

Chapter 11

Monetary Policy

After reading this chapter, you will understand:

1. How banks create money.
2. Why the size of the money stock is limited by the quantity of bank reserves.
3. The instruments available to the Fed for controlling the money stock.
4. How closely the money stock can be controlled.
5. The activities that the Fed undertakes in the international sphere.

Before reading this chapter, make sure you understand the meaning of:

1. M1, M2
2. Balance sheets
3. Federal Reserve System
4. Federal Open Market Committee
5. Bank reserves

INSIDE THE FED

As powerfully as the moon affects the tides, the Federal Reserve System influences American finance and business. Like the moon, the Fed is mysterious, unseen most of the time, and only partly illuminated the rest of the time. Here H. Robert Heller, who served on the Fed's board of governors under chairmen Paul Volcker and Alan Greenspan, tells what it was like to be a member of this august group.

One of the most breathtaking moments of my life was the first time I walked into a meeting of the Federal Open Market Committee. Volcker had administered the oath of office to me at 8:55 a.m. on August 19, 1986. Then the door to the boardroom, which adjoins his office, opened, and we walked into an FOMC meeting, which began at nine o'clock. Everybody was already seated at the table, and they all rose. It was sort of like being inducted into the College of Cardinals.

Then the discussion started. I was trying to keep track of the various positions. There was a broad range of views, with some advocating a little easier monetary policy, and some a little tighter. And I thought, "My God, what if I'm the swing vote?" Cold sweat started running down my back. Finally, when it came to the roll call, to my enormous surprise almost everybody agreed to ease monetary policy slightly.

I began to realize that the FOMC is an enormous consensus builder. That makes it very different from the Supreme Court. Five-to-four decisions are the rule there. What we tend to see here is either 12-0 or 11-1 decisions. Though people walk into the meeting with somewhat divergent views, the sharp edges are worn off in discussion. Eventually a consensus emerges and is formulated by the chairman. Following further discussion and possible modification of the chairman's proposal, it is put to a vote. You think: Can I associate myself sufficiently with the consensus to vote yes, or am I so opposed that I must say, "This policy would be unacceptable." I never dissented, and I'm proud of that, because I believe I helped to build that consensus.

Source: Robert F. Norton, "A Rare Glimpse Inside the Fed," *Fortune*, September 11, 1989, 155–156. 1989 The Time Inc. Magazine Company. All rights reserved.

ONLY A VERY few people ever sit on the Federal Open Market Committee. Most people's interactions with the banking system are limited to writing checks, getting an auto loan, or getting cash from an automatic teller machine. Yet, as this chapter will show, each depositor's and each borrower's actions ultimately influence and are influenced by decision makers throughout the financial system, including those who sit at the very top.

This chapter draws on the workings of the banking system. We begin by examining how banks create money in a simplified system. Then we discuss the tools that the Federal Reserve uses to control the money stock within the country. Finally we look briefly at the Fed's role in international financial markets.

THE CREATION OF MONEY

The bulk of the U.S. money supply consists of the liabilities of banks and thrift institutions. In this section we will see how these institutions create money on the basis of reserves supplied by the Federal Reserve System.

A Simplified Banking System

As we have done in building models of other parts of the economy, we will begin with a simplified situation and add details later. Our simplified banking system is as follows:

1. The system consists of ten identical banks.
2. The banks' only assets are loans and reserve deposits at the Fed; there is no vault cash.
3. The banks' only liabilities are demand deposits; their net worth is zero.
4. Demand deposits are the only form of money in the banking system.

5. The system is regulated by a simplified Federal Reserve System that has the power to set uniform reserve requirements on all deposits.
6. The Fed's only assets are government securities, and its only liabilities are the reserve deposits of member banks. Banks do not borrow reserves from the Fed.

Simplified as it is, this 10-bank system can show us a great deal about the mechanics of money creation in the U.S. banking system.

RESERVES: REQUIRED AND EXCESS The Federal Reserve System sets a minimum percentage of certain categories of deposits that each bank or thrift must hold as reserve deposits with the Fed or as vault cash. These are called **required reserves**. The ratio of required reserves to total deposits is the **required-reserve ratio**. If the bank holds more than the minimum amount of required reserves, the balance is known as **excess reserves**. In equation form, the relationships among required reserves, excess reserves, deposits, and the required-reserve ratio can be stated as follows:

$$\text{Required reserves} = \text{Deposits} \times \text{Required-reserve ratio}$$

and

$$\text{Excess reserves} = \text{Total reserves} - \text{Required reserves}$$

For our simplified banking system, we will assume a required-reserve ratio of 10 percent on all deposits.

BALANCE SHEET EQUILIBRIUM As profit-seeking firms, banks want to earn all the interest they can; thus, they normally keep excess reserves to a minimum in order to make as many loans or buy as many securities as possible. The situation in which required reserves equal total reserves represents a state of equilibrium. Although in practice, banks do not maintain reserves exactly at their equilibrium level at all times, in our simplified banking system we will assume that they quickly bring their excess reserves back to zero following any disturbance.

Mechanics of Money Creation

Now we are ready to examine the mechanics of money creation in our simplified banking system. As the following example will show, money creation is governed by the required-reserve ratio, the amount of reserves supplied, and banks' efforts to maximize their profits.

INITIAL BALANCE SHEETS Assume that each bank in the system starts out with a balance sheet that looks like this:

Initial Balance Sheet of a Representative Bank				
Assets			Liabilities	
Reserves		\$ 10,000	Demand deposits	\$100,000
Required	\$10,000			
Excess	0			
Loans		90,000		
Total assets		<u>\$100,000</u>	Total liabilities	<u>\$100,000</u>

Also assume that the Fed's initial balance sheet looks like this:

The Fed				
Assets			Liabilities	
U.S. government securities	\$100,000		Reserve deposits	\$100,000

Starting from this point, we will look at the effects of an injection of reserves into the banking system. Each bank receives new reserves every time a customer deposits funds that were withdrawn from another bank. However, this does not increase the reserves in the banking system as a whole. For total reserves to be increased, new reserves must come from outside the system. The chief source of new reserves is the Fed.

Suppose that the Fed decides to increase the amount of reserves available to the banking system by \$10,000. It usually does this by adding to its holdings of government securities, buying such securities from a securities dealer. Such an action is called an **open market operation** (in this case, an open market purchase) because the Fed, acting through the Federal Reserve Bank of New York, goes to the securities market and bids against other buyers to purchase the securities. Suppose the Fed buys \$10,000 in securities from a dealer and pays for them through a wire transfer to the dealer's bank, which we will call Albany National Bank.¹ The *wire transfer* is an electronic instruction made through the Fed's computer network that credits Albany National Bank's reserve account at the Fed with \$10,000 and simultaneously directs the bank to credit the same amount to the dealer's demand-deposit account.

At this point the Fed's initial goal of injecting \$10,000 of new reserves into the system has been achieved. The balance sheets of the Fed and Albany National Bank now look like this (changes from the previous balance sheet are shown in parentheses):

The Fed				
Assets			Liabilities	
U.S. government securities	\$110,000		Reserve deposits	\$100,000
	(+10,000)			(+10,000)

Albany National Bank				
	Assets		Liabilities	
Reserves		\$ 20,000	Demand deposits	\$110,000
		(+10,000)		(+10,000)
Required	\$11,000			
	(+1,000)			
Excess	9,000			
	(+9,000)			
Loans		90,000		
Total assets		<u>\$110,000</u>	Total liabilities	<u>\$110,000</u>
			(+10,000)	(+10,000)

LENDING OUT THE EXCESS RESERVES Note how the \$10,000 in new reserves at Albany National Bank is divided between required and excess reserves. Deposits have gone up by \$10,000, meaning that the bank must hold \$1,000 more in required reserves. The other \$9,000 in new reserves need not be held against deposits and hence is listed as excess reserves. Albany National Bank is no longer in equilibrium; it can increase its profits by lending out the excess reserves.

Of course, in order to make a loan the bank must find a borrower. Suppose that on the morning on which Albany gets its new reserves James Anderson walks in and applies for a \$9,000 auto loan. The loan is granted and the \$9,000 is credited to Anderson's checking account balance. (If Anderson had no checking account at Albany, he could ask the bank to pay him the proceeds of the loan in the form of a check or even currency. In that case, some of the intermediate steps in the following process would differ, but the end result would be the same.) At the moment at which the loan is completed—but before Anderson pays for the car—Albany National Bank's balance sheet looks like this:

Albany National Bank				
	Assets		Liabilities	
Reserves		\$ 20,000	Demand deposits	\$119,000
Required	\$11,900			
	(+900)			
Excess	8,100			
	(+9000)			
Loans		99,000		
		(+9,000)		
Total assets		<u>\$119,000</u>	Total liabilities	<u>\$119,000</u>
			(+9,000)	(+9,000)

CHECKING AWAY THE LOAN PROCEEDS In crediting Anderson’s account with \$9,000, Albany National Bank has created a new \$9,000 asset (the loan) matched by a new \$9,000 liability (the deposit). Because of the new deposit, its required reserves have risen by \$900. At this point Albany still has \$8,100 in excess reserves. Why, then, does it not use those reserves to make yet another loan?

The reason the bank cannot safely make new loans greater than the original amount added to its excess reserves is that it knows Anderson will not leave the \$9,000 sitting in his account; instead, he will write a check to pay for his new car. Let’s see what happens when he does so.

We will call the dealer who sells the car Joyce Barnard and assume that she keeps her checking account at Bethel National Bank. When Barnard deposits Anderson’s Albany National Bank check in her Bethel account, Bethel sends it to the Fed for clearance. *Clearing the check* simply means that the Fed credits \$9,000 to Bethel’s reserve account and subtracts \$9,000 from Albany’s reserve account. The Fed then puts the check in the mail so that Albany can forward it to Anderson for his records. When all these transactions have taken place, the two banks’ balance sheets look like this:

Albany National Bank				
Assets		Liabilities		
Reserves		\$ 11,000	Demand deposits	\$110,000
			(-9,000)	(-9,000)
Required	\$11,000			
	(-900)			
Excess	0			
	(-8,100)			
Loans		99,000		
Total assets		\$110,000	Total liabilities	\$110,000
			(-9,000)	(-9,000)

Bethel National Bank				
Assets		Liabilities		
Reserves		\$ 19,000	Demand deposits	\$109,000
			(+9,000)	(+9,000)
Required	\$10,900			
	(+900)			
Excess	8,100			
	(+8,100)			
Loans		99,000		
Total assets		\$109,000	Total liabilities	\$109,000
			(+9,000)	(+9,000)

A careful look at these balance sheets reveals two important things. First, we clearly see why Albany National Bank could not safely lend out more than its initial \$9,000 of excess reserves. It knew that the \$9,000 deposit it created by writing the loan to Anderson would not stay on its books for long. As soon as the check cleared, \$9,000 of deposits and reserves would be lost (unless the car dealer also kept an account at Albany). Only \$900 loss in deposits (10 percent of the total change in deposits) could be taken from required reserves; it needed the \$8,100 of excess reserves to make up the difference.

Second, we see that Albany's loss is Bethel's gain. Albany lost \$9,000 in reserves (\$900 required and \$8,100 excess) when the check was written and cleared, and Bethel gained exactly the same amounts. The check-clearing process thus has left the banking system's total reserves unchanged.

KEEPING THE EXPANSION GOING WITH ANOTHER LOAN The clearing of Anderson's check put Albany National Bank back in equilibrium, with \$10,000 more in total assets and \$10,000 more in liabilities than it started with. But now Bethel is out of equilibrium, with \$8,100 in excess reserves. The logical thing for Bethel to do is to make a loan of its own using its excess reserves. (We now know that the proceeds of this loan will be checked away quickly, so we will skip the intermediate balance sheet.) After Bethel's borrower has written a check for \$8,100, which is deposited in, say, Cooperstown National Bank, Bethel's and Cooperstown's balance sheets looks like this:

Bethel National Bank			
Assets		Liabilities	
Reserves		\$ 10,900	Demand deposits
		(-8,100)	\$109,000
Required	\$10,900		
	(unchanged)		
Excess	0		
	(-8,100)		
Loans		98,100	
		(+8,100)	
Total assets		\$109,000	Total liabilities
			\$109,000

Cooperstown National Bank				
Assets			Liabilities	
Reserves		\$ 18,100	Demand deposits	\$108,100
		(+8,100)		(+8,100)
Required	\$10,810			
	(+810)			
Excess	7,290			
	(+7,290)			
Loans		90,000		
Total assets		\$108,100	Total liabilities	\$108,100
			(+8,100)	(+8,100)

FURTHER ROUNDS IN THE EXPANSION OF DEPOSITS We need not go through all the rounds of the expansion process in detail, because a clear pattern has emerged. The initial open market purchase of securities by the Fed injected \$10,000 of new reserves into the system. The first bank to receive the funds kept \$1,000 (10 percent) as required reserves and lent out the remaining \$9,000. When the loan proceeds were checked away, they became \$9,000 in new deposits and reserves for a second bank, which kept \$900 (10 percent) and lent out the remaining \$8,100. The next bank, in turn, would be able to lend out \$7,290, the next one \$6,561, and so on round after round. The loans create new deposits at each round; therefore, the money supply, made up entirely of deposits, expands by \$10,000 + \$9,000 + \$8,100 + \$7,290 + \$6,561, and so on. In the end, the whole process creates \$100,000 in new deposits.

To summarize the process of deposit expansion, let's compare the beginning and final balance sheets for the ten-bank system as a whole. Initially the balance sheet looked like this:

Initial Balance Sheet of a Representative Bank				
Assets			Liabilities	
Reserves		\$ 100,000	Demand deposits	\$1,000,000
Required	\$100,000			
Excess	0			
Loans		900,000		
Total assets		\$1,000,000	Total liabilities	\$1,000,000

After the injection of \$10,000 in new reserves, the combined balance sheet for the ten banks looks like this:

Final Balance Sheet for the 10-Bank System			
	Assets		Liabilities
Reserves		\$ 110,000 (+10,000)	Demand deposits \$1,100,000 (+100,000)
Required	\$110,000 (+10,000)		
Excess	0		
Loans		990,000 (+90,000)	
Total assets		<u>\$1,100,000</u>	Total liabilities <u>\$1,100,000</u> (+100,000)

We see, then, that the expansion of deposits continues until excess reserves have disappeared. By the time the new reserves have become fully absorbed, total demand deposits will have expanded by \$100,000. On the assets side of the balance sheet, this \$100,000 of new liabilities will be offset by \$10,000 in new required reserves and \$90,000 in new loans.

Contraction of Money Supply

When the Fed withdraws reserves from the banking system, the whole process works in reverse. For example, assume that all the banks are back in the initial position in the last example and that the Fed decides to withdraw, say, \$1,000 in reserves. It can do this by making an open market sale of \$1,000 of securities from its portfolio. Now suppose that the securities are bought by a dealer who pays for them with a wire transfer from an account at Denver National Bank. To complete the transfer, the Fed deducts \$1,000 from Denver's reserve account. At that point Denver's balance sheet looks like this:

Denver National Bank			
	Assets	Liabilities	
Reserves		\$ 9,000 (-9,000)	Demand deposits \$99,000 (-1,000)
Required	\$9,900 (-100)		
Excess	-900 (-900)		
		90,000	
Total assets		<u>\$99,000</u>	Total liabilities <u>\$99,000</u> (-1,000)

The loss of \$1,000 in deposits when the dealer bought the security reduced required reserves by only \$100, whereas Denver's total reserves fell by \$1,000 when the Fed completed the transaction. This leaves the bank with negative excess reserves—that is, a \$900 reserve deficiency—that it must attempt to correct. In our simplified banking system, Denver must make up the deficiency by reducing its loans. It therefore leaves the next \$900 it receives in loan payments in its reserve account. (We assume that if the bank did not have the reserve deficiency, it would make new loans as old ones were paid off, keeping its total loan holdings steady.) In the real world, a bank with a reserve deficiency has a number of other options. One is to sell other assets, such as government securities. Another is to borrow reserves from a bank that has excess reserves. Still another is to borrow from the Fed itself. We will return to these options later.

When Denver National Bank reduces its loan holdings to make up its reserve deficiency, it drains reserves from some other bank in the system. For example, suppose that Maria Espinosa writes a check on Englewood National Bank to pay off \$900 that she borrowed from Denver. At the moment when the wire transfer is complete, the balance sheets of the Denver and Englewood banks will look like this:

Denver National Bank				
	Assets		Liabilities	
Reserves		\$ 9,900 (+900)	Demand deposits	\$99,000
Required	\$9,900 (unchanged)			
Excess	0 (+900)			
Loans		89,100 (-900)		
Total assets		\$99,000	Total liabilities	\$99,000

Englewood National Bank				
	Assets		Liabilities	
Reserves		\$ 9,100 (-900)	Demand deposits	\$99,100 (-900)
Required	\$9,910 (-90)			
Excess	-810 (-810)			
Loans		90,000		
Total assets		\$99,100	Total liabilities	\$99,100 (-900)

At this point, then, Denver has made up its reserve deficiency, but \$810 of it has been passed along to Englewood. Now it is Englewood's turn to reduce its loan holdings. Using an \$810 loan repayment that it has received from some other bank, Englewood will build up its reserves by the required amount, but a \$729 deficiency will appear somewhere else. The contraction process will continue until deposits in the banking system as a whole have been reduced by \$10,000—10 times the original loss of reserves that resulted from the Fed's open market security sale.

The Money Multiplier for the Simplified Banking System

As these examples have shown, the total amount of demand deposits that the banking system can hold depends on the total amount of reserves supplied by the Fed and on the required-reserve ratio. In equation form, with rr standing for the required-reserve ratio, the relationship is as follows:

$$\text{Total demand deposits} = (1/rr) \times \text{Total reserves}$$

Thus, when total reserves were \$100,000, the total money stock (consisting entirely of demand deposits in our example) was \$1 million. When the Fed injected \$10,000 of new reserves into the system, bringing total reserves to \$110,000, the money stock rose by \$100,000, to \$1.1 million. When the Fed withdrew \$1,000 of reserves through an open market sale, reducing total reserves to \$99,000, the money stock fell by \$10,000, to \$990,000.

The term $1/rr$ in the equation just given is called the money multiplier and is the ratio of the equilibrium money stock to total reserves. In our simplified banking system, in which the required-reserve ratio was 10 percent, the value of the money multiplier was 10. Each injection or withdrawal of reserves by the Fed thus increases or decreases the money stock by ten times the change in reserves.

THE INSTRUMENTS OF MONETARY POLICY

The Fed has a major role in providing services to the banking system and in ensuring the system's safety and stability. Our discussion of money creation here shows that the Fed has another power, namely, the power to control the money stock. Now that we know how money is created, we can examine the policy instruments that give the Fed this power.

Open Market Operations

The preceding section illustrated the most important of the policy instruments that the Fed uses to control the money stock: open market operations. If the Fed wants to expand the money stock, it instructs the Open Market Trading Desk at the Federal Reserve Bank of New York to buy

government securities. This is known as an *open market purchase*. *Economics in the News 11.1* presents an eyewitness account of an open market purchase of securities by the Fed.

Economics in the News 11.1

“THE FED’S IN!”

Scene: Morning. The trading desk at Aubrey Lanston & Co., a major New York bond dealer. There is the usual pandemonium associated with financial trading. Dealers are on the phone, sometimes on many phones at once. They are all shouting.

Suddenly, the Fed light flashes on. The room goes quiet. Bond dealer Richard Kelly grabs the direct line to the Fed. The message is quick, guarded.

“We’re taking offerings of bills. Regular delivery.”

Click.

“The Fed’s in!” Kelly shouts. The pandemonium resumes. On a scale of one to deafening, it’s gone from a 6.0 to 9.8.

Lanston is one of 44 primary bond dealers in New York that got the same call. Traders working the eighth-floor Open Market Desk at the New York Federal Reserve Bank would have reached all of them with the same message in the space of a minute.

The message means that the Fed is buying short-term securities—Treasury bills—in the open market. “Regular delivery” means the Fed will take them the next day. Traders from the Fed will call the firms back in a few minutes to let the dealers know how much time they have to get their offers together. It won’t be much; the Fed will have finished its dealing, buying more than a billion dollars worth of bills, by that afternoon.

“As soon as we hear from the Fed, we’ll call our customers who might have bills they want to sell, and we’ll also evaluate our own holdings to see whether we want to make an offer. Then, at the appointed time, we’ll call back and make our offers to sell.”

When Kelly calls back with an offer of securities already held by Lanston or from Lanston’s customers, he’ll list specific amounts of bills and the “discounts”—percentage reductions from the face values of the bills—at which Lanston or its customers are willing to offer them. The discount determines the price at which the bill is offered—the higher the discount, the lower the price of the bill.

Once the Fed has received offers from Lanston and the other primary dealers, staffers at the stately old New York Federal Reserve Bank will compare offers. They’ll take the best—those that offer the highest discounts—for the total quantity the Fed is buying that day.

If the Fed chooses to take any of the bills offered by Lanston, it will place funds directly in Lanston’s account. Those funds will constitute new reserves of the banking system. Because some of the purchases will be from Lanston’s customers, Lanston will transfer those funds to its customers’ banks all over the country.

Open market operations—purchases and sales of U.S. Treasury and federal agency securities—are the Federal Reserve’s principal tool for implementing monetary policy. The short-term objective for open market operations is specified by the Federal Open Market Committee (FOMC). Changes in the FOMC’s guidelines for open market operations affect both the quantity of bank reserves and the federal funds rate, which is the interest rate at which depository institutions lend balances at the Federal Reserve to other depository institutions overnight. Before 1994, the FOMC was highly secretive about its directives regarding open market operations. Beginning in 1994, the FOMC began announcing changes in its policy stance, and in 1995 it began to explicitly state its target level for the federal funds rate. Since February 2000, the statement issued by the FOMC shortly after each of its meetings usually has included the Committee’s assessment of the risks to the attainment of its long-run goals of price stability and sustainable economic growth as well as a target for the federal funds rate.

Sources: Timothy Tregarthen, “Making Money at the Fed,” *The Margin* (November–December 1988): 6; Federal Reserve Board, “Policy Tools: Open Market Operations,” (December 2003) available at <http://www.federalreserve.gov/policy.htm>.

Sometimes, as in the news item, the Fed makes an outright purchase of securities, but more frequently it buys the securities subject to a repurchase agreement. In such an arrangement the dealer selling the securities to the Fed agrees to buy them back at a later date. Open market operations involving repurchase agreements have only a temporary effect on bank reserves; reserves return to their initial level as soon as the “repurchase” part of the agreement is carried out. Such actions are used to make relatively small day-to-day adjustments in bank reserves.

Whichever form the purchase takes, the Fed pays for the securities by means of a wire transfer that adds funds to the reserves of the seller’s bank. Because these are newly created reserves and not just a transfer of reserves from one bank to another, they add to the banking system’s total reserves. Further, each dollar of reserves added to the banking system permits the volume of deposits subject to reserves to expand by several dollars. The amount of the expansion—the number of dollars added to the money stock per dollar of added reserves—is determined by the money multiplier. In the real world, however, the factors determining the value of the money multiplier are more complex than in the simplified system discussed in the preceding section.

If the Fed wants to decrease the money stock, it reverses this process: It instructs the Trading Desk to carry out an open market sale of securities, either outright or subject to a repurchase agreement. When a dealer buys securities from the Fed and pays for them with a wire transfer of funds from its deposit at a commercial bank, reserves will be drained from the banking system. The money supply will contract by an amount equal to the money multiplier times the size of the open market sale.

Although open market operations are the most frequently used tool for controlling the money stock, they are not the only one. If we remove some of the simplifying assumptions used so far in this chapter, we can see how these other tools work.

The Discount Rate

In our simplified banking system, banks can acquire new reserves only by attracting additional deposits. In practice, however, banks and thrifts that want additional reserves either to meet the Fed's requirements or to expand their loans have another option: borrowing reserves.

One possibility is to borrow reserves from another bank. The market in which banks make short-term loans of reserves to other banks is known as the **federal funds market**. The interest rate charged on such loans is called the **federal funds rate**. Transactions in this market, in which the usual loan term is 24 hours, total billions of dollars per day. As described in *Economics in the News 1.1*, the federal funds rate is very important. The Fed indicates its policy stance through setting a target for the federal funds rate, the **federal funds rate target**. The Fed's policymaking body, the Federal Open Market Committee (FOMC), is responsible for making decisions regarding this target. In the next chapter, we will return to the role of the federal funds rate as a part of the Fed's policy strategy.

Funds that banks borrow from one another through the federal funds market have no effect on total bank reserves; this type of borrowing just moves reserves around from one bank to another. Funds that commercial banks borrow directly from the Fed through the so-called **discount window** are another story, however. Any funds that banks borrow from the Fed are a net addition to total bank reserves, and therefore directly affect the money supply.

Banks borrow from the Fed in two kinds of situations. Most often they borrow for short periods to adjust their reserves when unexpected withdrawals have left them with less than the required amount of reserves. These banks are not in danger of insolvency, but are temporarily short on reserves. Banks with healthy balance sheets qualify for primary credit, and are charged the **discount rate**. Since January 2003, to discourage banks from borrowing too often or too much through the discount window, the Fed sets the discount rate above the federal funds rate target. Typically, the discount rate is one percentage point above the federal funds rate.

In addition to primary credit, the Fed sometimes makes loans to troubled banks to give them time to get their affairs in order. Since these banks are less likely to be able to repay the Fed, they must pay a higher interest rate, above the discount rate. Typically, the interest rate is one-half of a percentage point above the discount rate charged on primary credit loans.

The discount rate is a second policy instrument for controlling the money supply, although a less powerful one than open market operations. If the Fed wants to encourage more discount borrowing, it lowers the discount rate. As the discount rate falls relative to the federal funds rate, the cost of discount borrowing falls relative to the cost of borrowing from other banks and the volume of discount borrowing expands. However, because of the administrative pressures that the Fed uses to discourage excessive discount borrowing, there is a limit to how much discount

borrowing banks will want to undertake. If the Fed wants to reduce borrowing from the discount window, it raises the discount rate.

Changes in Required-Reserve Ratios

Changes in required-reserve ratios are a third potential policy instrument that the Fed can use to control the money supply. Earlier in the chapter we showed that the total volume of demand deposits in a simplified banking system is determined by the formula

$$\text{Total demand deposits} = (1 / rr) \times \text{Total reserves}$$

where rr stands for the required-reserve ratio. Similar but somewhat more complex formulas apply to the relationship between required-reserve ratios and all of the elements of M1 and M2 in the actual U.S. banking system. Thus, a reduction in required-reserve ratios will increase the money stock that can be created on the basis of a given quantity of reserves, and an increase in the ratios will decrease the money stock for a given quantity of reserves.

Although changes in required-reserve ratios have never been used for day-to-day control over the money supply, there have been times in the past when the Fed changed the ratios when it wanted to make a strong move toward expansion or contraction of the money supply. For example, in late 1990, the Fed eliminated a 3 percent reserve requirement on non-personal saving and time deposits. In April 1992, it reduced the required reserve ratio on transaction deposits from 12 percent to 10 percent. These changes were made, in part, to speed recovery from the 1990–1991 recession, although they also reflected a belief that lower reserve requirements would reduce bank's cost, encourage bank lending, and strengthen the role of banks in the financial system. More recently, the Fed has not used the reserve requirement as an instrument to control the money supply, because it poses difficulties in bank balance sheet management.

Other Factors Affecting the Money Multiplier and Reserves

In our simplified banking system, the money multiplier is a constant and the Fed has full control over bank reserves. In practice, however, the situation is more complex; both the money multiplier and reserves can vary for reasons beyond the Fed's control.

Consider, for example, the multiplier for the most important monetary aggregate, M2. M2 includes both transaction deposits, on which reserves are required, and saving and time deposits, on which no reserves are required. The total amount of M2 that banks can create per dollar of reserves (that is, the M2 multiplier) thus depends, among other things, on the relative amounts of reservable and nonreservable deposits that banks' customers decide to hold. If people decide to move their funds from transactions deposits to savings or time deposits, the M2 multiplier rises. If they move them from savings and time deposits to transactions deposits, the M2 multiplier falls.

Total reserves in the banking system can also be affected by choices made by bank customers. In our simplified banking system, reserve deposits at the Fed were the only form of reserves. In the real world, however, part of reserves are held in the form of vault cash. If bank customers decide to withdraw larger than normal amounts of currency from their accounts, as they typically do at Christmas time and during summer vacations, total bank reserves fall. If bank customers reduce their holdings of currency, reserves rise.

Such changes in reserves and the money multiplier make the Fed's job more difficult. When reserves or the money multiplier unexpectedly increase, the Fed must offset the increase with open market sales of securities or a rise in the discount rate. When reserves or the money multiplier fall, the Fed must buy securities on the open market or lower the discount rate. Such offsetting actions allow the Fed to maintain fairly close control over the money stock, but the control is not as direct or precise as in our simplified banking system.

CENTRAL BANKING IN THE INTERNATIONAL ECONOMY

The preceding section of this chapter looked at three instruments of monetary policy—open market operations, changes in the discount rate, and changes in reserve ratios—all of which operate entirely within the domestic economy. In this section we turn to a fourth instrument of monetary policy—operations in the **foreign-exchange market**, in which U.S. dollars, Japanese yen, European euros, British pounds, and the currencies of other countries are exchanged for one another. In this section, we take a preliminary look at the mechanics of the central bank activities in the foreign-exchange market and the relationship between those activities and domestic monetary policy. Succeeding chapters add details relating exchange rates to the balance of payments, interest rates, inflation, and economic growth.

Like its fellow central banks in other countries, the Fed has the right to use foreign-exchange market transactions as an instrument of monetary policy. However, for a variety of reasons, the Fed has not used this instrument as actively in recent years as have central banks abroad. Keep in mind as you read this section that although foreign-exchange market operations are a minor instrument of monetary policy for the Fed, they are a very important instrument, often the most important, for many other central banks.

The Structure of the Foreign-Exchange Market

As a traveler you may have had occasion to exchange U.S. dollars for Canadian dollars, Mexican pesos, or the currency of some other country. This trading in paper currencies is a small corner of the largest set of markets in the world—the foreign-exchange market, in which hundreds of billions of dollars are traded each day. Such trading reflects the fact that virtually every international transaction in goods, services, or financial assets is preceded by the exchange of one currency for another.

Large transactions in the foreign-exchange market, like large domestic transactions, are conducted with transaction deposits in commercial banks. A key role is played by large banks in the world's money centers—London, Zurich, Tokyo, and other cities—which are known as *trading banks*. These banks have branches all over the world and accept deposits denominated in many different currencies.

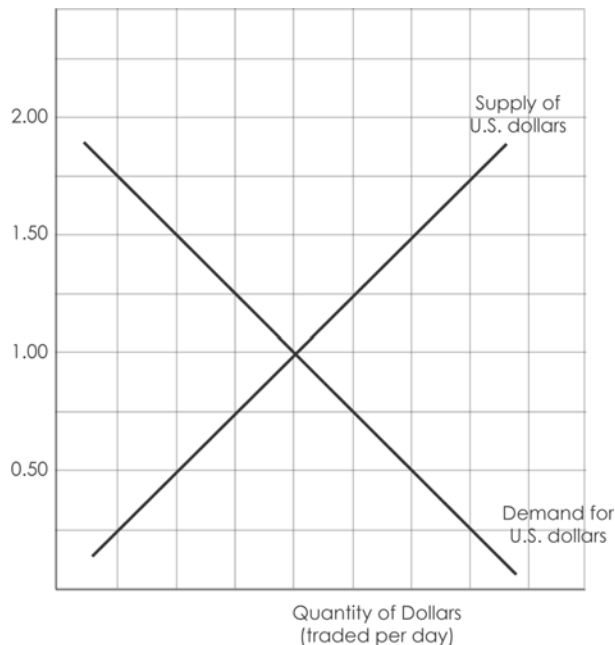
Suppose that Bloomingdale's department store in New York needs to buy euros to purchase Italian goods. Italy is part of the European Monetary Union (EMU), a group of countries that uses a single currency known as the euro. Bloomingdale's can ask Chase Manhattan Bank to debit its dollar-denominated account and credit a deposit of equal value to an account in Rome, Italy, denominated in euros that it can use to pay an Italian supplier. Similarly, if a German pension fund wants to buy U.S. Treasury bills, it can exchange a deposit denominated in euros at a German or U.S. trading bank for a deposit denominated in dollars and use those dollars to buy the Treasury bills. The trading banks make a profit on these transactions by charging an *asked* price for the currency they sell that is slightly higher than the *bid* price they pay for the currency they buy.

Supply and Demand in the Foreign-Exchange Market

What determines the number of euros that a customer gets in exchange for its dollars? Why, on a given day, is the exchange rate 0.85 euros per dollar rather than 0.75 or 1? The answer is that the rate depends on supply and demand. Here, we will consider a simplified illustration of the foreign-exchange market in which dollars are exchanged for euros.

Current account transactions include imports and exports of goods and services and international transfer payments, and *capital account transactions* (or *financial account transactions*, as they can also be called) involve international purchases and sales of assets and international borrowing and lending. Both play a role in determining the supply and demand for dollars in the foreign-exchange market.

Figure 11.1 The Foreign-Exchange Market for Dollars and Euro



This diagram represents the foreign-exchange market in which U.S. dollars are exchanged for European euros and euros are exchanged for dollars. The exchange rate is expressed as the number of euros required to purchase one U.S. dollar. The supply curve of dollars reflects the activities of U.S. importers of European goods and services. They sell dollars to obtain the euros they need in order to buy Italian leather shoes, German automobiles, and so on. The demand curve for dollars reflects the activities of European buyers of exports from the United States. They use euros to buy the dollars they need to buy Boeing aircraft, American wheat, and so on. The demand curve also includes the effects of net capital inflows to the United States. For example, a German pension fund that wants to buy U.S. government bonds first needs to exchange euros for dollars to use in purchasing the bonds.

In the example given earlier, a U.S. department store wanted to buy Italian leather shoes. To buy the leather shoes, it must first buy euros. An importer of goods or services to the United States enters the foreign-exchange market as a *supplier* of dollars. The supply curve for dollars shown in Figure 11.1 combines the transactions of all importers. In this diagram the supply curve has a positive slope, indicating that an increase in the exchange rate of the dollar relative to the euro (meaning that more euro can be bought per dollar) will increase the number of dollars supplied.²

On the other side of the market, a Spanish grocery chain that wishes to buy wheat exported from the United States must buy U.S. dollars to carry out the transaction. A buyer of U.S. exports enters the foreign-exchange market as a *demand*er of dollars. The demand curve shown in Figure 11.1 includes the demand for dollars of all European buyers of U.S. exports.

In addition to current account transactions, U.S. and European firms and individuals carry out numerous capital account transactions. For example, a German pension fund that wishes to buy U.S. Treasury bills must first buy dollars to use in paying for those securities. A *capital inflow*

(or *financial inflow*) to the United States thus is associated with a demand for dollars above and beyond the demand arising from current account transactions. What about a *capital outflow*, such as a purchase of foreign securities by a U.S. buyer? Such a transaction could be counted as a source of dollars supplied to the foreign-exchange market, but to simplify the diagram, a different approach is taken in Figure 11.1. There, capital outflows are first subtracted from capital inflows to arrive at a figure for *net capital inflows*. Only these net capital inflows (the excess of inflows over outflows) are added to the current account demand for dollars in drawing the dollar demand curve. As discussed in earlier chapters, the United States has experienced a net capital inflow each year for more than a decade. Still another source of demand for dollars, net purchases by central banks on the official reserve account, will be discussed in a future chapter.

PRICES IN THE FOREIGN-EXCHANGE MARKET Foreign-exchange rates—the prices of currencies in terms of other currencies, as determined by supply and demand—are published daily in financial newspapers. Figure 11.2 shows the foreign-exchange rate quotations for a typical day. A few currencies are commonly quoted in U.S. dollars per unit of foreign currency (Australian, EMU members, New Zealand, and the United Kingdom), while most are quoted in units of foreign currency per U.S. dollar. For example, the exchange rate between the euro and the dollar can be quoted in terms of euro per dollar, as was done in labeling the vertical axis in Figure 11.1. On the other hand, the price can be quoted in terms of dollars per euro, as is commonplace in foreign exchange rate quotes. Most currencies are quoted on a *spot* basis, that is, for immediate delivery. Some of the major currencies are also traded on a *forward* basis, meaning that the currencies will be exchanged at an agreed-upon future date at a price that is set today.

As supply and demand conditions change from day to day, exchange rates also change, as shown by the difference between the rates for successive days in Figure 11.2. A number of factors can contribute to such changes. For example, expansion of the U.S. economy would increase the demand for all sorts of goods, including goods imported from Mexico. Sales of dollars by U.S. importers to acquire the pesos needed to purchase those goods would cause the supply curve for dollars to shift to the right. Part (a) in Figure 11.3 shows how a U.S. would decrease the demand for goods imported from Mexico and, hence, cause the supply curve for U.S. dollars to shift to the left.

Figure 11.2 Foreign-Exchange Rates (Daily Rates for Week Ending November 21, 2003)

Country	Monetary Unit	Nov. 17	Nov. 18	Nov. 19	Nov. 20	Nov. 21
*Australia	dollar	0.7105	0.7212	0.7229	0.7238	0.7227
Brazil	real	2.9485	2.948	2.945	2.9465	2.924
Canada	dollar	1.3143	1.3025	1.304	1.3031	1.3042
China, P.R.	yuan	8.2769	8.2767	8.2767	8.2769	8.277
Denmark	kroner	6.3341	6.253	6.244	6.246	6.2435
*EMU members	euro	1.1744	1.1893	1.1909	1.1895	1.1913
Hong Kong	dollar	7.764	7.758	7.76	7.7615	7.764
India	rupee	45.55	45.62	45.63	45.78	45.75
Japan	yen	108.98	108.11	109.06	108.99	108.87
Malaysia	ringgit	3.8	3.8	3.8	3.8	3.8
Mexico	peso	11.18	11.168	11.198	11.188	11.204
*New Zealand	dollar	0.6257	0.6339	0.6385	0.6425	0.6406
Norway	kroner	6.9874	6.893	6.8565	6.867	6.851
Singapore	dollar	1.727	1.719	1.7132	1.7183	1.72
South Africa	rand	6.7346	6.6275	6.615	6.57	6.525
South Korea	won	1183	1181	1178	1191.9	1195.7
Sri Lanka	rupee	96.8	97.25	95.85	95.7	96
Sweden	krona	7.6407	7.54	7.5385	7.549	7.52
Switzerland	franc	1.3245	1.3055	1.3032	1.302	1.2985
Taiwan	dollar	34.01	34	34	34.03	34.05
Thailand	baht	39.95	39.96	39.93	39.91	39.95
*United Kingdom	pound	1.6885	1.6998	1.6982	1.7024	1.7025
Venezuela	bolivar	1600	1600	1600	1600	1600

In the foreign-exchange market, the dollar is traded for the currencies of other countries. The monetary unit (name of the currency) is also shown. Exchange rates vary from day to day according to supply and demand conditions. This figure shows the daily foreign-exchange quotations for the week ending on November 21, 2003. Exchange rates may be quoted in U.S. dollars per unit of the foreign currency (such as \$1.6885 per British pound) or units of the foreign currency per dollar (6.3341 Danish kroner per U.S. dollar).

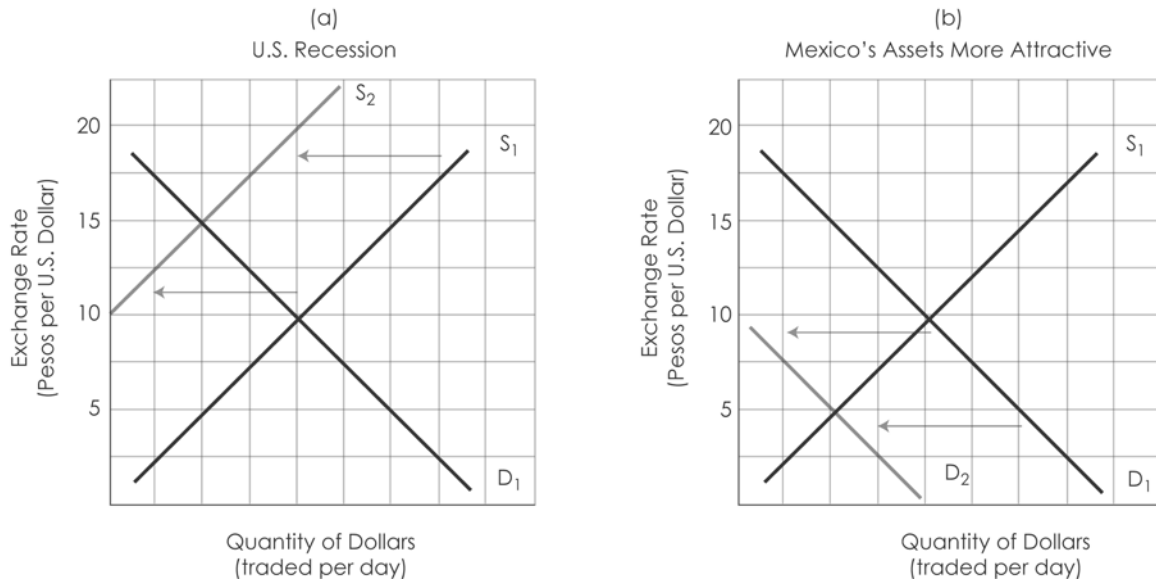
* U.S. dollars per unit of foreign currency

Source: Board of Governors of the Federal Reserve System, H.10 *Statistical Release*, November 21, 2003.

An increase in any condition making U.S. assets more attractive to Mexico's buyers would increase net capital inflows to the United States and produce a rightward shift in the demand curve for dollars. Examples might include an increase in the profit potential of U.S. corporations, which would make their stocks more attractive, or an increase in interest rates on U.S. government securities. Similarly, any condition making Mexico's assets more attractive to U.S. buyers, such as an increase in Mexico's interest rates relative to U.S. interest rates, would reduce net capital inflows and, hence, would shift the dollar demand curve to the left. This case is shown in part (b) of Figure 11.3.

These are only a few of the factors that can affect supply and demand in the foreign-exchange market. Changes in exchange rates have an important effect on the prices of goods and services in international trade. *Economics in the News 11.2* discusses what happened when the U.S. dollar lost value relative to the euro and how this affects Europeans' travel to the U.S.

Figure 11.3 The Foreign-Exchange Market for Dollars and Mexican peso



This diagram represents the foreign-exchange market in which U.S. dollars are exchanged for Mexican pesos and pesos are exchanged for U.S. dollars. The exchange rate is expressed as the number of pesos required to purchase one U.S. dollar. The supply curve of dollars reflects the activities of U.S. importers of Mexican goods and services. Therefore, as shown in part (a), when the U.S. economy goes into a recession, U.S. importers will buy fewer goods and services from Mexican businesses. This leads to a decrease in supply of U.S. dollars because American importers do not need to exchange as many U.S. dollars for pesos. The result is an increase in the exchange rate from 10 pesos to 15 pesos per U.S. dollar.

Economics in the News 11.2

WHERE TO SPEND VACATION?

December 22, 2003—For 21-year-old Yannick Stolk, a trip to the United States from her hometown near Antwerp, Belgium, was too big an expense.

Until now.

The euro has risen nearly 19 percent against the U.S. dollar this year, and European tourists like Yannick are cashing in on the dream trip that has suddenly become, well, 19 percent cheaper.

At American cruise operator Royal Caribbean Cruise Ltd., European bookings for 2004 are up 120 percent from last year, and 40 percent of those bookings are for U.S. destinations such

as Miami and the U.S. Virgin Islands. “The price sensitivity is definitely working to our advantage,” said Gary Burton, senior vice president of marketing at Royal Caribbean.

International visitors’ contribution to the U.S. economy this year is estimated at \$65.8 billion, with the projection for next year at \$69.4 billion, according to the Travel Industry Association of America. “Forty-five percent of that money comes from European travelers,” Cathy Keefe, TIA spokeswoman, told Reuters.

The British pound also reached a five-year high against the U.S. dollar last Thursday, prompting Britons to hop on planes to New York in order to pick up the designer items on their Christmas lists. “All the designer products are so much cheaper in the U.S. now. New York is an absolute hotspot for Christmas shopping, so they get an international holiday, plus they save money on their shopping at the same time,” said Jessica Potter, spokeswoman at ebooker.com, a British online travel agency that handles reservations for flights, hotels, and car rentals. “Bookings are significantly up this year, and flight availability has become difficult for us to find,” said Potter, who visited the U.S. for a shopping spree herself. “Levis and Reebok—they are so much cheaper there now!” she said.

The euro has risen 50 percent from its lowest point three years ago, making the United States and all its tourist attractions a better value for Europeans. “The only reason I’m here is that it’s cheaper,” said Marc Stolk, Yannick’s father, after a day of hiking and biking around the Everglades in Florida. “I’ve been wanting to come for a while, but when it was one euro to one dollar, it was too expensive.”

But with one euro now translating to \$1.24, the number of Europeans visiting the United States is on a climb from the 9.4 million European visitors last year, according to the Orlando/Orange County Visitors Bureau. Of the top 25 tourism generating countries, Sweden and the United Kingdom are expected to gain the biggest market share in the United States in 2003, according to the Travel Industry Association. The Stolks stayed at the Everglades Youth Hostel in Florida City, where 90 percent of the guests are European, and holiday bookings are up 30 percent from last year, the owner of the hostel told Reuters.

“Historically, the strength of foreign currency has always favored travel to the U.S.,” said Jose Estorino, senior vice president of marketing at the Orlando/Orange County Convention and Visitor’s Bureau, which is investing \$1.7 million in an upcoming marketing campaign in the United Kingdom. The campaign, which is scheduled to launch just after Christmas, will include direct mail at targeted households, advertisements on television, in newspapers, in the tunnels of the underground transportation system, and on buses. “We expect the economic impact of the campaign to be \$225 million in the next year,” Estorino said.

In the meantime, Marc Stolk said he is enjoying his affordable holiday. “And if the euro keeps going up, I’ll come back to see California.”

Source: Jui Chakravorty, “Euro Vacationers Find America Affordable,” *Reuters*, December 22, 2003.

Central Bank Intervention in the Foreign-Exchange Market

Exchange rates are not mere numbers; they have major impacts on the economy. For example, if the value of the dollar rises relative to that of the yen, as it did during the first half of the 1980s, more yen can be bought for a dollar. Japanese goods thus become relatively inexpensive for U.S. consumers. Imports from Japan increase, and U.S. firms competing with those imports face possibly devastating competition. At the same time, U.S. goods and services become relatively more expensive to Japanese buyers, not because the price in dollars has gone up, but because it now takes more yen to buy those dollars. U.S. exporters thus experience a decline in demand for their products when the value of the dollar rises relative to that of the yen.

When the dollar falls in value relative to the yen, as it did after February 1985, these effects are reversed. More dollars must be spent to import a given quantity of Japanese goods. The price that U.S. consumers pay for imports rises, and U.S. firms face less competition than before. U.S. exporters benefit from a fall in the value of the dollar, because Japanese buyers now find it easier to buy their products.

Because exchange rates affect the welfare of consumers and firms, their level is a matter of concern for policymakers. Consequently, from time to time central banks in the United States and other countries intervene in the foreign-exchange market in an attempt to stabilize exchange rates by offsetting market pressures that tend to raise or lower the exchange values of their currencies. The relatively infrequent foreign-currency operations of the U.S. government are directed by the Treasury, which has overall responsibility for the management of international financial policy, in close cooperation with the Federal Open Market Committee. They are carried out by the Fed through its foreign trading desk in New York.

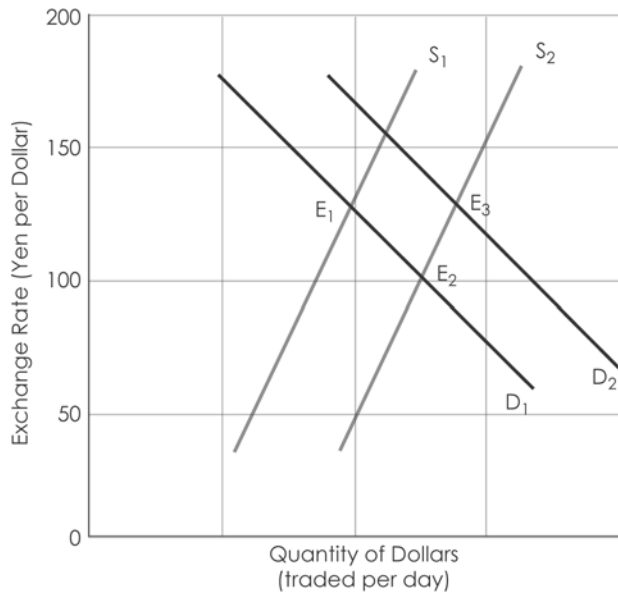
Suppose, for example, that equilibrium has been established at an exchange rate of 125 yen to the dollar, as shown by point E_1 in Figure 11.4. Firms and consumers have adjusted to this exchange rate, and the Treasury would like to avoid a sudden change. However, the U.S. economy now begins to expand strongly, shifting the dollar supply curve to the right, from S_1 to S_2 . If no action were taken, a new equilibrium will be established at an exchange rate of 100 yen to the dollar—point E_2 in the exhibit. What could the Fed do to stabilize the exchange rate at 125 yen?

MECHANICS OF INTERVENTION If it wanted to support the price of the dollar relative to the yen, the Treasury would instruct the Fed to intervene in a way that would increase the quantity of dollars demanded. The mechanics of such an action would be similar to those of an open market operation. What makes intervention possible is the fact that on the assets side of its balance sheet the Fed holds foreign securities along with its holdings of U.S. government securities; these include yen-denominated securities issued by the Japanese government.

To resist downward pressure on the exchange rate, the Fed would first sell some yen-denominated securities to a securities dealer in Tokyo. It would receive payment in the form of a yen-denominated transaction deposit at the Bank of Japan, that country's central bank. The Bank of Japan would act as the Fed's agent in this transaction. To acquire dollars the Fed would sell

the yen-denominated deposit to a Tokyo branch of one of the New York trading banks. The bank would pay for the yen deposit by drawing on the reserves of dollars it had on deposit with the Fed in the United States. The end result of this series of transactions would be a purchase of dollars by the Fed whose effect would be to increase the demand for dollars. It would shift the demand curve to the right, from D_1 to D_2 . A new equilibrium would be established at E_3 , where the exchange rate is unchanged because supply and demand have increased equally.

Figure 11.4 Effects of Intervention in the Foreign-Exchange Market



The Federal Reserve can intervene in the foreign-exchange market to resist changes in currency values. In this case, the exchange rate is initially in equilibrium at a rate of 125 yen per dollar. Expansion of the U.S. economy increases U.S. demand for imports from Japan, thus increasing the supply of dollars and shifting the supply curve to the right, from S_1 to S_2 . By itself, this shift would lower the equilibrium exchange rate to 100 yen per dollar. However, the Fed intervenes by purchasing dollars with yen. This has the effect of shifting the demand curve for dollars to the right, thereby preventing a decrease in the exchange rate.

If at another time the Fed wanted to counter upward pressure on the value of the dollar, it would have to reverse these transactions. In that case it would buy a yen-denominated deposit from the New York trading bank and pay for it with a wire transfer crediting the appropriate number of dollars to the bank's reserve account at the Fed. The Fed would then use the yen deposit to buy Japanese government securities for its portfolio. This set of trades would tend to nudge down the value of the dollar in the foreign-exchange market.

EFFECTS ON THE DOMESTIC MONEY STOCK Foreign-exchange market intervention as described in the preceding section would affect the U.S. banking system's reserves at the same

time that they influenced the dollar's exchange value. If the Fed were to buy foreign currencies in order to push down the value of the dollar and invest the funds in foreign government securities, it would increase the U.S. banking system's reserves in exactly the same way that it does when it buys U.S. government securities on the open market. If it were to sell foreign currencies obtained by reducing holdings of foreign government securities in order to support the value of the dollar, bank reserves would be depleted just as they are when the Fed conducts an open market sale of U.S. government securities. Thus, the Fed's actions in the exchange market potentially affect bank reserves and domestic monetary policy.

On the relatively rare occasions when the Fed does act in the foreign-exchange markets, it routinely acts to offset the effects of its foreign-exchange activities on domestic bank reserves by engaging in a special type of open market operation known as *sterilization*. To *sterilize* a sale of foreign currencies, which tends to decrease U.S. bank reserves, the Fed simultaneously makes an equal open market purchase of U.S. government securities. The open market purchase restores total reserves to their previous value. To sterilize a purchase of foreign currencies, which tends to increase bank reserves, the Fed carries out an offsetting domestic open market sale. The central banks of many other countries also use sterilization to limit the impact of foreign-exchange market operations on the domestic money supply. However, not all do so. In Chapter 14, we will examine what is called *exchange-rate based stabilization policy*, an approach used by the central banks of many emerging market countries. Central banks that take this approach want to strengthen, not weaken, the impact of foreign exchange rates on the domestic economy. For that reason, they do not use sterilization.

In concluding this section, it is worth emphasizing that foreign-exchange markets and exchange rates are very important to the Fed's decision making even though it does not often intervene to affect them and even though it uses sterilization when it does. The reason is that any decisions the Fed makes about domestic monetary policy that affect domestic interest rates, real output, and the price level also influence the value of the dollar via their effects on supply and demand in the foreign-exchange market. At the same time, movements in exchange rates that have their origin elsewhere in the world have far-reaching effects on the U.S. domestic economy. For these reasons, the Fed must take developments in the foreign-exchange market into account in determining domestic monetary policy. One rarely reads a newspaper article related to domestic monetary policy that does not also discuss effects on the international value of the dollar or a story on the value of the dollar that does not end by discussing U.S. monetary policy and interest rates.

SUMMARY

1. **How do banks create money?** Banks can make loans whenever their *reserves* exceed the minimum amount of *required reserves* set by the Fed. When a bank makes a loan, it credits

the proceeds to the borrower's transaction account. When the borrower spends this newly created money, the recipient deposits it in another bank, which in turn can use its excess reserves to make another loan. In this way, each dollar of new reserves that the banking system receives becomes the basis for a multiple expansion of deposits.

2. **Why is the size of the money stock limited by the quantity of bank reserves?** Banks can create money only to the extent that they have *excess reserves*. The total quantity of deposits that the banking system can create is thus limited by the total quantity of reserves available and the *required-reserve ratio*. In a simplified banking system, the number of dollars of deposits that can be created for each dollar of reserves equals $1/rr$, where rr is the required-reserve ratio. The ratio $1/rr$ is the *money multiplier* for the simplified banking system.
3. **What instruments are available to the Fed for controlling the money stock?** *Open market operations*, in which the Fed affects the banking system's reserves through purchases or sales of government securities, are the Fed's principal instrument of monetary control. An open market purchase injects reserves into the banking system and allows the money stock to expand; an open market sale drains reserves and causes the money stock to contract. Changes in the discount rate charged by the Fed on loans of reserves to banks are a second instrument of monetary control. An increase in the *discount rate* reduces the quantity of reserves borrowed. This absorbs excess reserves and thus tends to cause the money stock to contract. Lowering the discount rate encourages borrowing of reserves and thus tends to allow the money stock to expand. Changes in required-reserve ratios are a third means of controlling the money stock. A decrease in the required-reserve ratio creates excess reserves and allows the money stock to expand; an increase in the ratio causes the money stock to contract.
4. **How well can the money stock be controlled?** The Fed is able to control the money stock reasonably closely through the use of open market operations and changes in the discount rate. However, its control is not perfect; unpredicted variations in the money multiplier or in total reserves can cause unexpected changes in the money stock.
5. **What activities do central banks undertake in the international sphere?** From time to time, the Fed intervenes in the *foreign-exchange market* to counteract upward or downward pressure on the dollar's value relative to other currencies. It can lower the exchange value of the dollar by selling dollars and buying foreign currencies; and it can raise the value of the dollar by buying dollars and selling foreign currencies. Intervention in the foreign-exchange market can potentially affect the U.S. banking system's reserves and, hence, the domestic money stock. These effects on the domestic money stock are routinely avoided because the Fed offsets the reserve impact of its interventions through domestic open market operations a practice known as *sterilization*. However, sterilization does not completely break the linkage between domestic and international monetary and financial developments. The Fed intervenes in foreign exchange markets relatively infrequently, but this instrument of monetary policy is much more important for the central banks of some other countries.

KEY TERMS

Required reserves

Required-reserve ratio

Excess reserves

Open market operation

Money multiplier

Federal funds market

Federal funds rate

Discount window

Discount rate

Foreign-exchange market

PROBLEMS AND TOPICS FOR DISCUSSION

1. **Examining the lead-off case.** What are the duties of the Federal Open Market Committee? Who are the committee's voting members? Why is it considered such a powerful body? A vote to ease monetary policy means a vote to increase the growth of the money stock compared with the growth that would otherwise occur. What methods for implementing such a decision are available to the Fed?
2. **Multiple expansion of deposits.** Rework the deposit expansion examples in this chapter on the basis of the following assumptions:
 - a. An injection of \$5,000 in reserves via an open market purchase
 - b. An injection of \$20,000 in reserves with a 20 percent rather than 10 percent required-reserve ratio
 - c. Withdrawal of \$500 in reserves via an open market sale
3. **Currency and the money stock.** Use a balance sheet approach to trace the effects of a withdrawal of \$1,000 in currency from a bank. Assume that reserves are initially held half in the form of vault cash and half in the form of reserves on deposit with the Fed. Also assume that after the initial currency withdrawal there are no further changes in currency holdings by the public.
4. **The federal funds rate and the discount rate.** The *Federal Reserve Bulletin*, published monthly by the Fed, gives the values of the discount and federal funds rates and data for total and borrowed reserves. What has happened to the difference between these rates recently? Has the discount rate been changed? What has happened to the volume of borrowed re-

serves? Have they moved in the direction you would expect given the behavior of interest rates?

5. **The foreign-exchange market.** Find the most recent foreign-exchange quotations from the Board of Governors, *H.10 Statistical Release*, available at <http://www.federalreserve.gov/releases/>. How has the value of the dollar changed relative to other major currencies compared with the data given in Figure 11.2?

Case for Discussion

DOLLAR FINDS LITTLE JOY

LONDON (DECEMBER 23, 2003)—The dollar steadied against the euro and dipped versus the yen on Tuesday ahead of Christmas holidays in many markets, as investors juggled a heightened U.S. security alert, economic expectations, and intervention worries. Tokyo markets were shut for a holiday on Tuesday and several countries begin Christmas holidays on Wednesday. But the recent downtrend for the dollar continued, following a heightened U.S. security alert at the weekend and persistent worries about the U.S. ability to attract investment flows to cover its current account deficit.

“Security is an ongoing theme, and we have seen some rise in risk aversion on the back of the security alert,” said Mitul Kotecha, head of global foreign exchange research at Credit Agricole Indosuez. “Data today will confirm robust U.S. growth, but underlying negative factors for the dollar remain in place.” The dollar steadied at \$1.24 per euro early in the day on Friday, compared with record lows of \$1.2447 set on Monday, the U.S. currency’s 14th record low in 17 trading sessions.

The dollar eased 0.10 percent against the yen to 107.40, just over half a yen above three-year lows set earlier this month. Traders remain wary of yen-weakening intervention by the Japanese authorities during the thin holiday period, after Japan spent record amounts this year in order to curb the strength of the yen and protect the country’s export-led recovery.

Sterling was steady against the dollar and the euro after data showing UK growth of an upwardly revised 0.8 percent in the third quarter but a widening in the current account deficit during the same quarter, to 8.1 billion pounds.

MARKETS ALERT

The U.S. government raised its security alert on Sunday to orange, the second-highest level, saying there was a high risk of an attack in the holiday period. Geopolitical tensions have weighed on the dollar for much of 2003—before, during and after the Iraq (news–web sites) war. The dollar is nearing the end of the year down more than 15 percent against the euro and nearly 10 percent against the yen.

European trade chief Pascal Lamy said on Tuesday the euro’s current value was “not yet worrying,” but it was essential that currency movements did not happen too fast. Euro zone data

showed investment capital poured into the euro zone in October, with combined portfolio and investment inflows rising to 18.2 billion euros in October from 1.0 billion inflow in September.

U.S. final third quarter GDP (news–web sites), due at 8:30 A.M. EST, is expected to be unrevised at a healthy 8.2 percent annual growth. The final University of Michigan consumer sentiment survey for December, due at 9:45 A.M. EST, is forecast to be revised up to 91.0 from the preliminary 89.6, though still below November’s reading of 93.7.

“Economic data has not been having an impact on the dollar since early November,” said Jane Foley, currency strategist at Barclays Capital. “Sentiment is still clearly dollar-negative.”

QUESTIONS

1. Explain why a slowdown in the U.S. would tend to make the dollar fall relative to the yen and euro. How would the drop in U.S. interest rates, affect this outcome?
2. What actions could the Fed take to intervene in an attempt to prop up the dollar relative to the yen and euro?
3. What actions could the Bank of Japan (Japan’s central bank) take to intervene in an attempt to prop up the dollar relative to the yen and euro? Why might it be interested in doing so?
4. What effects would a lower value for the dollar, relative to the yen and euro, have on the U.S. economy? Who would benefit from the low value of the dollar? Who would be hurt?

END NOTES

1. Only one of the nearly 40 primary security dealers is a bank; the remainder are nonbank institutions. For clarity, we assume in this discussion that the Fed does business only with nonbank dealers. Open market operations carried out through a bank dealer have exactly the same final effects, but some of the intermediate steps are different.
2. The slope of the current account supply curve for dollars depends on the price elasticity of demand for European goods imported into the United States. The preliminary conclusions drawn in this section will be restated to apply to a broader variety of circumstances in that chapter.