10 Money, the Federal Reserve, and the Interest Rate

CHAPTER OUTLINE AND LEARNING OBJECTIVES

In the last two chapters, we explored how consumers, firms, and the government interact in the goods market. In this chapter, we show how the money market works in the macroeconomy. We begin by defining money and describing its role in the U.S. economy. Microeconomics has little to say about money. Microeconomic theories and models are concerned primarily with *real* quantities (apples, oranges, hours of labor) and *relative* prices (the price of apples relative to the price of oranges or the price of labor relative to the prices of other goods). By contrast, as we will now see, money is an important part of the macroeconomy.

An Overview of Money

10.1 LEARNING OBJECTIVE

Define money and discuss its functions.

You often hear people say things like, "She makes a lot of money" (in other words, "She has a high income") or "She's worth a lot of money" (meaning "She is very wealthy"). It is true that your employer uses money to pay you your income, and your wealth may be accumulated in the form of money. However, "money" is defined differently in macroeconomics.

What Is Money? MyLab Economics Concept Check

Most people take the ability to obtain and use money for granted. When the whole monetary system works well, as it generally does in the United States, the basic mechanics of the system are virtually invisible. People take for granted that they can walk into any store, restaurant, boutique, or gas station and buy whatever they want as long as they have enough green pieces of paper, a debit card with a large enough balance in their checking account, or a smartphone with a mobile wallet app.

The idea that you can buy things with money is so natural and obvious that it seems absurd to mention it, but stop and ask yourself: "How is it that a store owner is willing to part with a steak and a loaf of bread that I can eat in exchange for access to some pieces of paper that are intrinsically worthless?" Why, on the other hand, are there times and places where it takes a shopping cart full of money to purchase a dozen eggs? The answers to these questions lie in what money is—a means of payment, a store of value, and a unit of account.

A Means of Payment, or Medium of Exchange

Money is vital to the working of a market economy. Imagine what life would be like without it. The alternative to a monetary economy is **barter**, people exchanging goods and services for other goods and services directly instead of exchanging via the medium of money.

barter The direct exchange of goods and services for other goods and services.

How does a barter system work? Suppose you want bacon, eggs, and orange juice for breakfast. Instead of going to the store and buying these things with money, you would have to find someone who has the items and is willing to trade them. You would also have to have something the bacon seller, the orange juice purveyor, and the egg vendor want. Having pencils to trade will do you no good if the bacon, orange juice, and egg sellers do not want pencils.

A barter system requires a *double coincidence of wants* for trade to take place. That is, to effect a trade, you have to find someone who has what you want and that person must also want what you have. Where the range of goods traded is small, as it is in relatively unsophisticated economies, it is not difficult to find someone to trade with and barter is often used. In a complex society with many goods, barter exchanges involve an intolerable amount of effort. Imagine trying to find people who offer for sale all the things you buy in a typical trip to the supermarket and who are willing to accept goods that you have to offer in exchange for their goods.

Some agreed-to **medium of exchange (*or* means of payment)** neatly eliminates the double-coincidence-of-wants problem. Under a monetary system, money is exchanged for goods or services when people buy things; goods or services are exchanged for money when people sell things. No one ever has to trade goods for other goods directly. Money is a lubricant in the functioning of a market economy.

medium of exchange, or means of payment What sellers generally accept and buyers generally use to pay for goods and services.

A Store of Value

Economists have identified other roles for money aside from its primary function as a medium of exchange. Money also serves as a **store of value**—an asset that can be used to transport purchasing power from one time period to another. If you raise chickens and at the end of the month sell them for more than you want to spend and consume immediately, you may keep some of your earnings in the form of money until the time you want to spend it.

store of value An asset that can be used to transport purchasing power from one time period to another.

There are many other stores of value besides money. You could have decided to hold your "surplus" earnings by buying such things as antique paintings, or diamonds, which you could sell later when you want to spend your earnings. Money has several advantages over these other stores of value. First, it comes in convenient denominations and is easily portable. Debit cards and phones that provide access to the money in your checking account make money even more convenient. You do not have to worry about making change for a Renoir painting to buy a gallon

ECONOMICS IN PRACTICE

Don't Kill the Birds!

In most countries commodity monies were abandoned many years ago. At one point, sea shells and other artifacts from nature were commonly used. One of the more interesting examples of a commodity money is described by David Houston, an ethno-ornithologist.[1]

In the nineteenth century, elaborate rolls of red feathers harvested from the Scarlet Honeyeater bird were used as currency between the island of Santa Cruz and nearby Pacific Islands. Feathers were made into rolls of more than 10 meters in length and were never worn, displayed, or used. Their sole role was to serve as currency in a complex valuation system. Houston tells us that more than 20,000 of these birds were killed each year to create this "money," adding considerably to bird mortality. Running the printing presses is much easier.

Today, one of the few remaining uses of commodity monies is the use of dolphin teeth in the Solomon Islands. Apparently there is even a problem with counterfeiting as people try to pass off fruit bat teeth as dolphin teeth![2]

CRITICAL THINKING

1. Why do red feather rolls and dolphin teeth make good commodity monies, whereas coconut shells would not?

[1]David Houston, "The Impact of the Red Feather Currency on the Population of the Scarlet Honeyeater on Santa Cruz," in Sonia Tidemann and Andrew Gosler, eds., *Ethno-Ornithology: Birds, Indigenous Peoples, Culture and Society* (London, Earthscan Publishers, 2010), pp. 55–66.

[2]*The Wall Street Journal*, excerpted from "Shrinking Dollar Meets Its Match in Dolphin Teeth" by Yaroslav Trofimov. Copyright 2008 by Dow Jones & Company, Inc. Reproduced with permission of Dow Jones & Company, Inc. via Copyright Clearance Center.

liquidity property of money The property of money that makes it a good medium of exchange as well as a store of value: it is portable and readily accepted and thus easily exchanged for goods.

of gasoline. Second, because money is also a means of payment, it is easily exchanged for goods at all times. These two factors compose the **liquidity property of money**. Money is easily spent, flowing out of your hands like liquid.

The main disadvantage of money as a store of value is that the value of money falls when the prices of goods and services rise. If the price of potato chips rises from $1 per bag to $2 per bag, the value of a dollar bill in terms of potato chips falls from one bag to half a bag. When this happens, it may be better to use potato chips (or antiques or real estate) as a store of value. Indeed, there have been times of rising prices when people hoard goods rather than storing money to support their future needs.

unit of account A standard unit that provides a consistent way of quoting prices.

A Unit of Account Money also serves as a **unit of account** —a consistent way of quoting prices. All prices are quoted in monetary units. A textbook is quoted as costing $150, not 150 bananas or five pizzas. Obviously, a standard unit of account is extremely useful when quoting prices. This function of money may have escaped your notice—what else would people quote prices in except money?

Commodity and Fiat Monies MyLab Economics Concept Check

Introductory economics textbooks are full of stories about the various items that have been used as money by various cultures—candy bars, cigarettes (in World War II prisoner-of-war camps), huge wheels of carved stone (on the island of Yap in the South Pacific), beads (among North American Indians), cattle (in southern Africa), and small green scraps of paper (in contemporary North America). The *Economics in Practice* box on the preceding page describes the use of bird

feathers as money. These various kinds of money are generally divided into two groups, commodity monies and fiat money.

Commodity monies are those items used as money that also have an intrinsic value in some other use. For example, prisoners of war made purchases with cigarettes, quoted prices in terms of cigarettes, and held their wealth in the form of accumulated cigarettes. Of course, cigarettes could also be smoked—they had an alternative use apart from serving as money. In fact, one of the problems with commodity monies, like cigarettes, is that their value may change when demand for them as items of use falls. If no one in prison smoked, the value of the cigarettes would likely fall, perhaps even to zero. Gold represents another form of commodity money. For hundreds of years gold could be used directly to buy things, but it also had other uses, ranging from jewelry to dental fillings.

commodity monies Items used as money that also have intrinsic value in some other use.

By contrast, money in the United States today is mostly fiat money. **Fiat money**, sometimes called **token money**, is money that is intrinsically worthless. The actual value of a $1, $10, or $50 bill is basically zero; what other uses are there for a small piece of paper with some green ink on it?

fiat, or token, money Items designated as money that are intrinsically worthless.

Why would anyone accept worthless scraps of paper as money instead of something that has some value, such as gold, cigarettes, or cattle? If your answer is "because the paper money is backed by gold or silver," you are wrong. There was a time when dollar bills were convertible directly into gold. The government backed each dollar bill in circulation by holding a certain amount of gold in its vaults. If the price of gold were $35 per ounce, for example, the government agreed to sell one ounce of gold for 35 dollar bills. However, dollar bills are no longer backed by any commodity—gold, silver, or anything else. They are exchangeable only for dimes, nickels, pennies, other dollars, and so on. The good news here is that the value of this money does not depend on the value of money in another use, as in the case of cigarettes. The harder question is why it has any value at all!

The public accepts paper money as a means of payment and a store of value because the government has taken steps to ensure that its money is accepted. The government declares its paper money to be **legal tender**. That is, the government declares that its money must be accepted in settlement of debts. It does this by fiat (hence *fiat money*). It passes laws defining certain pieces of paper printed in certain inks on certain plates to be legal tender, and that is that. Printed on every Federal Reserve note in the United States is, "This note is legal tender for all debts, public and private." Often the government can get a start on gaining acceptance for its paper money by requiring that it be used to pay taxes.

legal tender Money that a government has required to be accepted in settlement of debts.

Aside from declaring its currency legal tender, the government usually does one other thing to ensure that paper money will be accepted: It promises the public that it will not print paper money so fast that it loses its value. Expanding the supply of currency so rapidly that it loses much of its value has been a problem throughout history and is known as **currency debasement**. Debasement of the currency has been a special problem of governments that lack the strength to take the politically unpopular step of raising taxes. Printing money to be used on government expenditures of goods and services can serve as a substitute for tax increases, and weak governments have often relied on the printing press to finance their expenditures. An interesting example is Zimbabwe. In 2007, faced with a need to improve the public water system, Zimbabwe's president, Robert Mugabe, said, "Where money for projects cannot be found, we will print it" (reported in the *Washington Post*, July 29, 2007). In later chapters we will see the way in which this strategy for funding public projects can lead to serious inflation.

currency debasement The decrease in the value of money that occurs when its supply is increased rapidly.

It is interesting to ask whether cryptocurrencies like Bitcoin are in fact currency, satisfying the three functions of a currency that we listed. Bitcoins were designed to be a currency, one which could be used anonymously in transactions, which has advantages in some situations. Bitcoin supply was also deliberately limited to avoid the currency debasement problem we described above. The U.S Treasury refers to cryptocurrencies as virtual currency, while the U.S. Internal Revenue Service calls them assets. In terms of the criteria we have listed, while bitcoins are used as a method of exchange and qualify as currency on that dimension, the value volatility of Bitcoin makes its function as a store of value or a unit of account less clear.

Measuring the Supply of Money in the United States MyLab Economics Concept Check

We now turn to the various kinds of money in the United States. Recall that money is used to buy things (a means of payment), to hold wealth (a store of value), and to quote prices (a unit of account). Unfortunately, these characteristics apply to a broad range of assets in the U.S. economy

in addition to dollar bills. As we will see, it is not at all clear where we should draw the line and say, "Up to this is money, beyond this is something else."

To solve the problem of multiple monies, economists have given different names to different measures of money. The two most common measures of money are transactions money, also called M1, and broad money, also called M2.

M1: Transactions Money What should be counted as money? Coins and dollar bills, as well as higher denominations of currency, must be counted as money—they fit all the requirements. What about checking accounts? Checks, too, can be used to buy things and can serve as a store of value. Debit cards provide even easier access to funds in checking accounts, as do smartphones linked to checking accounts. In fact, bankers call checking accounts *demand deposits* because depositors have the right to cash in (demand) their entire checking account balance at any time. That makes your checking account balance virtually equivalent to bills in your wallet, and it should be included as part of the amount of money you hold, as we have done thus far in our discussion.

If we take the value of all currency (including coins) held outside of bank vaults and add to it the value of all demand deposits, traveler's checks, and other checkable deposits, we have defined **M1, *or* transactions money**. As its name suggests, this is the money that can be directly used for transactions—to buy things.

M1, *or* transactions money Money that can be directly used for transactions.

$$\text{M1} \equiv \text{currency held outside banks} + \text{demand deposits} + \text{traveler's checks} + \text{other checkable deposits}$$

M1 at the end of March 2018 was $3,664.3billion. M1 is a stock measure—it is measured at a point in time. It is the total amount of coins and currency outside of banks and the total dollar amount in checking accounts.

M2: Broad Money Although M1 is the most widely used measure of the money supply, there are other measures as well. Although many savings accounts cannot be used for transactions directly, it is easy to convert them into cash or to transfer funds from them into a checking account. What about money market accounts (which allow only a few checks per month, but pay market-determined interest rates) and money market mutual funds (which sell shares and use the proceeds to purchase short-term securities)? These can be used to write checks and make purchases, although only over a certain amount.

near monies Close substitutes for transactions money, such as savings accounts and money market accounts.

M2, *or* broad money M1 plus savings accounts, money market accounts, and other near monies.

If we add **near monies**, close substitutes for transactions money, to M1, we get **M2**, called **broad money** because it includes not-quite-money monies such as savings accounts, money market accounts, and other near monies.

$$\text{M2} \equiv \text{M1} + \text{Savings accounts} + \text{Money market accounts} + \text{Other near monies}$$

M2 at the end of March 2018 was $13,918.1 billion, considerably larger than the total M1 of $3,664.3 billion. The main advantage of looking at M2 instead of M1 is that M2 is sometimes more stable. For instance, when banks introduced new forms of interest-bearing checking accounts in the early 1980s, M1 shot up as people switched their funds from savings accounts to checking accounts. However, M2 remained fairly constant because the fall in savings account deposits and the rise in checking account balances were both part of M2, canceling each other out.

Beyond M2 Because a wide variety of financial instruments bear some resemblance to money, some economists have advocated including almost all of them as part of the money supply. For example, credit cards are used extensively in exchange. Everyone who has a credit card has a credit limit—you can charge only a certain amount on your card before you have to pay it off. One of the very broad definitions of money includes the amount of available credit on credit cards (your charge limit minus what you have charged but not paid) as part of the money supply.

There are no rules for deciding what is and is not money. However, *for our purposes, "money" will always refer to transactions money, or M1*. For simplicity, we will say that M1 is the sum of two *general* categories: currency in circulation and deposits. Keep in mind, however, that M1 has *four* specific components: currency held outside banks, demand deposits, traveler's checks, and other checkable deposits.

How Banks Create Money

10.2 LEARNING OBJECTIVE

Explain how banks create money.

So far we have described the general way that money works and the way the supply of money is measured in the United States, but how much money is available at a given time? Who supplies it, and how does it get supplied? We are now ready to analyze these questions in detail. In particular, we want to explore a process that many find mysterious: the way banks *create money*.

A Historical Perspective: Goldsmiths MyLab Economics Concept Check

To begin to see how banks create money, consider the origins of the modern banking system. In the fifteenth and sixteenth centuries, citizens of many lands used gold as money, particularly for large transactions. Gold is both inconvenient to carry around and susceptible to theft. For these reasons people began to place their gold with goldsmiths for safekeeping. On receiving the gold, a goldsmith would issue a receipt to the depositor, charging him a small fee for looking after his gold. After a time, these receipts themselves, rather than the gold that they represented, began to be traded for goods. The receipts became a form of paper money, making it unnecessary to go to the goldsmith to withdraw gold for a transaction. The receipts of the de Medici's, who were both art patrons and goldsmith-bankers in Italy in the Renaissance period, were reputedly accepted in wide areas of Europe as currency.

At this point, all the receipts issued by goldsmiths were backed 100 percent by gold. If a goldsmith had 100 ounces of gold in his safe, he would issue receipts for 100 ounces of gold, and no more. Goldsmiths functioned as warehouses where people stored gold for safekeeping. The goldsmiths found, however, that people did not come often to withdraw gold. Why should they, when paper receipts that could easily be converted to gold were "as good as gold"? (In fact, receipts were better than gold—more portable, safer from theft, and so on.) As a result, goldsmiths had a large stock of gold continuously on hand.

Because they had what amounted to "extra" gold sitting around, goldsmiths gradually realized that they could lend out some of this gold without any fear of running out of gold. Why would they do this? Instead of just keeping their gold idly in their vaults, they could earn interest on loans. Something subtle, but dramatic, happened at this point. The goldsmiths changed from mere depositories for gold into banklike institutions that had the power to create money. This transformation occurred as soon as goldsmiths began making loans. Without adding any more real gold to the system, the goldsmiths increased the amount of money in circulation by creating additional claims to gold—that is, receipts that entitled the bearer to receive a certain number of ounces of gold on demand.[1] Thus, there were more claims than there were ounces of gold.

A detailed example may help to clarify what might look at first to you like a sleight of hand. Suppose you go to a goldsmith who is functioning only as a depository, or warehouse, and ask for a loan to buy a plot of land that costs 20 ounces of gold. Also suppose that the goldsmith has 100 ounces of gold on deposit in his safe and receipts for exactly 100 ounces of gold out to the various people who deposited the gold. If the goldsmith decides he is tired of being a mere goldsmith and wants to become a real bank, he will loan you some gold. You don't want the gold itself, of course; rather, you want a slip of paper that represents 20 ounces of gold. The goldsmith in essence "creates" money for you by giving you a receipt for 20 ounces of gold (even though his entire supply of gold already belongs to various other people).[2] When he does, there will be receipts for 120 ounces of gold in circulation instead of the 100 ounces worth of receipts before your loan and the supply of money will have increased.

People think the creation of money is mysterious, far from it! The creation of money is simply an accounting procedure, among the most mundane of human endeavors. You may suspect the whole process is fundamentally unsound or somehow dubious. After all, the banking system began when someone issued claims for gold that already belonged to someone else. Here you may be on slightly firmer ground.

---

[1] Remember, these receipts circulated as money, and people used them to make transactions without feeling the need to cash them in—that is, to exchange them for gold itself.

[2] In return for lending you the receipt for 20 ounces of gold, the goldsmith expects to get an IOU promising to repay the amount (in gold itself or with a receipt from another goldsmith) with interest after a certain period of time.

ECONOMICS IN PRACTICE

A Run on the Bank: George Bailey, Mary Poppins, Wyatt Earp

Frank Capra's 1946 classic film, *It's a Wonderful Life*, stars Jimmy Stewart as George Bailey, the-salt-of-the earth head of a small town building and loan bank. At one point late in the movie, as a result of some devilry by a competitor, the soundness of Bailey's bank comes to be questioned. The result? A classic run on the bank, shown in the movie by a mob trying to get their deposits back at the bank window. Stewart's explanation to his depositors could be straight out of an economics textbook. "I don't have your money here," he tells them. "Your money is being used to build your neighbor's new house." Just like the goldsmiths of yore, George Bailey's banks lent out their deposits, creating money. Bailey's defense against the bank run was easier in a time when people knew their bankers. "What we need now," Bailey assured us with Jimmy Stewart's earnest acting, "is faith in each other." In today's market, faith in the government is the more typical defense against a bank run.

Another cinematic look at bank runs, by the way, comes in *Mary Poppins* when Tommy, one of Poppins' two young charges, loudly insists in the middle of the bank where his father works that he wants his tuppence back and the bank won't give it to him. The result? Another bank run, British style!

Finally, there is Wyatt Earp, in this case a true story. Earp in 1909, near the end of his colorful life, was hired by a bank in Los Angeles. Rumors were out that the bank had loaned more money than it had gold in its vaults. Depositors, we assume not understanding that this is common, were storming the bank to get their money out. Earp was hired to calm things down. His response was different from George Bailey's. He took empty money sacks from the bank, hired a wagon and driver, drove to a nearby iron works, and filled the sacks with iron slugs about the size of $20 gold pieces. He drove back to the bank, where police were holding back the mob. He announced that he had about a million dollars in the wagon and began unloading the bars into the bank. He told the police to tell the crowd that "any gent who thinks he can find a better bank to put his money into to go and find it. But he'd better be damned careful he don't get hit over the head and robbed while he's doing it." As the bars were being loaded into the bank, the crowd dispersed.

Wyatt Earp and some of his buddies were members of the Dodge City Peace Commission in 1883. From left to right (top row): William H. Harris, Luke Short, William Bat Masterson, (bottom row): Charles E. Bassett, Wyatt Earp, Frank McLain, Jerry Hausman

CRITICAL THINKING

1. How do Earp's remarks illustrate the advantages of paper money over gold?

Casey Tefertiller, *Wyatt Earp: The Life Behind the Legend*, John Wiley & Sons, Inc., 1997.

Goldsmiths-turned-bankers did face certain problems. Once they started making loans, their receipts outstanding (claims on gold) were greater than the amount of gold they had in their vaults at any given moment. If the owners of the 120 ounces worth of gold receipts all presented their receipts and demanded their gold at the same time, the goldsmith would be in trouble. With only 100 ounces of gold on hand, people could not get their gold at once.

In normal times, people would be happy to hold receipts instead of real gold, and this problem would never arise. If, however, people began to worry about the goldsmith's financial safety, they might begin to have doubts about whether their receipts really were as good as gold. Knowing there were more receipts outstanding than there were ounces of gold in the goldsmith's vault, they might start to demand gold for receipts.

This situation leads to a paradox. It makes perfect sense for people to hold paper receipts (instead of gold) if they know they can always get gold for their paper. In normal times, goldsmiths

could feel perfectly safe in loaning out more gold than they actually had in their possession, but once people start to doubt the safety of the goldsmith, they are foolish not to demand their gold back from the vault.

A run on a goldsmith (or in our day, a **run on a bank**) occurs when many people present their claims at the same time. These runs tend to feed on themselves. If I see you going to the goldsmith to withdraw your gold, I may become nervous and decide to withdraw my gold as well. It is the *fear* of a run that usually causes the run. Runs on a bank can be triggered by a variety of causes: rumors that an institution may have made loans to borrowers who cannot repay, wars, failures of other institutions that have borrowed money from the bank, and so on. As you will see later in this chapter, today's bankers differ from goldsmiths—today's banks are subject to a "required reserve ratio." Goldsmiths had no legal reserve requirements, although the amount they loaned out was subject to the restriction imposed on them by their fear of running out of gold. The *Economics in Practice* box on page 222 describes several fictional bank runs, along with a description of Wyatt Earp's role in preventing a real bank run!

run on a bank Occurs when many of those who have claims on a bank (deposits) present them at the same time.

The Modern Banking System MyLab Economics Concept Check

To understand how the modern banking system works, you need to be familiar with some basic principles of accounting. Once you are comfortable with the way banks keep their books, you will see that the process is not so dissimilar to the world of the goldsmith.

A Brief Review of Accounting

Central to accounting practices is the statement that "the books always balance." In practice, this means that if we take a snapshot of a firm—any firm, including a bank—at a particular moment in time, then by definition:

$$\text{Assets} - \text{Liabilities} \equiv \text{Net Worth}$$
$$\text{or}$$
$$\text{Assets} \equiv \text{Liabilities} + \text{Net Worth}$$

Assets are things a firm owns that are worth something. For a bank, these assets include the bank building, its furniture, its holdings of government securities, cash in its vaults, bonds, stocks, and so on. Most important among a bank's assets, for our purposes at least, are the loans it has made. A borrower gives the bank an *IOU*, a promise to repay a certain sum of money on or by a certain date. This promise is an asset of the bank because it is worth something. The bank could (and sometimes does) sell the IOU to another bank for cash.

Other bank assets include cash on hand (sometimes called *vault cash*) and deposits with the U.S. central bank—the **Federal Reserve Bank (the Fed)**. As we will see later in this chapter, federal banking regulations require that banks keep a certain portion of their deposits on hand as vault cash or on deposit with the Fed.

Federal Reserve Bank (the Fed) The central bank of the United States.

A firm's *liabilities* are its debts—what it owes. A bank's liabilities are the promises to pay, or IOUs, that it has issued. A bank's most important liabilities are its deposits. *Deposits* are debts owed to the depositors because when you deposit money in your account, you are in essence making a loan to the bank.

The basic rule of accounting says that if we add up a firm's assets and then subtract the total amount it owes to all those who have lent it funds, the difference is the firm's net worth. *Net worth* represents the value of the firm to its stockholders or owners. How much would you pay for a firm that owns $200,000 worth of diamonds and had borrowed $150,000 from a bank to pay for them? The firm is worth $50,000—the difference between what it owns and what it owes. If the price of diamonds were to fall, bringing their value down to only $150,000, the firm would be worth nothing.

We can keep track of a bank's financial position using a simplified balance sheet called a T-account. By convention, the bank's assets are listed on the left side of the T-account and its liabilities and net worth are on the right side. By definition, the balance sheet always balances, so that the sum of the items on the left side of the T-account is equal to the sum of the items on the right side.

The T-account in Figure 10.1 shows a bank having $110 million in *assets*, of which $20 million are **reserves**, the deposits the bank has made at the Fed, and its cash on hand (coins and currency).

reserves The deposits that a bank has at the Federal Reserve bank plus its vault cash on hand.

▸ FIGURE 10.1
T-Account for a Typical Bank (millions of dollars)
The balance sheet of a bank must always balance, so that the sum of assets (reserves and loans) equals the sum of liabilities (deposits) and net worth.

	Assets	Liabilities	
Reserves	20	100	Deposits
Loans	90	10	Net worth
Total	110	110	Total

MyLab Economics Concept Check

Reserves are an asset to the bank because it can go to the Fed and get cash for them, the same way you can go to the bank and get cash for the amount in your savings account. Our bank's other asset is its loans, worth $90 million.

Why do banks hold reserves/deposits at the Fed? There are many reasons, but perhaps the most important is the legal requirement that they hold a certain percentage of their deposit liabilities as reserves. The percentage of its deposits that a bank must keep as reserves is known as the **required reserve ratio**. If the reserve ratio is 20 percent, a bank with deposits of $100 million must hold $20 million as reserves, either as cash or as deposits at the Fed. To simplify, we will assume that banks hold all of their reserves in the form of deposits at the Fed.

required reserve ratio The percentage of its total deposits that a bank must keep as cash or reserves at the Federal Reserve.

On the liabilities side of the T-account, the bank has deposits of $100 million, which it owes to its depositors. This means that the bank has a net worth of $10 million to its owners ($110 million in assets − $100 million in liabilities = $10 million net worth). The net worth of the bank is what "balances" the balance sheet. Remember that when some item on a bank's balance sheet changes, there must be at least one other change somewhere else to maintain balance. If a bank's reserves increase by $1, one of the following must also be true: (1) Its other assets (for example, loans) decrease by $1, (2) its liabilities (deposits) increase by $1, or (3) its net worth increases by $1. Various fractional combinations of these are also possible.

The Creation of Money MyLab Economics Concept Check

Like the goldsmiths, today's bankers can earn income by lending money out at a higher interest rate than they pay depositors for use of their money. In modern times, the chances of a run on a bank are fairly small, and even if there is a run, the central bank protects the private banks in various ways. Therefore, banks if they choose to can make loans up to the reserve requirement restriction. A bank's required amount of reserves is equal to the required reserve ratio times the total deposits in the bank. If a bank has deposits of $100 and the required ratio is 20 percent, the required amount of reserves is $20. The difference between a bank's actual reserves and its required reserves is its **excess reserves**:

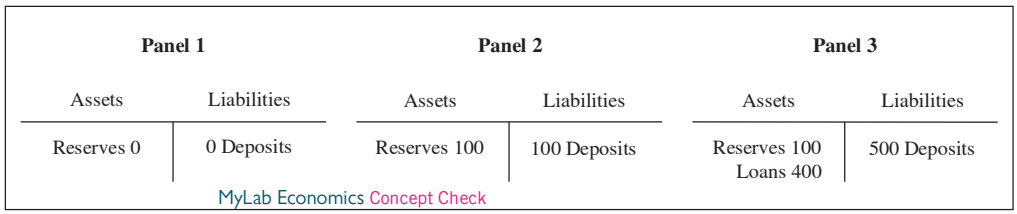
excess reserves The difference between a bank's actual reserves and its required reserves.

$$\text{excess reserves} \equiv \text{actual reserves} - \text{required reserves}$$

When a bank's excess reserves are zero, it can no longer make loans. Why is this? When a bank makes a loan, it creates a demand deposit for the borrower. That demand deposit, in turn, requires reserves to back it up, just like the other deposits in the bank. With excess reserves at zero, and no new cash coming in, the bank has no way to reserve against the new deposit.

An example will help to show the connection between loans and excess reserves more generally. Assume that there is only one private bank in the country, the required reserve ratio is 20 percent, and the bank starts off with nothing, as shown in panel 1 of Figure 10.2. Now suppose dollar bills are in circulation and someone deposits 100 of them in the bank. The bank deposits the $100 with the central bank, so it now has $100 in reserves, as shown in panel 2. The bank now has assets (reserves) of $100 and liabilities (deposits) of $100. If the required reserve ratio is 20 percent, the bank has excess reserves of $80.

How much can the bank lend and still meet the reserve requirement? For the moment, let us assume that anyone who gets a loan keeps the entire proceeds in the bank or pays them to



▲ **FIGURE 10.2 Balance Sheets of a Bank in a Single-Bank Economy**
In panel 2, there is an initial deposit of $100. In panel 3, the bank has made loans of $400.

someone else who does. Nothing is withdrawn as cash. In this case, the bank can lend $400 and still meet the reserve requirement. Panel 3 shows the balance sheet of the bank after completing the maximum amount of loans it is allowed with a 20 percent reserve ratio. With $80 of excess reserves, the bank can have up to $400 of additional deposits. The $100 original deposit, now in reserves, plus $400 in loans (which are made as deposits) equals $500 in deposits. With $500 in deposits and a required reserve ratio of 20 percent, the bank must have reserves of $100 (20 percent of $500)—and it does. The bank can lend no more than $400 because that is all its $100 of reserves will support, given its initial deposit. Another way to see this is to recognize that the bank originally had $80 in excess reserves. That $80 would support $400 in new deposits (loans) because 20% of $400 equals the $80 excess reserve figure. The $400 in loans uses up all of the excess reserves. When a bank has no excess reserves and thus can make no more loans, it is said to be *loaned up*.

Remember, the money supply (M1) equals cash in circulation plus deposits. Before the initial deposit, the money supply was $100 ($100 cash and no deposits). After the deposit and the loans, the money supply is $500 (no cash outside bank vaults and $500 in deposits). It is clear then that when loans are converted into deposits, the supply of money will increase.

The bank whose T-accounts are presented in Figure 10.2 is allowed to make loans of $400 based on the assumption that loans that are made *stay in the bank* in the form of deposits. Now suppose you borrow from the bank to buy a personal computer and you write a check to the computer store. If the store also deposits its money in the bank, your check merely results in a reduction in your account balance and an increase to the store's account balance within the bank. No cash has left the bank. As long as the system is closed in this way—remember that so far we have assumed that there is only one bank—the bank knows that it will never be called on to release any of its $100 in reserves. It can expand its loans up to the point where its total deposits are $500.

Of course, there are many banks in the country, a situation that is depicted in Figure 10.3. As long as the banking system as a whole is closed, it is still possible for an initial deposit of $100 to result in an expansion of the money supply to $500, but more steps are involved when there is more than one bank.

To see why, assume that Mary makes an initial deposit of $100 in Bank 1 and the bank deposits the entire $100 with the Fed (panel 1 of Figure 10.3). All loans that a bank makes are withdrawn from the bank as the individual borrowers write checks to pay for merchandise. After Mary's deposit, Bank 1 can make a loan of up to $80 to Bill because it needs to keep only $20 of its $100 deposit as reserves. (We are assuming a 20 percent required reserve ratio.) In other words, Bank 1 has $80 in excess reserves.

Bank 1's balance sheet at the moment of the loan to Bill appears in panel 2 of Figure 10.3. Bank 1 now has loans of $80. It has credited Bill's account with the $80, so its total deposits are $180 ($80 in loans plus $100 in reserves). Bill then writes a check for $80 for a set of shock absorbers for his car. Bill wrote his check to Penelope's Car Shop, and Penelope deposits Bill's check in Bank 2. When the check clears, Bank 1 transfers $80 in reserves to Bank 2. Bank 1's balance sheet now looks like the top of panel 3. Its assets include reserves of $20 and loans of $80; its liabilities are $100 in deposits. Both sides of the T-account balance: the bank's reserves are 20 percent of its deposits, as required by law, and it is fully loaned up.

Panel 1

	Assets	Liabilities
Bank 1	Reserves 100	100 Deposits
Bank 2	Reserves 80	80 Deposits
Bank 3	Reserves 64	64 Deposits

Panel 2

	Assets	Liabilities
Bank 1	Reserves 100 Loans 80	180 Deposits
Bank 2	Reserves 80 Loans 64	144 Deposits
Bank 3	Reserves 64 Loans 51.20	115.20 Deposits

Panel 3

	Assets	Liabilities
Bank 1	Reserves 20 Loans 80	100 Deposits
Bank 2	Reserves 16 Loans 64	80 Deposits
Bank 3	Reserves 12.80 Loans 51.20	64 Deposits

Summary:	Loans	Deposits
Bank 1	80	100
Bank 2	64	80
Bank 3	51.20	64
Bank 4	40.96	51.20
⋮	⋮	⋮
Total	400.00	500.00

MyLab Economics Concept Check

▲ **FIGURE 10.3 The Creation of Money When There Are Many Banks**
In panel 1, there is an initial deposit of $100 in Bank 1. In panel 2, Bank 1 makes a loan of $80 by creating a deposit of $80. A check for $80 by the borrower is then written on Bank 1 (panel 3) and deposited in Bank 2 (panel 1). The process continues with Bank 2 making loans and so on. In the end, loans of $400 have been made and the total level of deposits is $500.

Now look at Bank 2. Because Bank 1 has transferred $80 in reserves to Bank 2, Bank 2 now has $80 in deposits and $80 in reserves (panel 1, Bank 2). Its reserve requirement is also 20 percent, so it has excess reserves of $64 on which it can make loans.

Now assume that Bank 2 loans the $64 to Kate to pay for a textbook and Kate writes a check for $64 payable to the Manhattan College Bookstore. The final position of Bank 2, after it honors Kate's $64 check by transferring $64 in reserves to the bookstore's bank, is reserves of $16, loans of $64, and deposits of $80 (panel 3, Bank 2).

The Manhattan College Bookstore deposits Kate's check in its account with Bank 3. Bank 3 now has excess reserves because it has added $64 to its reserves. With a reserve ratio of 20 percent, Bank 3 can loan out $51.20 (80 percent of $64, leaving 20 percent in required reserves to back the $64 deposit).

As the process is repeated over and over, the total amount of deposits created is $500, the sum of the deposits in each of the banks. The banking system can be looked at as one big bank therefore, the outcome here for many banks is the same as the outcome in Figure 10.2 for one bank.[3]

The Money Multiplier MyLab Economics Concept Check

money multiplier The multiple by which deposits can increase for every dollar increase in reserves; equal to 1 divided by the required reserve ratio.

In practice, the banking system is not completely closed—there is some leakage out of the system, as people send money abroad or even hide it under their mattresses! Still, the point here is that an increase in bank reserves can lead to a greater than one-for-one increase in the money supply. Economists call the relationship between the final change in deposits and the change in reserves that caused this change the money multiplier. Stated somewhat differently, the **money multiplier** is the multiple by which deposits can increase for every dollar increase in reserves. Do not confuse the money multiplier with the spending multipliers we discussed in the last two chapters. They are not the same thing.

[3]If banks create money when they make loans, does repaying a loan "destroy" money? The answer is yes.

In the example we just examined, reserves increased by $100 when the $100 in cash was deposited in a bank and the amount of deposits increased by $500 ($100 from the initial deposit, $400 from the loans made by the various banks from their excess reserves). The money multiplier in this case is $\$500/\$100 = 5$. Mathematically, the money multiplier can be defined as follows:[4]

$$\text{money multiplier} \equiv \frac{1}{\text{required reserve ratio}}$$

In the United States, the required reserve ratio varies depending on the size of the bank and the type of deposit. For large banks and for checking deposits, the ratio is currently 10 percent, which makes the potential money multiplier $1/.10 = 10$. This means that an increase in reserves of $1 could cause an increase in deposits of $10 if there were no leakage out of the system.

It is important to remember that the money multiplier is derived under the assumption that banks hold no excess reserves. For example, when Bank 1 gets the deposit of $100, it loans out the maximum that it can, namely $100 times 1 minus the reserve requirement ratio. If instead Bank 1 held the $100 as excess reserves, the increase in the money supply would just be the initial $100 in deposits (brought in, say, from outside the banking system). We return to the question of excess reserves later in this chapter.

The Federal Reserve System

10.3 LEARNING OBJECTIVE

Describe the functions and structure of the Federal Reserve System.

We have seen how the private banking system can create money by making loans. However, private banks are not free to create money at will. We have already seen the way that their ability to create money is governed by the reserve requirements set by the Fed. We will now examine the structure and function of the Fed.

Founded in 1913 by an act of Congress (to which major reforms were added in the 1930s), the Fed is the central bank of the United States. The Fed is a complicated institution with many responsibilities, including the regulation and supervision of about 6,000 commercial banks. The organization of the Federal Reserve System is presented in Figure 10.4.

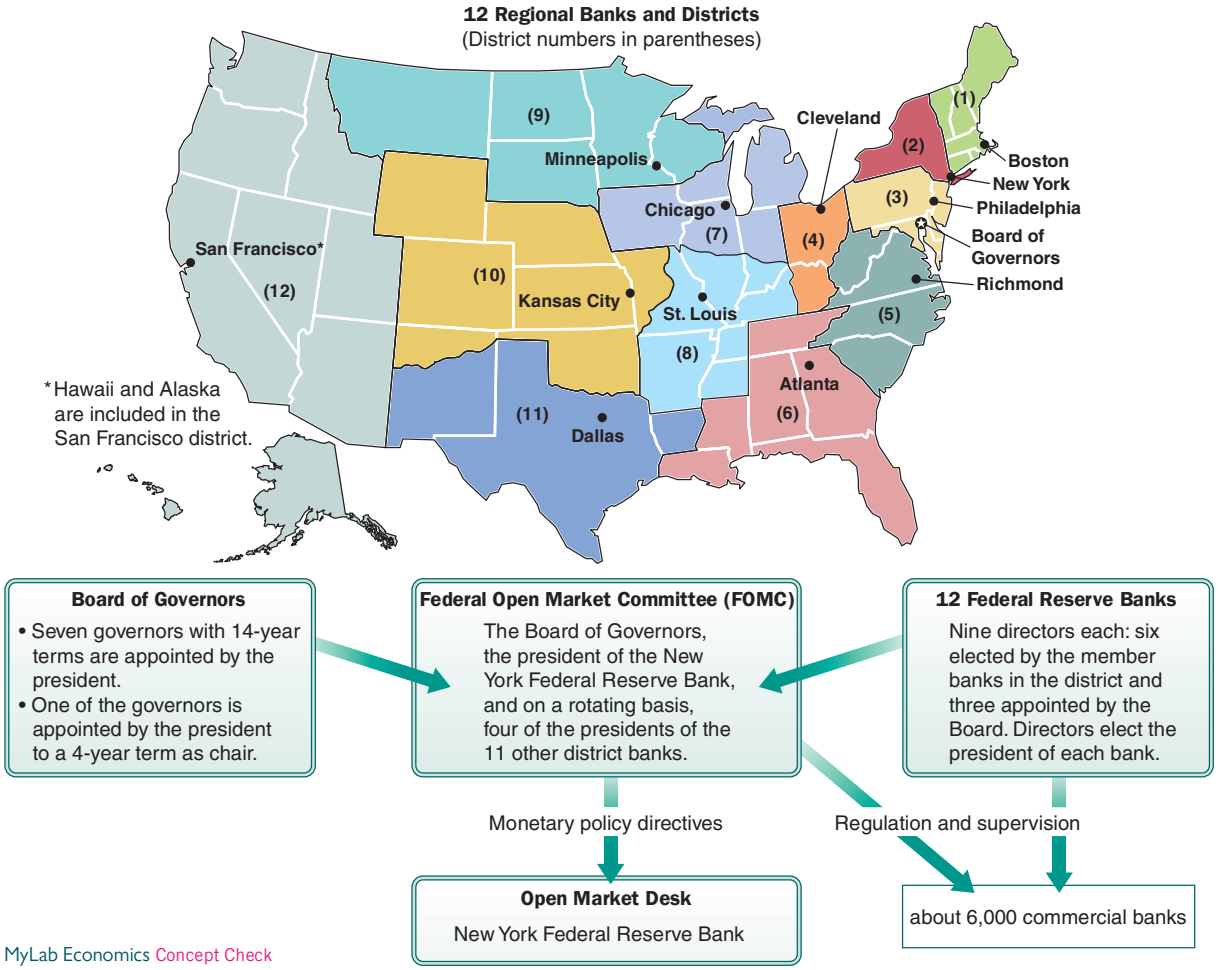
The *Board of Governors* is the most important group within the Federal Reserve System. The board consists of seven members, each appointed for 14 years by the president of the United States. The *chair* of the Fed, who is appointed by the president and whose term runs for four years, usually dominates the entire Federal Reserve System and is sometimes said to be the second most powerful person in the United States. The Fed is an independent agency in that it does not take orders from the president or from Congress. The United States is divided into 12 Federal Reserve districts, each with its own Federal Reserve bank. These districts are indicated on the map in Figure 10.4. The district banks are like branch offices of the Fed in that they carry out the rules, regulations, and functions of the central system in their districts and report to the Board of Governors on local economic conditions.

U.S. monetary policy is formally set by the **Federal Open Market Committee (FOMC).** The FOMC consists of the seven members of the Fed's Board of Governors; the president of the New York Federal Reserve Bank; and on a rotating basis, four of the presidents of the 11 other district banks. The FOMC sets goals concerning interest rates, and it directs the **Open Market Desk** in the New York Federal Reserve Bank to buy and/or sell government securities. (We discuss the specifics of open market operations later in this chapter.)

Federal Open Market Committee (FOMC) A group composed of the seven members of the Fed's Board of Governors, the president of the New York Federal Reserve Bank, and four of the other 11 district bank presidents on a rotating basis; it sets goals concerning the money supply and interest rates and directs the operation of the Open Market Desk in New York.

Open Market Desk The office in the New York Federal Reserve Bank from which government securities are bought and sold by the Fed.

[4]To show this mathematically, let rr denote the reserve requirement ratio, like 0.20. Say someone deposits 100 in Bank 1 in Figure 10.3. Bank 1 can create $100(1 - rr)$ in loans, which are then deposits in Bank 2. Bank 2 can create $100(1 - rr)(1 - rr)$ in loans, which are then deposits in Bank 3, and so on. The sum of the deposits is thus $100[1 + (1 - rr) + (1 - rr)^2 + (1 - rr)^3 + \ldots]$. The sum of the infinite series in brackets is $1/rr$, which is the money multiplier.



▲ FIGURE 10.4 **The Structure of the Federal Reserve System**

Functions of the Federal Reserve MyLab Economics Concept Check

The Fed is the central bank of the United States. Central banks are sometimes known as "bankers' banks" because only banks (and occasionally foreign governments) can have accounts in them. As a private citizen, you cannot go to the nearest branch of the Fed and open a checking account or apply to borrow money.

As we will see shortly, the Fed is responsible for monetary policy in the United States, but it also performs several important administrative functions for banks. These functions include clearing interbank payments, regulating the banking system, and assisting banks in a difficult financial position. The Fed is also responsible for managing exchange rates and the nation's foreign exchange reserves.[5] In addition, it is often involved in intercountry negotiations on international economic issues.

Clearing interbank payments works as follows. Suppose you write a $100 check drawn on your bank, the First Bank of Fresno (FBF), to pay for tulip bulbs from Crockett Importers of Miami, Florida. How does your money get from your bank in Fresno to Crockett's bank in Florida? The Fed does it. Both FBF and Banco de Miami have accounts at the Fed. When Crockett Importers receives your check and deposits it at Banco de Miami, the bank submits the check to the Fed, asking it to collect the funds from FBF. The Fed presents the check to FBF and is instructed to

[5] *Foreign exchange reserves* are holdings of the currencies of other countries—for example, Japanese yen—by the U.S. government. We discuss exchange rates and foreign exchange markets at length in Chapter 19.

debit FBF's account for the $100 and to credit the account of Banco de Miami. Accounts at the Fed count as reserves, so FBF loses $100 in reserves, and Banco de Miami gains $100 in reserves. The two banks effectively have traded ownerships of their deposits at the Fed. The *total* volume of reserves has not changed, nor has the money supply.

This way of clearing interbank payments allows banks to shift money around virtually instantaneously. All they need to do is wire the Fed and request a transfer, and the funds move from one computer account to another.

Besides facilitating the transfer of funds among banks, the Fed is responsible for many of the regulations governing banking practices and standards. For example, the Fed has the authority to control mergers among banks, and it is responsible for examining banks to ensure that they are financially sound and that they conform to a host of government accounting regulations. As we saw previously, the Fed also sets reserve requirements for all financial institutions.

An important responsibility of the Fed is to act as the **lender of last resort** for the banking system. As our discussion of goldsmiths suggested, banks are subject to the possibility of runs on their deposits. In the United States, most deposits of less than $250,000 are insured by the Federal Deposit Insurance Corporation (FDIC), a U.S. government agency that was established in 1933 during the Great Depression. Deposit insurance makes panics less likely, but the Fed stands ready to provide funds to a troubled bank that cannot find any other sources of funds.

lender of last resort One of the functions of the Fed: it provides funds to troubled banks that cannot find any other sources of funds.

The Fed is the ideal lender of last resort for two reasons. As a nonprofit institution whose function is to serve the overall welfare of the public, the Fed has an interest in preventing catastrophic banking panics such as those that occurred in the late 1920s and the 1930s. The Fed also has an essentially unlimited supply of funds with which to help banks facing the possibility of runs since as we shall see, it can create reserves at will. These administrative and regulatory functions of the Fed are important, but its central function is to help manage the macroeconomy by setting the interest rate. To see how this process works we need to add a discussion of the demand for money to our analysis, which we turn to now.

The Demand for Money

10.4 LEARNING OBJECTIVE

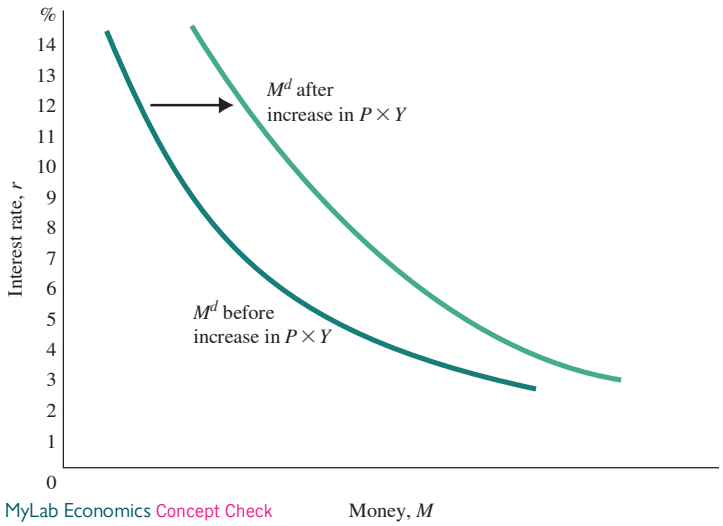
Describe the determinants of money demand.

Think about the financial assets of a household. Some of those assets are held in what we have called in this chapter M1 money, cash and checking accounts offering little or no interest, but great convenience in use. One can access these accounts by withdrawing money, but also by using a debit card or smartphone connected to a checking account. Other assets likely held by a household include interest-bearing savings accounts and securities which are less convenient to use, but do earn interest. In this section we consider how households think about dividing their assets between these two broad categories. What determines how much money people choose to hold?

As we have seen, one of the major functions of money is as a means of exchange, to facilitate transactions. We have already discussed the transactions use of money. Convenience in transactions is an obvious motive for people to hold some money, rather than keep all their assets in a harder-to-use savings account. In this section we consider what determines *how much* money people choose to hold. We will assume in this discussion that money as we are defining it earns no interest. It can take the form of either cash or deposits in non-interest-bearing checking accounts. Note that if debit cards or cell phones are used to pay for items in stores, deposits in checking accounts are needed to back this up. So "money" is being used for these kinds of payments.

Consider a simple example of how the decision to hold money versus an interest-bearing instrument might work. We will also assume for simplicity that there is only one form other than money in which financial assets can be held, namely in a "savings account," which earns interest. Say at the end of the month the firm you work for deposits $5,000 in your checking account. If you leave the deposits in your checking account, you earn no interest. If you move some or all to your savings account, you earn interest on the amount moved. How much should you move? The gain from moving is the interest you earn on the amount moved. The constraint is that you may need the deposits in your checking account to support your transactions, via checks, debit card, or smartphone. The deposits in your checking account support your transactions. The more of your assets you move to your savings account, the more often you will have to move deposits back to your checking account as it is drawn down by your transactions.

FIGURE 10.5 The Demand for Money
The quantity of money demanded (Md) depends negatively on the interest rate because the opportunity cost of holding money decreases as the interest rate falls. An increase in transactions ($P \times Y$) shifts the money demand curve to the right.



MyLab Economics Concept Check

We thus have a typical economic trade-off here. You gain interest by moving checking account deposits to your savings account, but the more you move, the more often you will have to move some back, which is costly in time. How much should you move? Here is where the interest rate plays a key role. The higher the interest rate, the more costly it is to keep deposits in your checking account. If the interest rate is close to zero, as it has been for a number of years, you earn very little by moving deposits to your savings account, so there is little reason to do so. There is a time cost of moving deposits back and forth, and there is no reason to bear this cost if you are earning practically nothing on your savings account. On the other hand, if the interest rate rises, the opportunity cost of keeping deposits in your checking account rises, and you should move some of the deposits to your savings account. The higher the interest rate, the more deposits you should keep on average in your savings account, other things being equal. Or, put another way, the higher the interest rate, the less on average you should hold in the form of money in your checking account. The amount of money you should hold thus depends negatively on the interest rate. Again, this is because a high interest rate means the opportunity cost of holding money is high because of the interest lost by not moving deposits to your savings account. You trade off convenience against an interest rate.

The amount of money you want to hold obviously also depends on the size of your transactions. The more you spend in a given period, the more deposits on average you will want to have in your checking account, other things being equal. If you hold very little in your checking account relative to the size of your transactions, you will need to spend more time moving deposits from your savings account to your checking account, which is costly.

To summarize, the demand for money depends positively on the size of total transactions in a period and negatively on the interest rate. In what follows we will use nominal income $P \times Y$ as the measure of transactions, where P is the aggregate price level—the GDP deflator—and Y is real output—real GDP. Figure 10.5 shows the demand for money schedule. The schedule slopes down because, as just discussed, the demand for money rises as the interest rate falls. The figure also shows that the demand for money curve shifts to the right as $P \times Y$ increases because of the increase in transactions. The relationship between money demand and the interest rate will be an important part of our story of monetary policy and the Fed.

10.5 LEARNING OBJECTIVE
Define interest and discuss the relationship between interest rates and security prices.

Interest Rates and Security Prices

Before we discuss how the Fed controls the interest rate, we need to briefly digress and consider the relationship between interest rates and security prices.

In our discussion thus far we have described the way in which households choose between holding money and holding their assets in interest-bearing securities or accounts. Interest-bearing securities are issued by firms and the government seeking to borrow money. Short-term

ECONOMICS IN PRACTICE

Professor Serebryakov Makes an Economic Error

In Chekhov's play *Uncle Vanya*, Alexander Vladimirovitch Serebryakov, a retired professor, but apparently not of economics, calls his household together to make an announcement. He has retired to his country estate, but he does not like living there. Unfortunately, the estate does not derive enough income to allow him to live in town. To his gathered household, he thus proposes the following:

> Omitting details, I will put it before you in rough outline. Our estate yields on an average not more than two percent, on its capital value. I propose to sell it. If we invest the money in suitable securities, we should get from 4 to 5 percent, and I think we might even have a few thousand roubles to spare for buying a small villa in Finland.

This idea was not well received by the household, especially by Uncle Vanya, who lost it for a while and tried to kill Professor Serebryakov, but no one pointed out that this was bad economics. As discussed in the text, if you buy a bond and interest rates rise, the price of your bond falls. What Professor Serebryakov does not realize is that what he is calling the capital value of the estate, on which he is earning 2 percent, is not the value for which he could sell the estate if the interest rate on "suitable" securities is 5 percent. If an investor in Russia can earn 5 percent on these securities, why would he or she buy an estate earning only 2 percent? The price of the estate would have to fall until the return to the investor was 5 percent. To make matters worse, it may have been that the estate was a riskier investment than the securities, and if this were so, a return higher than 5 percent would have been required on the estate purchase to compensate the investor for the extra risk. This would, of course, lower the price of the estate even more. In short, this is not a scheme by which the professor could earn more money than what the estate is currently yielding. Perhaps had Uncle Vanya taken an introductory economics course and known this, he would have been less agitated.

CRITICAL THINKING

1. What would happen to the value of the estate if the interest rate on the securities that Professor Serebryakov is talking about fell?

securities are usually called "bills," and long-term securities are usually called "bonds." Both types of securities work in similar ways. To induce lenders to buy these securities and provide funds, borrowers promise not only to return the funds borrowed at some later date, but also to pay interest. For our discussion we will look at a 10-year U.S. Treasury security, a government bond.

Bonds are issued with a face value, typically in denominations of $1,000. They also come with a maturity date, which is the date the borrower agrees to pay the lender the face value of the bond. A bond also specifies a fixed dollar payment that will be paid to the bondholder each year. This payment is known as a coupon. Say that on January 2, 2018, the U.S. Treasury issued a 10-year bond that had a face value of $1,000 and paid a coupon of $20 per year. The bond was sold on this date in the bond market. The price at which the bond sold would be whatever price the market determined it to be. Say that the market-determined price was in fact $1,000. (The Treasury when issuing bonds tries to choose the coupon to be such that the price that the bond initially sells for is roughly equal to its face value.) The lender would give the Treasury a check for $1,000, and every January for the next 10 years the Treasury would send the lender a check for $20. Then on January 2, 2028, the Treasury would send the lender a check for the face value of the bond—$1,000—plus the last coupon payment—$20—and that would square all accounts.

In this example the interest rate that the lender receives each year on his or her $1,000 investment is 2 percent. In return for the $1,000 payment the lender receives $20 each year, or 2 percent of the market price of the bond.

Suppose that just before the government put its bond on the market, many other, identical-looking bonds were offered to lenders with coupons of $30, face values of $1,000, and maturity of 10 years. Also, suppose that these bonds were selling for $1,000. Could the Treasury still sell its bond? The answer is yes, but at a lower price. What would that price be? The other securities are offering lenders 3 percent interest, so the Treasury will have to do the same. With a coupon value fixed at $20, the only way to raise the interest rate to the required 3 percent is to lower the price of the bond. The market price of the bond will be less than $1,000.

A key relationship that we can see from this example and that we will use later in this chapter is that market-determined prices of existing bonds and interest rates are inversely related. When the Treasury (or a firm) issues a bond, the face value, coupon, and maturity are set. This means that the market price of the bond will change as market interest rates change. When interest rates rise, prices of existing bonds fall. We will use the inverse relationship between interest rates and bond prices as we explore monetary policy post 2008 near the end of the next section. We turn now to put money supply and money demand together to look at how monetary policy works through the Fed.

10.6 LEARNING OBJECTIVE

Understand how the Fed can change the interest rate.

How the Federal Reserve Controls the Interest Rate

Tools Prior to 2008 MyLab Economics Concept Check

Traditionally the Fed had three tools available to it to control the interest rate via changing the money supply: open market operations, changing the reserve requirement ratio, and changing the discount rate that banks pay to the Fed to borrow reserves.

Consider again Figure 10.2. We see in this figure that if commercial bank reserves increase by $100 with a reserve requirement ratio of 20 percent, bank loans can increase by $400, with the money supply increasing by $500 ($400 in loans plus the initial $100 in reserves). This calculation assumes that no excess reserves are held. So one way the Fed can increase the money supply is by simply increasing reserves. How does the Fed do this? Its principal tool is to buy U.S. Treasury securities from the banks, which the banks hold. These securities do not count as reserves when held by the banks. If the Fed buys $100 in securities from a bank, it credits the bank with $100 in reserves. The bank's reserves have gone up by $100, so it can make loans of $400, thus increasing the money supply by $500. (We are assuming a single-bank economy, but the analysis goes through with many banks, as in Figure 10.3.) Conversely, if the Fed sells $100 in securities, the bank's reserves go down by $100 (the securities are paid for by the bank by a debit to the bank's reserves), and loans must be decreased by $400, thus decreasing the money supply by $500. This buying and selling of government securities by the Fed is called **open market operations**. Prior to 2008, when essentially no excess reserves were held by banks, it was the main way in which the Fed changed the money supply.

open market operations The purchase and sale by the Fed of government securities in the open market.

Deposits in Figure 10.2 can also be increased if the reserve requirement ratio is lowered. We have already seen this in our discussion of the creation of money. If the reserve requirement ratio were 10 percent rather than 20 percent, loans of $900 could be made, thus increasing the money supply (deposits) to $1,000. Conversely, if the reserve requirement ratio were increased, loans would have to fall and thus the money supply (deposits) would fall. In the period before 2008, when banks rarely held excess reserves, changing the reserve requirement ratio was another tool the Fed could use to change the money supply, although it used this tool infrequently.

Banks also have the option to borrow reserves from the Fed, which they did now and again prior to 2008. Borrowed reserves are counted as reserves that can back loans, so when there is an increase in borrowed reserves, there is an increase in the money supply as banks increase their loans. Banks pay interest on the borrowed reserves, called the **discount rate**, and so a third way the Fed can increase the money supply is to lower the discount rate, inducing banks to borrow more and thus expand loans. Conversely, the Fed can raise the discount rate, inducing banks to pay back some of their borrowed reserves and thus contract loans. This third tool to change the money supply, changing the discount rate, was also infrequently used.

discount rate The interest rate that banks pay to the Fed to borrow from it.

How do these tools give the Fed the ability to control the interest rate? We have just seen that when no excess reserves are held, the Fed can change the money supply through one of the three tools, the main tool being open market operations. The Fed can thus set the value of the money supply, the quantity of money, at whatever it wants. Assuming that the money market clears, which it does in practice, we can combine the demand for money schedule in Figure 10.5 with the money supply that the Fed chooses to determine the equilibrium value of the interest rate. This is done in Figure 10.6. Given the quantity of money that the Fed chooses to supply, the interest rate can simply be read off the money demand schedule. A value of M_0 leads to an interest rate of r_0 in the figure. Figure 10.6 also shows that if the Fed increases the money supply, from M_0 to M_1, the interest rate falls from r_0 to r_1. So any change in the money supply that the Fed might make leads to a change in the interest rate, with the magnitude of the interest rate change depending on the shape of the money demand function.

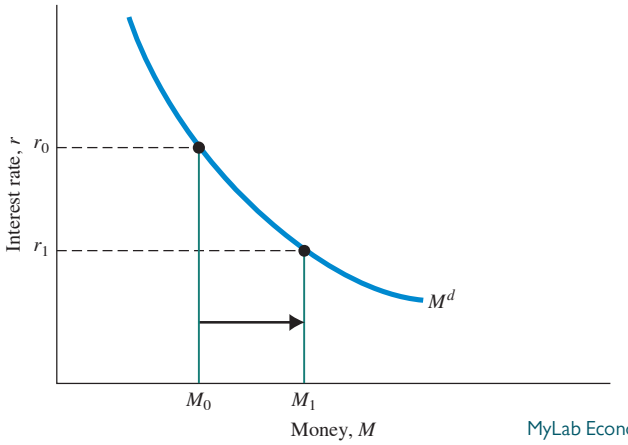
Prior to 2008 the preceding discussion would be the end of the story. Banks essentially held no excess reserves, and the Fed engaged in open market operations to change the money supply and the interest rate. This channel for monetary policy changed in 2008, as the Fed responded to the financial crisis.

Expanded Fed Activities Beginning in 2008 MyLab Economics Concept Check

In March 2008, faced with many large financial institutions simultaneously in serious financial trouble, the Fed began to broaden its role in the banking system. No longer would it be simply a lender of last resort to banks, but it would become an active participant in the private banking system. How did this change come about?

Beginning in about 2003, the U.S. economy experienced rapidly rising housing prices, in what some called a "housing bubble." Financial institutions began issuing mortgages with less oversight, in some cases to households with poor credit ratings (so-called subprime borrowers). Some households bought homes they could not afford based on their incomes, expecting to eventually "cash in" on the rising housing prices. Regulation, by the Fed or other federal or state agencies, was lax, and many financial firms took very large risks. When housing prices began to fall in late 2005, the stage was set for a financial crisis. Financial institutions, even large ones, began to experience very large losses, as home owners began defaulting on their loans, setting off a chain reaction that many people thought threatened the economic system.

The Fed responded to these events in a number of ways. In March 2008 it participated in an attempted bailout of Bear Stearns, a large financial institution, by guaranteeing $30 billion of Bear Stearns' liabilities to JPMorgan. On September 7, 2008, it participated in a government takeover of the Federal National Mortgage Association (Fannie Mae) and the Federal Home Loan Mortgage Corporation (Freddie Mac), which at that time owned or guaranteed about half of the $12 trillion mortgage market in the United States. On September 17, 2008, the Fed loaned $85



MyLab Economics Concept Check

FIGURE 10.6 The Equilibrium Interest Rate
Given a value of the money supply that the Fed chooses, the equilibrium interest rate can be read off of the money demand schedule. If the Fed increases the money supply from M_0 to M_1, the interest rate falls from r_0 to r_1.

billion to the American International Group (AIG) insurance company to help it avoid bankruptcy. In mid-September, the Fed urged Congress to pass a $700 billion bailout bill, which was signed into law on October 3.

In the process of bailing out Fannie Mae and Freddie Mac, in September 2008 the Fed began buying securities of these two associations, called "federal agency debt securities." More remarkable, however, is that in January 2009 the Fed began buying mortgage-backed securities, securities that the private sector was reluctant to hold because of their perceived riskiness, and long-term government bonds. By September 2012 the Fed was buying mortgage-backed securities and long-term government bonds to the tune of $85 billion per month. This practice ended in November 2014. Most of these purchases ended up as an increase in excess reserves of commercial banks, as we will see in the next section.

As is not surprising, there has been much political discussion of whether the Fed should have regulated financial institutions more in 2003–2005 and whether its subsequent active role in the system was warranted. Whatever one's views, it is certainly the case that the Fed has taken a much more active role in financial markets since 2008.

The Federal Reserve Balance Sheet MyLab Economics Concept Check

The expanded Fed activities we have just described can be seen clearly by examining the way in which the Fed's balance sheet changed during the period after 2008.

Although the Fed is a special bank, it is similar to an ordinary commercial bank in that it has a balance sheet that records its asset and liability position at any moment of time. The balance sheet for April 11, 2018, is presented in Table 10.1.

On April 11, 2018, the Fed had $4,431 billion in assets, of which $11 billion was gold, $2,413 billion was U.S. Treasury securities, $4 billion was federal agency debt securities, $1,754 billion was mortgage-backed securities, and $291 billion was other.

Gold is trivial. *Do not think that this gold has anything to do with money in circulation.* Most of the gold was acquired during the 1930s, when it was purchased from the U.S. Treasury Department. Since 1934, the dollar has not been backed by (is not convertible into) gold. You cannot take a dollar bill to the Fed to receive gold for it; all you can get for your old dollar bill is a new dollar bill.[6] Although it is unrelated to the money supply, the Fed's gold counts as an asset on its balance sheet because it is something of value the Fed owns.

U.S. Treasury securities are the traditional assets held by the Fed. These are obligations of the federal government that the Fed has purchased over the years. As we discussed previously, when banks hold no excess reserves the buying and selling of Treasury securities (open market

TABLE 10.1 Assets and Liabilities of the Federal Reserve System, April 11, 2018 (Billions of Dollars)

Assets		Liabilities	
Gold	11	Currency in circulation	1,641
U.S. Treasury securities	2,413	Reserve balances (about 133 required)	2,129
Federal agency debt securities	4	U.S. Treasury deposits	370
Mortgage-backed securities	1,754	All other liabilities and net worth	291
All other assets	249	Total	4,431
Total	4,431		

Source: Federal Reserve Statistical Release, Factors affecting Reserve Balances, Board of Governors of the Federal Reserve System.

MyLab Economics Real-time data

[6]The fact that the Fed is not obliged to provide gold for currency means it can never go bankrupt. When the currency was backed by gold, it would have been possible for the Fed to run out of gold if too many of its depositors came to it at the same time and asked to exchange their deposits for gold. If depositors come to the Fed to withdraw their deposits today, all they can get is dollar bills. The dollar was convertible into gold internationally until August 15, 1971.

operations) is the way the Fed affects the money supply and the interest rate. Before the change in Fed behavior in 2008, almost all of its assets were in the form of U.S. Treasury securities. For example, in the ninth edition of this text, the balance sheet presented was for October 24, 2007, where total Fed assets were $885 billion, of which $780 billion were U.S. Treasury securities. The new assets of the Fed (since 2008) are federal agency debt securities and mortgage-backed securities. These were both zero on the October 24, 2007, balance sheet, although it is now the case that the Fed has unwound almost all of its holdings of federal agency debt, where the current holdings are just $4 billion.

Of the Fed's liabilities, $1,641 billion is currency in circulation, $2,129 billion is reserve balances, $370 billion is U.S. Treasury deposits, and $291 billion is other. The Fed acts as a bank for the U.S. government, and so U.S. Treasury deposits are held by the U.S. government at the Fed. When the government needs to pay for something like a new aircraft carrier, it may write a check to the supplier of the ship drawn on its "checking account" at the Fed. Similarly, when the government receives revenues from tax collections, fines, or sales of government assets, it may deposit these funds at the Fed.

Currency in circulation accounts for about 37 percent of the Fed's liabilities. The dollar bill that you use to buy a pack of gum is clearly an asset from your point of view. Because every financial asset is by definition a liability of some other agent in the economy, whose liability is the dollar bill? The dollar bill is a liability—an IOU—of the Fed. It is, of course, a strange IOU because it can only be redeemed for another IOU of the same type. It is nonetheless classified as a liability of the Fed.

Reserve balances account for about 48 percent of the Fed's liabilities. These are the reserves that commercial banks hold at the Fed. Remember that commercial banks are required to keep a certain fraction of their deposits at the Fed. These deposits are assets of the commercial banks and liabilities of the Fed. What is remarkable about the $2,129 billion in reserve balances at the Fed is that only about $133 billion are required reserves. The rest—about $2 trillion—are excess reserves, reserves that the commercial banks could lend to the private sector if they wanted to. The existence of these excess reserves complicates our story of the Fed's operations.

Tools After 2008 MyLab Economics Concept Check

After 2008 we see that we are no longer in a world of zero excess reserves. Indeed, excess reserves on April 11, 2018, were about $2 trillion, which is considerably above zero! What does this do to the Fed's ability to change the money supply and the interest rate?

Between 2008 and the end of 2015, the Fed kept the short-term interest rate close to zero. It began increasing the short-term interest rate in December of 2015. How did the Fed do this? Not through the traditional tools of open market operations, reserve requirement ratio, and discount rate. Consider open market operations. Prior to 2008 the Fed would sell government securities, which would decrease reserves, contract bank loans, drive down the money supply, and thus increase the interest rate. With the existence of excess reserves, however, if the Fed sold government securities, the securities would mostly be bought by the banks with their excess reserves. Bank reserves would decrease, but with ample excess reserves remaining no contraction in bank loans is needed. Look at Table 10.1. If the Fed sold $1 trillion in U.S. Treasury securities, there would be a fall in U.S. Treasury securities of $1 trillion and a fall in Reserve balances of $1 trillion. Both Fed assets and liabilities would be lower by $1 trillion, but there would be no change in the interest rate! Banks would now have $1 trillion less in reserves, but still have roughly $1 trillion in excess reserves. Just swapping Treasury securities for reserves does not change the interest rate. For the same reason, changing the reserve requirement ratio would also be useless: the banks are well over the requirement.

The tool that the Fed now uses to raise the short-term interest rate is to increase the rate it pays to banks on their reserves. Beginning in the post-2008 period, the Fed began paying interest on bank reserves. (Indeed, this may help to explain why banks began holding reserves rather than lending them out.) If the Fed increases the rate it pays on bank reserves, this will increase the interest rate on short-term U.S. Treasury securities. Suppose the Fed raises the rate it pays

on bank reserves by 0.25 percentage points. What effect does this have on the short-term U.S. Treasury securities market? With some simplification, the story is roughly as follows. Banks hold both reserves and Treasury securities. Before the Fed increased the rate paid on bank reserves, the interest rates on reserves and short-term Treasury securities were roughly the same. After the Fed's move, the interest rate on reserves is initially 0.25 points higher. This higher rate induces banks to try to sell their now unattractive securities to the Fed. If the Fed does not buy, then the securities will be sold on the bond market, causing their price to change. As we saw in the previous section, when the price of a security falls, the interest rate rises, so with security prices falling, the interest rate on the securities rises. The new equilibrium will be where the interest rate on the securities is also 0.25 points higher. The interest rate on short-term Treasury securities can thus be changed by the Fed simply increasing the rate it pays on bank reserves. This requires no change in the Fed's balance sheet.

Finally, we should add that when the Fed changes the short-term interest rate, this also changes longer-term interest rates. This is briefly explained in the appendix to this chapter. The appendix also discusses some of the key interest rates in the U.S. economy. Although in the text we are primarily focusing on one interest rate, denoted r, in practice there are many.

Looking Ahead

This has been a long chapter, but for future analysis we really only need one point, namely that the Fed has the ability to control the short-term interest rate. Before 2008 it did this primarily through open market operations, and it now does this by changing the rate it pays banks on their reserves with the Fed.

SUMMARY

10.1 AN OVERVIEW OF MONEY *p. 217*

1. Money has three distinguishing characteristics: (1) a *means of payment*, or *medium of exchange*; (2) *a store of value*; and (3) *a unit of account*. The alternative to using money is *barter*, in which goods are exchanged directly for other goods. Barter is costly and inefficient in an economy with many different kinds of goods.
2. *Commodity monies* are items that are used as money and that have an intrinsic value in some other use—for example, gold and cigarettes. *Fiat monies* are intrinsically worthless apart from their use as money. To ensure the acceptance of fiat monies, governments use their power to declare money *legal tender* and promise the public they will not debase the currency by expanding its supply rapidly.
3. There are various definitions of money. Currency plus demand deposits plus traveler's checks plus other checkable deposits compose M1, or *transactions money*—money that can be used directly to buy things. The addition of savings accounts and money market accounts (*near monies*) to M1 gives M2, or *broad money*.

10.2 HOW BANKS CREATE MONEY *p. 221*

4. The *required reserve ratio* is the percentage of a bank's deposits that must be kept as *reserves* at the nation's central bank, the *Federal Reserve*.
5. Banks create money by making loans. When a bank makes a loan to a customer, it creates a deposit in that customer's account. This deposit becomes part of the money supply. Banks can create money only when they have *excess reserves*—reserves in excess of the amount set by the required reserve ratio.
6. The *money multiplier* is the multiple by which the total supply of money can increase for every dollar increase in reserves. The money multiplier is equal to 1/required reserve ratio.

10.3 THE FEDERAL RESERVE SYSTEM *p. 227*

7. The Fed's most important function is controlling the short-term interest rate. The Fed also performs several other functions: it clears interbank payments, is responsible for many of the regulations governing banking practices and standards, and acts as a *lender of last resort* for troubled banks that cannot find any other sources of funds. The Fed also acts as the bank for the U.S. government.

10.4 THE DEMAND FOR MONEY *p. 229*

8. The demand for money depends negatively on the interest rate. The higher the interest rate, the higher the opportunity cost (more interest forgone) from holding money and the less money people will want to hold. An increase in the interest rate reduces the quantity demanded for money, and the money demand curve slopes downward.

9. The demand for money depends positively on nominal income. Aggregate nominal income is $P \cdot Y$, where P is the aggregate price level and Y is aggregate real income. An increase in either P or Y increases the demand for money.

10.5 INTERNET RATES AND SECURITY PRICES *p. 230*

10. Interest rates and security prices are inversely related. If market interest rates rise, prices of existing bonds fall.

10.6 HOW THE FEDERAL RESERVE CONTROLS THE INTEREST RATE *p. 232*

11. Prior to 2008 the Fed had three tools to control the money supply: (1) changing the required reserve ratio, (2) changing the *discount rate* (the interest rate member banks pay when they borrow from the Fed), and (3) engaging in *open market operations* (the buying and selling of already-existing government securities). To increase the money supply, the Fed could create additional reserves by lowering the discount rate or by buying government securities, or the Fed could increase the number of deposits that can be created from a given quantity of reserves by lowering the required reserve ratio. To decrease the money supply, the Fed could reduce reserves by raising the discount rate or by selling government securities or it could raise the required reserve ratio.

12. In the post-2008 period large quantities of excess reserves have been held by banks. The Fed is now paying interest on these reserves. When the Fed wants to raise interest rates it does so by increasing the interest rate it pays on bank reserves.

REVIEW TERMS AND CONCEPTS

barter, *p. 217*
commodity monies, *p. 219*
currency debasement, *p. 219*
discount rate, *p. 232*
excess reserves, *p. 224*
Federal Open Market Committee (FOMC), *p. 227*
Federal Reserve Bank (the Fed), *p. 223*
fiat, *or* token, money, *p. 219*
legal tender, *p. 219*
lender of last resort, *p. 229*
liquidity property of money, *p. 218*
M1, *or* transactions money, *p. 220*
M2, *or* broad money, *p. 220*
medium of exchange, *or* means of payment, *p. 217*
money multiplier, *p. 226*
near monies, *p. 220*
Open Market Desk, *p. 227*
open market operations, *p. 232*
required reserve ratio, *p. 224*
reserves, *p. 223*
run on a bank, *p. 223*
store of value, *p. 217*
unit of account, *p. 218*

Equations: M1 ≡ currency held outside banks + demand deposits + traveler's checks + other checkable deposits, *p. 220*
M2 ≡ M1 + savings accounts + money market accounts + other near monies, *p. 220*
Assets ≡ Liabilities + Net Worth, *p. 223*
Excess reserves ≡ actual reserves − required reserves, *p. 224*
Money multiplier $\equiv \frac{1}{\text{required reserve ratio}}$, *p. 227*

PROBLEMS

All problems are available on MyLab Economics.

10.1 AN OVERVIEW OF MONEY

LEARNING OBJECTIVE: Define money and discuss its functions.

1.1 **[Related to the *Economics in Practice* on *p. 218*]** It is well known that cigarettes served as money for prisoners of war in World War II. Do an Internet search using the key word cigarettes and write a description of how this came to be and how it worked.

1.2 As king of Medivalia, you are constantly strapped for funds to pay your army. Your chief economic wizard suggests the following plan: "When you collect your tax payments from your subjects, insist on being paid in gold coins. Take those gold coins, melt them down, and remint them with an extra 10 percent of brass thrown in. You will then have 10 percent more money than you started with." What do you think of the plan? Will it work?

1.3 Why aren't money market accounts included in M1 alongside demand deposits? Explain in your own words using the definitions of M1 and M2.

1.4 After suffering two years of staggering hyperinflation, the African nation of Zimbabwe officially abandoned its currency, the Zimbabwean dollar, in April 2009 and made the U.S. dollar its official currency. Why would anyone in Zimbabwe be willing to accept U.S. dollars in exchange for goods and services?

1.5 In March 2018, the word "cryptocurrency" was added to the Merriam-Webster dictionary, defined as "any