that the Fed's primary tool is the *open-market operation*—the purchase and sale of U.S. government bonds. (Recall that a U.S. government bond is a certificate of indebtedness of the federal government.) If the FOMC decides to increase the money supply, the Fed creates dollars and uses them to buy government bonds from the public in the nation's bond markets. After the purchase, these dollars are in the hands of the public. Thus, an open-market purchase of bonds by the Fed increases the money supply. Conversely, if the FOMC decides to decrease the money supply, the Fed sells government bonds from its portfolio to the public in the nation's bond markets. After the sale, the dollars it receives for the bonds are out of the hands of the public. Thus, an open-market sale of bonds by the Fed decreases the money supply.

Central banks are important institutions because changes in the money supply can profoundly affect the economy. One of the *Ten Principles of Economics* in Chapter 1 is that prices rise when the government prints too much money. Another of the *Ten Principles of Economics* is that society faces a short-run trade-off between inflation and unemployment. The power of the Fed rests on these principles. For reasons we discuss more fully in the coming chapters, the Fed's policy decisions have an important influence on the economy's rate of inflation in the long run and the economy's employment and production in the short run. Indeed, the chairman of the Federal Reserve has been called the second most powerful person in the United States.

QUICK QUIZ

What are the primary responsibilities of the Federal Reserve? If the Fed wants to increase the supply of money, how does it usually do so?

16-3 Banks and the Money Supply

So far, we have introduced the concept of "money" and discussed how the Federal Reserve controls the supply of money by buying and selling government bonds in open-market operations. Although this explanation of the money supply is correct, it is not complete. In particular, it omits the central role that banks play in the monetary system.

Recall that the amount of money you hold includes both currency (the bills in your wallet and coins in your pocket) and demand deposits (the balance in your checking account). Because demand deposits are held in banks, the behavior of banks can influence the quantity of demand deposits in the economy and, therefore, the money supply. This section examines how banks affect the money supply and, in doing so, how they complicate the Fed's job of controlling the money supply.



"I've heard a lot about money, and now I'd like to try some."

16-3a The Simple Case of 100-Percent-Reserve Banking

To see how banks influence the money supply, let's first imagine a world without any banks at all. In this simple world, currency is the only form of money. To be concrete, let's suppose that the total quantity of currency is \$100. The supply of money is, therefore, \$100.

Now suppose that someone opens a bank, appropriately called First National Bank. First National Bank is only a depository institution—that is, it accepts deposits but does not make loans. The purpose of the bank is to give depositors a safe place to keep their money. Whenever a person deposits some money, the bank keeps the money in its vault until the depositor withdraws it, writes a check, or uses a debit card to access his or her balance. Deposits that banks have received but have not loaned out are called **reserves**. In this imaginary economy, all deposits are held as reserves, so this system is called *100-percent-reserve banking*.

We can express the financial position of First National Bank with a *T-account*, which is a simplified accounting statement that shows changes in a bank's assets and liabilities. Here is the T-account for First National Bank if the economy's entire \$100 of money is deposited in the bank:

First National Bank			
Assets		Liabilities	
Reserves	\$100.00	Deposits	\$100.00

On the left side of the T-account are the bank's assets of \$100 (the reserves it holds in its vaults). On the right side are the bank's liabilities of \$100 (the amount it owes to its depositors). Because the assets and liabilities of First National Bank exactly balance, this accounting statement

is sometimes called a *balance sheet*.

Now consider the money supply in this imaginary economy. Before First National Bank opens, the money supply is the \$100 of currency that people are holding. After the bank opens and people deposit their currency, the money supply is the \$100 of demand deposits. (There is no longer any currency outstanding, for it is all in the bank vault.) Each deposit in the bank reduces currency and raises demand deposits by exactly the same amount, leaving the money supply unchanged. Thus, *if banks hold all deposits in reserve, banks do not influence the supply of money*.

16-3b Money Creation with Fractional-Reserve Banking

Eventually, the bankers at First National Bank may start to reconsider their policy of 100-percent-reserve banking. Leaving all that money idle in their vaults seems unnecessary. Why not lend some of it out and earn a profit by charging interest on the loans? Families buying houses, firms building new factories, and students paying for college would all be happy to pay interest to borrow some of that money for a while. First National Bank has to keep some reserves so that currency is available if depositors want to make withdrawals. But if the flow of new deposits is roughly the same as the flow of withdrawals, First National needs to keep only a fraction of its deposits in reserve. Thus, First National adopts a system called **fractional-reserve banking**.

The fraction of total deposits that a bank holds as reserves is called the **reserve ratio**. This ratio is determined by a combination of government regulation and bank policy. As we discuss more fully later in the chapter, the Fed sets a minimum amount of reserves that banks must hold, called a *reserve requirement*. In addition, banks may hold reserves above the legal minimum, called *excess reserves*, so they can be more confident that they will not run short of cash. For our purpose here, we take the reserve ratio as given to examine how fractional-reserve banking influences the money supply.

Let's suppose that First National has a reserve ratio of $1/10$, or 10 percent. This means that it keeps 10 percent of its deposits in reserve and loans out the rest. Now let's look again at the bank's T-account:

First National Bank			
Assets		Liabilities	
Reserves	\$10.00	Deposits	\$100.00
Loans	90.00		

First National still has \$100 in liabilities because making the loans did not alter the bank's obligation to its depositors. But now the bank has two kinds of assets: It has \$10 of reserves in its vault, and it has loans of \$90. (These loans are liabilities of the people taking out the loans, but they are assets of the bank making the loans because the borrowers will later repay the bank.) In total, First National's assets still equal its liabilities.

Once again consider the supply of money in the economy. Before First National makes any loans, the money supply is the \$100 of deposits in the bank. Yet when First National makes these loans, the money supply increases. The depositors still have demand deposits totaling \$100, but now the borrowers hold \$90 in currency. The money supply (which equals currency plus demand deposits) equals \$190. Thus, *when banks hold only a fraction of deposits in reserve, banks create money*.

At first, this creation of money by fractional-reserve banking may seem too good to be true: It appears that the bank has created money out of thin air. To make this creation of money seem less miraculous, note that when First National Bank loans out some of its reserves and creates money, it does not create any wealth. Loans from First National give the borrowers some currency and thus the ability to buy goods and services. Yet the borrowers are also taking on debts, so the loans do not make them any richer. In other words, as a bank creates the asset of money, it also creates a corresponding liability for those who borrowed the created money. At the end of this process of money creation, the economy is more liquid in the sense that there is more of the medium of exchange, but the economy is no wealthier than before.

16-3c The Money Multiplier

The creation of money does not stop with First National Bank. Suppose the borrower from First National uses the \$90 to buy something from

someone who then deposits the currency in Second National Bank. Here is the T-account for Second National Bank:

Second National Bank			
Assets		Liabilities	
Reserves	\$ 9.00	Deposits	\$90.00
Loans	81.00		

After the deposit, this bank has liabilities of \$90. If Second National also has a reserve ratio of 10 percent, it keeps assets of \$9 in reserve and makes \$81 in loans. In this way, Second National Bank creates an additional \$81 of money. If this \$81 is eventually deposited in Third National Bank, which also has a reserve ratio of 10 percent, this bank keeps \$8.10 in reserve and makes \$72.90 in loans. Here is the T-account for Third National Bank:

Third National Bank			
Assets		Liabilities	
Reserves	\$ 8.10	Deposits	\$81.00
Loans	72.90		

The process goes on and on. Each time that money is deposited and a bank loan is made, more money is created.

How much money is eventually created in this economy? Let's add it up:

Original deposit	= \$100.00
First National lending	= \$ 90.00 [= .9 × \$100.00]
Second National lending	= \$ 81.00 [= .9 × \$90.00]
Third National lending	= \$ 72.90 [= .9 × \$81.00]
•	•
•	•
•	•
<hr/>	
Total money supply	= \$1,000.00

It turns out that even though this process of money creation can continue forever, it does not create an infinite amount of money. If you laboriously add the infinite sequence of numbers in the preceding example, you find the \$100 of reserves generates \$1,000 of money. The amount of money the banking system generates with each dollar of reserves is called the **money multiplier**. In this imaginary economy, where the \$100 of reserves generates \$1,000 of money, the money multiplier is 10.

What determines the size of the money multiplier? It turns out that the answer is simple: *The money multiplier is the reciprocal of the reserve ratio.* If R is the reserve ratio for all banks in the economy, then each dollar of reserves generates $1/R$ dollars of money. In our example, $R = 1/10$, so the money multiplier is 10.

This reciprocal formula for the money multiplier makes sense. If a bank holds \$1,000 in deposits, then a reserve ratio of $1/10$ (10 percent) means that the bank must hold \$100 in reserves. The money multiplier just turns this idea around: If the banking system as a whole holds a total of \$100 in reserves, it can have only \$1,000 in deposits. In other words, if R is the ratio of reserves to deposits at each bank (that is, the reserve ratio), then the ratio of deposits to reserves in the banking system (that is, the money multiplier) must be $1/R$.

This formula shows how the amount of money banks create depends on the reserve ratio. If the reserve ratio were only $1/20$ (5 percent), then

the banking system would have 20 times as much in deposits as in reserves, implying a money multiplier of 20. Each dollar of reserves would generate \$20 of money. Similarly, if the reserve ratio were $1/4$ (25 percent), deposits would be 4 times reserves, the money multiplier would be 4, and each dollar of reserves would generate \$4 of money. Thus, *the higher the reserve ratio, the less of each deposit banks loan out, and the smaller the money multiplier*. In the special case of 100-percent-reserve banking, the reserve ratio is 1, the money multiplier is 1, and banks do not make loans or create money.

16-3d Bank Capital, Leverage, and the Financial Crisis of 2008–2009

In the previous sections, we have seen a very simplified explanation of how banks work. The reality of modern banking, however, is a bit more complicated, and this complex reality played a leading role in the financial crisis of 2008 and 2009. Before looking at that crisis, we need to learn a bit more about how banks actually function.

In the bank balance sheets you have seen so far, a bank accepts deposits and uses those deposits either to make loans or to hold reserves. More realistically, a bank gets financial resources not only from accepting deposits but also, like other companies, from issuing equity and debt. The resources that a bank obtains from issuing equity to its owners are called **bank capital**. A bank uses these financial resources in various ways to generate profit for its owners. It not only makes loans and holds reserves but also buys financial securities, such as stocks and bonds.

Here is a more realistic example of a bank's balance sheet:

More Realistic National Bank			
Assets		Liabilities and Owners' Equity	
Reserves	\$200	Deposits	\$800
Loans	700	Debt	150
Securities	100	Capital (owners' equity)	50

On the right side of this balance sheet are the bank's liabilities and capital (also known as *owners' equity*). This bank obtained \$50 of resources from its owners. It also took in \$800 of deposits and issued \$150 of debt. The total of \$1,000 was put to use in three ways; these are listed on the left side of the balance sheet, which shows the bank's assets. This bank held \$200 in reserves, made \$700 in bank loans, and used \$100 to buy financial securities, such as government or corporate bonds. The bank decides how to allocate its resources among asset classes based on their risk and return, as well as on any regulations (such as reserve requirements) that restrict the bank's choices.

By the rules of accounting, the reserves, loans, and securities on the left side of the balance sheet must always equal, in total, the deposits, debt, and capital on the right side of the balance sheet. There is no magic in this equality. It occurs because the value of the owners' equity is, by definition, the value of the bank's assets (reserves, loans, and securities) minus the value of its liabilities (deposits and debt). Therefore, the left and right hand sides of the balance sheet always sum to the same total.

Many businesses in the economy rely on **leverage**, the use of borrowed money to supplement existing funds for investment purposes. Indeed, whenever anyone uses debt to finance an investment project, he is applying leverage. Leverage is particularly important for banks, however, because borrowing and lending are at the heart of what they do. To fully understand banking, therefore, it is crucial to understand how leverage works.

The **leverage ratio** is the ratio of the bank's total assets to bank capital. In this example, the leverage ratio is $\$1,000/\50 , or 20. A leverage ratio of 20 means that for every dollar of capital that the bank owners have contributed, the bank has \$20 of assets. Of the \$20 of assets, \$19 are financed with borrowed money—either by taking in deposits or issuing debt.

You may have learned in a science class that a lever can amplify a force: A boulder that you cannot move with your arms alone will move more easily if you use a lever. A similar result occurs with bank leverage. To see how this works, let's continue with this numerical example. Suppose that the bank's assets were to rise in value by 5 percent because, say, some of the securities the bank was holding rose in price. Then the \$1,000 of assets would now be worth \$1,050. Because the depositors and debt holders are still owed \$950, the bank capital rises from \$50 to \$100. Thus, when the leverage rate is 20, a 5-percent increase in the value of assets increases the owners' equity by 100 percent.

The same principle works on the downside, but with troubling consequences. Suppose that some people who borrowed from the bank default

on their loans, reducing the value of the bank's assets by 5 percent, to \$950. Because the depositors and debt holders have the legal right to be paid before the bank owners, the value of the owners' equity falls to zero. Thus, when the leverage ratio is 20, a 5-percent fall in the value of the bank assets leads to a 100-percent fall in bank capital. If the value of assets were to fall by more than 5 percent, the bank's assets would fall below its liabilities. In this case, the bank would be *insolvent*, and it would be unable to pay off its debt holders and depositors in full.

Bank regulators require banks to hold a certain amount of capital. The goal of such a **capital requirement** is to ensure that banks will be able to pay off their depositors (without having to resort to government-provided deposit insurance funds). The amount of capital required depends on the kind of assets a bank holds. If the bank holds safe assets such as government bonds, regulators require less capital than if the bank holds risky assets such as loans to borrowers whose credit is of dubious quality.

In 2008 and 2009, many banks found themselves with too little capital after they had incurred losses on some of their assets—specifically, mortgage loans and securities backed by mortgage loans. The shortage of capital induced the banks to reduce their lending, a phenomenon sometimes called a *credit crunch*, which in turn contributed to a severe downturn in economic activity. (This event is discussed more fully in Chapter 20.) To address this problem, the U.S. Treasury, working together with the Federal Reserve, put many billions of dollars of public funds into the banking system to increase the amount of bank capital. As a result, it temporarily made the U.S. taxpayer a part owner of many banks. The goal of this unusual policy was to recapitalize the banking system so that bank lending could return to a more normal level, which in fact occurred by late 2009.

16-4 The Fed's Tools of Monetary Control

As we have already discussed, the Federal Reserve is responsible for controlling the supply of money in the economy. Now that we understand how banking works, we are in a better position to understand how the Fed carries out this job. Because banks create money in a system of fractional-reserve banking, the Fed's control of the money supply is indirect. When the Fed decides to change the money supply, it must consider how its actions will work through the banking system.

The Fed has a variety of tools in its monetary toolbox. We can group those tools into two groups: those that influence the quantity of reserves and those that influence the reserve ratio and thereby the money multiplier.

16-4a How the Fed Influences the Quantity of Reserves

The first way the Fed can change the money supply is by changing the quantity of reserves. The Fed alters the quantity of reserves in the economy either by buying or selling bonds in open-market operations or by making loans to banks (or by some combination of the two). Let's consider each of these in turn.

Open-Market Operations

As we noted earlier, the Fed conducts **open-market operations** when it buys or sells government bonds. To increase the money supply, the Fed instructs its bond traders at the New York Fed to buy bonds from the public in the nation's bond markets. The dollars the Fed pays for the bonds increase the number of dollars in the economy. Some of these new dollars are held as currency, and some are deposited in banks. Each new dollar held as currency increases the money supply by exactly \$1. Each new dollar deposited in a bank increases the money supply by more than a dollar because it increases reserves and, thereby, the amount of money that the banking system can create.

To reduce the money supply, the Fed does just the opposite: It sells government bonds to the public in the nation's bond markets. The public pays for these bonds with its holdings of currency and bank deposits, directly reducing the amount of money in circulation. In addition, as people make withdrawals from banks to buy these bonds from the Fed, banks find themselves with a smaller quantity of reserves. In response, banks reduce the amount of lending, and the process of money creation reverses itself.

Open-market operations are easy to conduct. In fact, the Fed's purchases and sales of government bonds in the nation's bond markets are similar to the transactions that any individual might undertake for his own portfolio. (Of course, when an individual buys or sells a bond, money changes hands, but the amount of money in circulation remains the same.) In addition, the Fed can use open-market operations to change the money supply by a small or large amount on any day without major changes in laws or bank regulations. Therefore, open-market operations are the tool of monetary policy that the Fed uses most often.

Fed Lending to Banks

The Fed can also increase the quantity of reserves in the economy by lending reserves to banks. Banks borrow from the Fed when they feel they do not have enough reserves on hand, either to satisfy bank regulators, meet depositor withdrawals, make new loans, or for some other business reason.

There are various ways banks can borrow from the Fed. Traditionally, banks borrow from the Fed's *discount window* and pay an interest rate on that loan called the **discount rate**. When the Fed makes such a loan to a bank, the banking system has more reserves than it otherwise would, and these additional reserves allow the banking system to create more money.

The Fed can alter the money supply by changing the discount rate. A higher discount rate discourages banks from borrowing reserves from the Fed. Thus, an increase in the discount rate reduces the quantity of reserves in the banking system, which in turn reduces the money supply. Conversely, a lower discount rate encourages banks to borrow from the Fed, increasing the quantity of reserves and the money supply.

In recent years, the Federal Reserve has set up new mechanisms for banks to borrow from the Fed. For example, under the *Term Auction Facility*, the Fed sets a quantity of funds it wants to lend to banks, and eligible banks then bid to borrow those funds. The loans go to the highest eligible bidders—that is, to the banks that have acceptable collateral and are offering to pay the highest interest rate. Unlike at the discount window, where the Fed sets the price of a loan and the banks determine the quantity of borrowing, at the Term Auction Facility the Fed sets the quantity of borrowing and competitive bidding among banks determines the price. The more funds the Fed makes available through this and similar facilities, the greater the quantity of reserves and the larger the money supply.

The Fed uses such lending not only to control the money supply but also to help financial institutions when they are in trouble. For example, when the stock market crashed by 22 percent on October 19, 1987, many Wall Street brokerage firms found themselves temporarily in need of funds to finance the high volume of stock trading. The next morning, before the stock market opened, Fed Chairman Alan Greenspan

announced the Fed's "readiness to serve as a source of liquidity to support the economic and financial system." Many economists believe that Greenspan's reaction to the stock crash was an important reason it had few repercussions.

Similarly, in 2008 and 2009, a fall in housing prices throughout the United States led to a sharp rise in the number of homeowners defaulting on their mortgage loans, and many financial institutions holding those mortgages ran into trouble. In an attempt to prevent these events from having broader economic ramifications, the Fed provided many billions of dollars of loans to financial institutions in distress.

16-4b How the Fed Influences the Reserve Ratio

In addition to influencing the quantity of reserves, the Fed changes the money supply by influencing the reserve ratio and thereby the money multiplier. The Fed can influence the reserve ratio either through regulating the quantity of reserves banks must hold or through the interest rate that the Fed pays banks on their reserves. Again, we consider each of these monetary policy tools in turn.

Reserve Requirements

One way the Fed can influence the reserve ratio is by altering **reserve requirements**, the regulations that set the minimum amount of reserves that banks must hold against their deposits. Reserve requirements influence how much money the banking system can create with each dollar of reserves. An increase in reserve requirements means that banks must hold more reserves and, therefore, can loan out less of each dollar that is deposited. As a result, an increase in reserve requirements raises the reserve ratio, lowers the money multiplier, and decreases the money supply. Conversely, a decrease in reserve requirements lowers the reserve ratio, raises the money multiplier, and increases the money supply.

The Fed uses changes in reserve requirements only rarely because these changes disrupt the business of banking. When the Fed increases reserve requirements, for instance, some banks find themselves short of reserves, even though they have seen no change in deposits. As a result, they have to curtail lending until they build their level of reserves to the new required level. Moreover, in recent years, this particular tool has become less effective because many banks hold excess reserves (that is, more reserves than are required).

Paying Interest on Reserves

Traditionally, banks did not earn any interest on the reserves they held. In October 2008, however, the Fed began paying *interest on reserves*. That is, when a bank holds reserves on deposit at the Fed, the Fed now pays the bank interest on those deposits. This change gives the Fed another tool with which to influence the economy. The higher the interest rate on reserves, the more reserves banks will choose to hold. Thus, an increase in the interest rate on reserves will tend to increase the reserve ratio, lower the money multiplier, and lower the money supply. Because the Fed has paid interest on reserves for a relatively short time, it is not yet clear how important this new instrument will be in the conduct of monetary policy.

16-4c Problems in Controlling the Money Supply

The Fed's various tools—open-market operations, bank lending, reserve requirements, and interest on reserves—have powerful effects on the money supply. Yet the Fed's control of the money supply is not precise. The Fed must wrestle with two problems, each of which arises because much of the money supply is created by our system of fractional-reserve banking.

The first problem is that the Fed does not control the amount of money that households choose to hold as deposits in banks. The more money households deposit, the more reserves banks have, and the more money the banking system can create. The less money households deposit, the less reserves banks have, and the less money the banking system can create. To see why this is a problem, suppose that one day people begin to lose confidence in the banking system and, therefore, decide to withdraw deposits and hold more currency. When this happens, the banking system loses reserves and creates less money. The money supply falls, even without any Fed action.

The second problem of monetary control is that the Fed does not control the amount that bankers choose to lend. When money is deposited in a bank, it creates more money only when the bank loans it out. Because banks can choose to hold excess reserves instead, the Fed cannot be sure how much money the banking system will create. For instance, suppose that one day bankers become more cautious about economic conditions and decide to make fewer loans and hold greater reserves. In this case, the banking system creates less money than it otherwise would. Because of the bankers' decision, the money supply falls.

Hence, in a system of fractional-reserve banking, the amount of money in the economy depends in part on the behavior of depositors and bankers. Because the Fed cannot control or perfectly predict this behavior, it cannot perfectly control the money supply. Yet if the Fed is vigilant, these problems need not be large. The Fed collects data on deposits and reserves from banks every week, so it is quickly aware of any

changes in depositor or banker behavior. It can, therefore, respond to these changes and keep the money supply close to whatever level it chooses.

Case Study: Bank Runs and the Money Supply

Most likely you have never witnessed a bank run in real life, but you may have seen one depicted in movies such as *Mary Poppins* or *It's a Wonderful Life*. A bank run occurs when depositors suspect that a bank may go bankrupt and, therefore, "run" to the bank to withdraw their deposits. The United States has not seen a major bank run in recent history, but in the United Kingdom, a bank called Northern Rock experienced a run in 2007 and, as a result, was eventually taken over by the government.

Bank runs are a problem for banks under fractional-reserve banking. Because a bank holds only a fraction of its deposits in reserve, it cannot satisfy withdrawal requests from all depositors. Even if the bank is in fact *solvent* (meaning that its assets exceed its liabilities), it will not have enough cash on hand to allow all depositors immediate access to all of their money. When a run occurs, the bank is forced to close its doors until some bank loans are repaid or until some lender of last resort (such as the Fed) provides it with the currency it needs to satisfy depositors.

Bank runs complicate the control of the money supply. An important example of this problem occurred during the Great Depression in the early 1930s. After a wave of bank runs and bank closings, households and bankers became more cautious. Households withdrew their deposits from banks, preferring to hold their money in the form of currency. This decision reversed the process of money creation, as bankers responded to falling reserves by reducing bank loans. At the same time, bankers increased their reserve ratios so that they would have enough cash on hand to meet their depositors' demands in any future bank runs. The higher reserve ratio reduced the money multiplier, which further reduced the money supply. From 1929 to 1933, the money supply fell by 28 percent, without the Federal Reserve taking any deliberate contractionary action. Many economists point to this massive fall in the money supply to explain the high unemployment and falling prices that prevailed during this period. (In future chapters, we examine the mechanisms by which changes in the money supply affect unemployment and prices.)

Today, bank runs are not a major problem for the U.S. banking system or the Fed. The federal government now guarantees the safety of deposits at most banks, primarily through the Federal Deposit Insurance Corporation (FDIC). Depositors do not run on their banks because they are confident that, even if their bank goes bankrupt, the FDIC will make good on the deposits. The policy of government deposit insurance has costs: Bankers whose deposits are guaranteed may have too little incentive to avoid bad risks when making loans. But one benefit of deposit insurance is a more stable banking system. As a result, most people see bank runs only in the movies.

A not-so-wonderful bank run



If you read about U.S. monetary policy in the newspaper, you will find much discussion of the federal funds rate. This raises several questions:

Q: What is the federal funds rate?

A: The **federal funds rate** is the short-term interest rate that banks charge one another for loans. If one bank finds itself short of reserves while another bank has excess reserves, the second bank can lend some reserves to the first. The loans are temporary—typically overnight. The price of the loan is the federal funds rate.

Q: How is the federal funds rate different from the discount rate?

A: The discount rate is the interest rate banks pay to borrow directly from the Federal Reserve through the discount window. Borrowing reserves from another bank in the federal funds market is an alternative to borrowing reserves from the Fed, and a bank short of reserves will typically do whichever is cheaper. In practice, the discount rate and the federal funds rate move closely together.

Q: Does the federal funds rate matter only for banks?

A: Not at all. While only banks borrow directly in the federal funds market, the economic impact of this market is much broader. Because different parts of the financial system are highly interconnected, interest rates on different kinds of loans are strongly correlated with one another. So when the federal funds rate rises or falls, other interest rates often move in the same direction.

Q: What does the Federal Reserve have to do with the federal funds rate?

A: In recent years, the Federal Reserve has set a target goal for the federal funds rate. When the Federal Open Market Committee meets approximately every six weeks, it decides whether to raise or lower that target.

Q: How can the Fed make the federal funds rate hit the target it sets?

A: Although the actual federal funds rate is set by supply and demand in the market for loans among banks, the Fed can use open-market operations to influence that market. For example, when the Fed buys bonds in open-market operations, it injects reserves into the banking system. With more reserves in the system, fewer banks find themselves in need of borrowing reserves to meet reserve requirements. The fall in demand for borrowing reserves decreases the price of such borrowing, which is the federal funds rate. Conversely, when the Fed sells bonds and withdraws reserves from the banking system, more banks find themselves short of reserves, and they bid up the price of borrowing reserves. Thus, open-market purchases lower the federal funds rate, and open-market sales raise the federal funds rate.

Q: But don't these open-market operations affect the money supply?

A: Yes, absolutely. When the Fed announces a change in the federal funds rate, it is committing itself to the open-market operations necessary to make that change happen, and these open-market operations will alter the supply of money. Decisions by the FOMC to change the target for the federal funds rate are also decisions to change the money supply. They are two sides of the same coin. Other things equal, a decrease in the target for the federal funds rate means an expansion in the money supply, and an increase in the target for the federal funds rate means a contraction in the money supply.

Bernanke on the Fed's Toolbox

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QUICK QUIZ

Describe how banks create money. • If the Fed wanted to use all three of its policy tools to decrease the money supply, what would it do?

16-5 Conclusion

Ask the Author: Does the Federal Reserve control both the money supply and interest rates?

Some years ago, a book made the best-seller list with the title *Secrets of the Temple: How the Federal Reserve Runs the Country*. Although no doubt an exaggeration, this title did highlight the important role of the monetary system in our daily lives. Whenever we buy or sell anything, we are relying on the extraordinarily useful social convention called "money." Now that we know what money is and what determines its supply, we can discuss how changes in the quantity of money affect the economy. We begin to address that topic in the next chapter.

Chapter Recap: Summary

- The term *money* refers to assets that people regularly use to buy goods and services.
- Money serves three functions. As a medium of exchange, it provides the item used to make transactions. As a unit of account, it provides the way in which prices and other economic values are recorded. As a store of value, it provides a way of transferring purchasing power from the present to the future.
- Commodity money, such as gold, is money that has intrinsic value: It would be valued even if it were not used as money. Fiat money, such as paper dollars, is money without intrinsic value: It would be worthless if it were not used as money.
- In the U.S. economy, money takes the form of currency and various types of bank deposits, such as checking accounts.
- The Federal Reserve, the central bank of the United States, is responsible for regulating the U.S. monetary system. The Fed chairman is appointed by the president and confirmed by Congress every four years. The chairman is the lead member of the Federal Open Market Committee, which meets about every six weeks to consider changes in monetary policy.
- Bank depositors provide resources to banks by depositing their funds into bank accounts. These deposits are part of a bank's liabilities. Bank owners also provide resources (called bank capital) for the bank. Because of leverage (the use of borrowed funds for investment), a small change in the value of a bank's assets can lead to a large change in the value of the bank's capital. To protect depositors, bank regulators require banks to hold a certain minimum amount of capital.
- The Fed controls the money supply primarily through open-market operations: The purchase of government bonds increases the money supply, and the sale of government bonds decreases the money supply. The Fed also uses other tools to control the money supply. It can expand the money supply by decreasing the discount rate, increasing its lending to banks, lowering reserve requirements, or decreasing the interest rate on reserves. It can contract the money supply by increasing the discount rate, decreasing its lending to banks, raising reserve requirements, or increasing the interest rate on reserves.
- When individuals deposit money in banks and banks loan out some of these deposits, the quantity of money in the economy increases. Because the banking system influences the money supply in this way, the Fed's control of the money supply is imperfect.
- The Federal Reserve has in recent years set monetary policy by choosing a target for the federal funds rate, a short-term interest rate at which banks make loans to one another. As the Fed achieves its target, it adjusts the money supply.

Ask the Instructor: When people in one country buy goods from people in another country, how do they pay?

Ask the Instructor: What are the functions of money and what circumstances might cause money to fail to perform these functions?

Ask the Instructor: Why should we care if the money supply is large or small or whether it is increasing at 20 percent per year or 4 percent?

Ask the Instructor: Why do so many people listen to Alan Greenspan?

Ask the Instructor: How do you calculate a bank's excess reserves?

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Chapter Recap: Questions for Review

1. What distinguishes money from other assets in the economy?
2. What is commodity money? What is fiat money? Which kind do we use?
3. What are demand deposits and why should they be included in the stock of money?
4. Who is responsible for setting monetary policy in the United States? How is this group chosen?
5. If the Fed wants to increase the money supply with open-market operations, what does it do?
6. Why don't banks hold 100 percent reserves? How is the amount of reserves banks hold related to the amount of money the banking system creates?
7. Bank A has a leverage ratio of 10, while Bank B has a leverage ratio of 20. Similar losses on bank loans at the two banks cause the value of their assets to fall by 7 percent. Which bank shows a larger change in bank capital? Does either bank remain solvent? Explain.
8. What is the discount rate? What happens to the money supply when the Fed raises the discount rate?
9. What are reserve requirements? What happens to the money supply when the Fed raises reserve requirements?
10. Why can't the Fed control the money supply perfectly?

Chapter Recap: Problems and Applications

1. Which of the following are money in the U.S. economy? Which are not? Explain your answers by discussing each of the three functions of money.
 - a. a U.S. penny
 - b. a Mexican peso
 - c. a Picasso painting
 - d. a plastic credit card
2. Your uncle repays a \$100 loan from Tenth National Bank (TNB) by writing a \$100 check from his TNB checking account. Use T-accounts to show the effect of this transaction on your uncle and on TNB. Has your uncle's wealth changed? Explain.
3. Beleaguered State Bank (BSB) holds \$250 million in deposits and maintains a reserve ratio of 10 percent.
 - a. Show a T-account for BSB.
 - b. Now suppose that BSB's largest depositor withdraws \$10 million in cash from her account. If BSB decides to restore its reserve ratio by reducing the amount of loans outstanding, show its new T-account.
 - c. Explain what effect BSB's action will have on other banks.
 - d. Why might it be difficult for BSB to take the action described in part (b)? Discuss another way for BSB to return to its original reserve ratio.
4. You take \$100 you had kept under your mattress and deposit it in your bank account. If this \$100 stays in the banking system as reserves and if banks hold reserves equal to 10 percent of deposits, by how much does the total amount of deposits in the banking system increase? By how much does the money supply increase?
5. Happy Bank starts with \$200 in bank capital. It then takes in \$800 in deposits. It keeps 12.5 percent ($1/8$ th) of deposits in reserve. It uses the rest of its assets to make bank loans.
 - a. Show the balance sheet of Happy Bank.
 - b. What is Happy Bank's leverage ratio?
 - c. Suppose that 10 percent of the borrowers from Happy Bank default and these bank loans become worthless. Show the bank's new balance sheet.
 - d. By what percentage do the bank's total assets decline? By what percentage does the bank's capital decline? Which change is larger? Why?
6. The Federal Reserve conducts a \$10 million open-market purchase of government bonds. If the required reserve ratio is 10 percent, what is the largest possible increase in the money supply that could result? Explain. What is the smallest possible increase? Explain.
7. Assume that the reserve requirement is 5 percent. All other things equal, will the money supply expand more if the Federal Reserve buys \$2,000 worth of bonds or if someone deposits in a bank \$2,000 that he had been hiding in his cookie jar? If one creates more, how much more does it create? Support your thinking.
8. Suppose that the T-account for First National Bank is as follows:

Assets		Liabilities	
Reserves	\$100,000	Deposits	\$500,000
Loans	400,000		

- a. If the Fed requires banks to hold 5 percent of deposits as reserves, how much in excess reserves does First National now hold?
 - b. Assume that all other banks hold only the required amount of reserves. If First National decides to reduce its reserves to only the required amount, by how much would the economy's money supply increase?
9. Suppose that the reserve requirement for checking deposits is 10 percent and that banks do not hold any excess reserves.
- a. If the Fed sells \$1 million of government bonds, what is the effect on the economy's reserves and money supply?
 - b. Now suppose the Fed lowers the reserve requirement to 5 percent, but banks choose to hold another 5 percent of deposits as excess reserves. Why might banks do so? What is the overall change in the money multiplier and the money supply as a result of these actions?
10. Assume that the banking system has total reserves of \$100 billion. Assume also that required reserves are 10 percent of checking deposits and that banks hold no excess reserves and households hold no currency.
- a. What is the money multiplier? What is the money supply?
 - b. If the Fed now raises required reserves to 20 percent of deposits, what are the changes in reserves and in the money supply?
11. Assume that the reserve requirement is 20 percent. Also assume that banks do not hold excess reserves and there is no cash held by the public. The Federal Reserve decides that it wants to expand the money supply by \$40 million dollars.
- a. If the Fed is using open-market operations, will it buy or sell bonds?
 - b. What quantity of bonds does the Fed need to buy or sell to accomplish the goal? Explain your reasoning.
12. The economy of Elmendyn contains 2,000 \$1 bills.
- a. If people hold all money as currency, what is the quantity of money?
 - b. If people hold all money as demand deposits and banks maintain 100 percent reserves, what is the quantity of money?
 - c. If people hold equal amounts of currency and demand deposits and banks maintain 100 percent reserves, what is the quantity of money?
 - d. If people hold all money as demand deposits and banks maintain a reserve ratio of 10 percent, what is the quantity of money?
 - e. If people hold equal amounts of currency and demand deposits and banks maintain a reserve ratio of 10 percent, what is the quantity of money?

For further information on topics in this chapter, additional problems, applications, examples, online quizzes, and more, please visit our website at www.cengage.com/economics/mankiw (<http://www.cengage.com/economics/mankiw>).

Chapter Recap: Key Terms

- bank capital
the resources a bank's owners have put into the institution
- capital requirement
a government regulation specifying a minimum amount of bank capital
- central bank
an institution designed to oversee the banking system and regulate the quantity of money in the economy
- commodity money
money that takes the form of a commodity with intrinsic value
- currency
the paper bills and coins in the hands of the public
- demand deposits
balances in bank accounts that depositors can access on demand by writing a check
- discount rate
the interest rate on the loans that the fed makes to banks
- federal funds rate
the interest rate at which banks make overnight loans to one another
- Federal Reserve
(Fed) the central bank of the United States
- fiat money
money without intrinsic value that is used as money because of government decree
- fractional-reserve banking
a banking system in which banks hold only a fraction of deposits as reserves
- leverage
the use of borrowed money to supplement existing funds for purposes of investment
- leverage ratio
the ratio of assets to bank capital
- liquidity
the ease with which an asset can be converted into the economy's medium of exchange
- medium of exchange
an item that buyers give to sellers when they want to purchase goods and services
- monetary policy

the setting of the money supply by policymakers in the central bank

- money

the set of assets in an economy that people regularly use to buy goods and services from other people

- money multiplier

the amount of money the banking system generates with each dollar of reserves

- money supply

the quantity of money available in the economy

- open-market operations

the purchase and sale of U.S. government bonds by the fed

- reserve ratio

the fraction of deposits that banks hold as reserves

- reserve requirements

regulations on the minimum amount of reserves that banks must hold against deposits

- reserves

deposits that banks have received but have not loaned out

- store of value

an item that people can use to transfer purchasing power from the present to the future

- unit of account

the yardstick people use to post prices and record debts